Complementarity and Evolution of Contractual Provisions: An Empirical Study of IT Services Contracts

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An increasing volume of business activity appears to be occurring via alliances or other interfirm arrangements in which complex contracts are featured, yet there has been relatively little study of contract design in the strategy or management literatures. The economics literature on contracting has been extensive, but it has been less concerned with learning and evolution—phenomena in which strategy and organization scholars are deeply interested. In this paper, we investigate the relationship between two types of contractual provisions that are important in high-technology contracts, or contracts for which environmental uncertainty or technological complexity are significant, namely, contingency planning and task description. Previous research suggests that contracts can vary significantly in the degree of detail with which such key provisions are written, and that they are each subject to learning. In this paper, we find evidence from a sample of 386 contracts that contingency planning and task description behave as complements in contractual design. We argue that this complementarity reflects patterns of learning to contract. We also find that repeated exchange between two firms leads to greater effort at contingency planning in subsequent contracts, a finding that is also consistent with learning effects, but not with frequently made claims that contracts and trust are substitutes.

Key words: contracts; complementarity; learning

Introduction

A major theme in the literature on managing outsourcing relationships is that the structure of the agreement plays a large role in determining the performance of the relationship (e.g., Ciborra 1993, McFarlane and Nolan 1995, DiRomualdo and Gurbaxani 1998, Barthelemy 2001, Kern et al. 2002). There has been little systematic theoretical or empirical analysis in the strategy or management literature, however, of how contracts are actually designed and how their structures evolve. This gap may be due in part to the heavy emphasis in the management literature on the role of trust in interorganizational relationships, which follows from Macaulay's (1963) classic work on noncontractual relations in business, and the corresponding skepticism about the importance of business contracts in governing interorganizational relationships (e.g., Gulati 1995a, 1998; Ring and Van de Ven 1992, 1994). A well-developed branch of the literature on alliances and interfirm relationships does imply, however, that sophisticated contracts are an important feature of the business landscape in many industries, particularly where high technology is involved (e.g., Pisano 1989,

Parkhe 1993, Oxley 1997, Mayer and Argyres 2004, Sampson 2004).

The empirical economics literature, on the other hand, has studied the determinants of contract structure extensively, focusing on provisions such as contract duration, payment terms, intellectual property rights allocations, and equity participation (e.g., Joskow 1985, 1987; Masten and Crocker 1988; Goldberg and Erickson 1987; Crocker and Masten 1988; Pisano 1989; Lafontaine 1992; Oxley 1997; Lerner and Merges 1998; Lafontaine and Shaw 1999; Anand and Khanna 2000; Bercovitz 2002; Kalnins and Mayer 2004). Studies such as these have typically drawn on transaction cost, property rights, or agency theories for their theoretical basis (e.g., Williamson 1975, 1985; Jensen and Meckling 1976; Holmstrom 1979; Klein et al. 1978; Grossman and Hart 1986; Hart and Moore 1988). Empirical research on contract structure in economics, however, has not tended to investigate evolutionary patterns in contract structures and mechanisms of learning to contract, instead treating observed contract designs as equilibrium outcomes of competition. Therefore, many economics approaches

implicitly portray contract design as a once-and-for-all activity rather than as an evolving process requiring significant learning.

This paper seeks a better understanding of the nature of contractual learning processes by investigating the relationships among different elements of contract designs and their coevolution over time. We study two categories of contractual provisions that are particularly important for contractual relationships in which environmental uncertainty, or task or technological complexity is present: task description and contingency planning. Task description terms are often important because agreeing on a description of the task to be completed is necessary for the parties to come to a meeting of the minds, which is in turn a requirement for a contract to be legally valid (e.g., Beatty and Samuelson 2001). While describing the task is trivial for many kinds of exchanges, for others it can be technologically complex, posing important contracting challenges. Macaulay (1963) discussed the role that contracts can play in defining an exchange, and thereby avoiding misunderstandings about each party's roles and responsibilities relative to that exchange. Contingency planning is also fundamental to contracting in high-technology contexts because in uncertain environments situations can arise unexpectedly that threaten to derail even strong relationships between well-intentioned parties. In high-technology contexts there are likely to be numerous important contingencies (e.g., changes in technology, competitor actions, regulations, etc.) that the parties may wish to anticipate (to the extent possible given their cognitive limits) and make provision for in their contracts.

In this paper, we study how learning processes are reflected in systematic relationships between contingency planning and task description contractual provisions through an empirical analysis of contracts for IT services. We argue that as partners learn about how different combinations of transactional features are best matched with different combinations of contractual provisions, learning spillovers between these two categories emerge, and complementarities between them are discovered and exploited. Consistent with this idea, we find evidence that learning spillovers between contingency planning and task description contract clauses help to create a relationship of complementarity between the two types of clauses. Specifically, we find that the extensiveness of task description and contingency planning have reciprocal positive effects on each other in our sample of contracts, and that these effects are statistically significant across contracts written by the same two partners over time. We also find that as two partners contract with each other over time, they tend to include more, not less, contingency planning in their contracts. This last finding is inconsistent with views of interorganizational relationships that emphasize that trust tends to substitute for detailed contracts as such relationships develop

over time (e.g., Ring and Van de Ven 1992, 1994; Gulati 1995a, 1998), but is consistent with processes of learning to contract. Our various findings, then, by illuminating the underlying relationships between elements of a contract design and their discovery over time, provide insight into the ways in which firms can learn to use contracts to help govern complex transactions.

The paper proceeds by outlining our theoretical arguments and presenting our hypotheses. We then describe our data and methods, and explain our results. We conclude by discussing the implications of our results and providing suggestions for future research.

Theory and Hypotheses

Transaction Cost Theories of Contract Design
Empirical research on contract design has been heavily influenced by transaction cost economics (TCE). TCE's theory of contract design is premised on ideas about the functions of contracts that were first emphasized in the legal literature. In particular, business contracts are designed for the purpose of facilitating a transaction between two parties, and this purpose is achieved to the extent that the contract (1) aligns the parties' expectations with regard to each other's obligations under the agreement, (2) provides incentives for the parties to fulfill these obligations, (3) prevents costly disputes from arising, and (4) provides a basis for resolving disputes that arise despite best efforts, whether the disputes arise from opportunism or from honest misunderstandings (Llewellyn 1931; Macaulay 1963; Macneil 1974; Williamson 1975, 1985).

The TCE of contracting assumes that parties to a contract have bounded rationality (Simon 1957) that prevents them from foreseeing all possible future contingencies that may arise (Williamson 1975, 1985). Given this incompleteness, TCE argues that contract terms will reflect certain key characteristics of the transaction. The most important of these characteristics is the degree of bilateral dependency between the two parties, which is in turn determined in large part by the degree of asset specificity in the relationship (Williamson 1985). Another key characteristic is the degree to which property rights to assets developed or deployed in the relationship can be legally protected (Teece 1986). TCE suggests that as bilateral dependency increases and as available legal protection decreases, contracts will incorporate additional safeguards against opportunism (Williamson 1991).

Contractual safeguards can take a number of forms. For example, a contract might provide for an exchange of contractual "hostages," which reduces the incentive for parties to hold each other up (Williamson 1985). Equity participation in alliances may be one form of such hostage taking (Pisano 1989). Safeguards could also be constructed, however, by making efforts to write

contracts that are more detailed (more complete). A key way in which parties can write more complete contracts is to include more provisions addressing contingencies that threaten the relationship. *Contingency planning clauses* can thus be defined as the parts of a contract that are designed to support within-agreement adjustments by proscribing the ways in which the contractual partners will deal with problematic contingencies that might arise during the execution of the contract. If a contingency can be clearly identified and codified so that both parties agree on whether it has occurred, then one or both parties can be required to take specific actions or follow predefined processes in response to the event, with the aim of preserving each party's interest in continuing the exchange. In some cases, a contingency could occur that provides an opportunity for one party to take advantage of the other. By including provision for such contingencies in the contract, such situations can be avoided, increasing the willingness of the vulnerable party to commit to the exchange (Klein 1993).

Contingency planning clauses can be relatively generic, specifying processes or procedures to follow in case a given broad contingency occurs. The following is an example from our sample of contracts of a generic, process-related clause that could be used to accommodate many types of change:

> Section 6. Project Change Requests.
> (a) A project change request (PCR) is a written document that requests a change in the scope of the services described in the statement of work (SOW), an adjustment of the prices, or adjustment of the time of performance.
> (b) The parties shall agree upon changes or additions to the SOW by executing a PCR that describes the requested changes or adjustment in detail. If a PCR will increase or decrease the cost or time required to complete the SOW, then the PCR shall set forth the appropriate adjustment to completion deadlines or compensation.
> (c) Changes requested by either party shall not be implemented until the PCR is approved in writing by both parties. (Contract 1 with Customer 12, dated May 25, 1995)

Contingency planning clauses can also be more specific, identifying specific contingencies that might occur, and perhaps outlining a procedure to be followed under that contingency. Such clauses might specify, for example, which party has which kinds of decision rights or financial claims if a technological or competitive change renders the product for which the buyer contracted obsolete before it is completed. An example of a relatively detailed contingency planning clause from a contract in our database is as follows:

> During code conversion, it may be determined that structural changes will be necessary to port a specific function to UTS. In such cases, the [Compustar] technical staff will discuss the situation & possible alternatives with [Customer]. The selection of viable alternatives will be

a joint decision between [Compustar] and [Customer]. A list of all such changes will be kept and those changes will be document as to "what the change was" and "why it was made." During the course of code modification porting [Customer] applications to UTS, it is likely that situations will be found where restructuring of code would significantly enhance performance or reliability. In such cases, it will be noted and documented for future evaluation and disposition by [Customer]. (Contract 2)

A second way in which parties may choose to write more complete contracts is by including more detailed specification of the task to be completed. For many kinds of transactions, the task to be completed is fairly straightforward and can be described simply and without much effort. In complex high-technology contracts, however, tasks can be quite involved and firms must decide how much effort to devote to describing these tasks in their contracts. The contracts in our database vary widely in the detail with which task descriptions are written, even for projects that are quite similar to each other. A relatively detailed task description from our database might include the following elements:

1. The criteria used to determine which projects should be migrated first.
2. A detailed task list.
3. The number of personnel required to complete the project. (e.g.,"One (1) Technical Lead from [Compustar], with good experience in four (4) disciplines involving the migration effort...to be involved in the duration of the project. Two (2) C programmers from [Compustar] with experience in the four (4) disciplines involved in the migration effort, capable of providing direction for multiple simultaneous conversion efforts, beginning at project inception and to be involved for approximately the first thirty (30) days of the project.")
4. Scheduling initiation of work, and duration of various aspects of the project.
5. Provisions for testing converting applications.
6. Information and resources required from the customer in order to determine the software applications that need to be migrated. (Contract 3)

Crocker and Reynolds (1993) argued that contracting parties face a key trade-off when deciding on the degree of incompleteness of their contract. On the one hand, identifying additional possible future contingencies and incorporating them into the contract is costly due to bounded rationality. Moreover, leaving a contract relatively incomplete allows the parties more flexibility to deal with new contingencies as they arise. On the other hand, highly incomplete contracts leave more room for opportunism by either party and may lead to a greater likelihood of misunderstandings regarding the roles of each party in the exchange.[1] By reducing the degree of incompleteness, a party can limit the potential for misaligned expectations and leave less room for a firm to opportunistically interpret or circumvent a contract term

in order to expropriate quasirents from its contractual partner (Klein et al. 1978, Klein 1993).[2]

Parties may choose to further specify the task and include additional contingencies even when their primary concerns are simply to align expectations and prevent disputes that might arise from honest misunderstandings.

Learning and Complements

As Crocker and Reynolds (1993) emphasized, bounded rationality implies that the completeness of a complex contract can be conceived of as a choice variable. This in turn implies that developing complex contracts is a costly activity, requiring investments in transaction planning and in codification of those plans in a legally enforceable document. A natural question to ask then is whether various types of contractual provisions act as complements or substitutes for one another when firms invest in transaction planning and contract design. This is because the nature of the relationships between provision types will inform both the level and the directions of planning investments.

An agency theory perspective, for example, might imply that task definition and contingency planning are substitutes, because they are alternative mechanisms for monitoring and controlling behavior in an agency type of relationship (Jensen and Meckling 1976). For example, perhaps by developing more detailed task descriptions, a supplier is better controlled, and its opportunities for opportunistic behavior are reduced. Alternatively, a more detailed task description may limit the severity of any negative consequences associated with opportunism by the supplier. In either case, a more detailed task description may reduce the value of additional contingency planning. Similarly, perhaps if more contingencies are identified ex ante and explicit procedures are established for dealing with them, a detailed task description is unnecessary. In these kinds of cases, task description and contingency planning provisions may be substitutes.

Literature in other areas of organization theory, however, suggest possible complementarities between these types of contractual provisions. While the traditional organization theory literature does not address contract structure per se, it has long emphasized that many features of an organization's structure fit together in particular ways (e.g., Khandwalla 1973, Miller 1981, Drazin and Van de Ven 1985). This idea is captured, for example, in the idea that organizations present "a syndrome of attributes" (Williamson 1991, p. 293). Aspects of this idea have been formalized by Holmstrom and Milgrom (1991), who showed that when organization members undertake multiple tasks, the incentives they face for carrying out each task must be consistent with each other or inefficient allocation of effort will result. That is, a firm's incentive arrangements tend to be highly complementary (Holmstrom and Milgrom 1994). Empirical research on human resource management practices also emphasizes the importance of complementarities among various governance arrangements (e.g., Ichniowski and Shaw 1999).

The empirical economics literature on contracts has tended to focus, however, on explaining individual contract terms such as contract duration, payment structures, etc., rather than interactions between them (an exception is Brickley 1999). However, because contracts are similar to organizations in that they are mechanisms for organizing and governing business activity (e.g., Macneil 1974, 1978; Williamson 1991), ideas about organizational complementarities may be applicable to contracts as well.

One important idea emerging from recent research on organizational complementarities is that the nature of the relationships between various features of an organization's structure and activities may only be discovered by organization members over time. Traditional treatments of fit or configuration have either treated it in a static way or have conceived of strategic change as involving a quantum leap from one entire configuration to another (Miller 1996). Longitudinal case study research by Siggelkow (2002), however, showed how the Vanguard Group, a mutual fund provider, slowly evolved toward fit through incremental changes in core and elaborating elements of the configuration of its activities. Siggelkow (2002) described various organizational processes through which this evolution toward fit occurred, including the reinforcement of existing core elements with new elaborating elements, and the creation of new core elements with corresponding elaborating elements.

This dynamic way of thinking about the discovery of complementarities between organizational activities over time parallels the kinds of learning processes described in the Mayer and Argyres (2004) study of learning to contract in the personal computer industry. That study explains how two contractual partners slowly learned about the features of their transactions, and how those features interacted over a nine-year period. The partners also learned how various categories of contractual provisions with different levels and kinds of detail dealt more or less effectively with different combinations of transactional features. That is, the partners slowly learned about both the effective matching between combinations of transaction features and combinations of contractual provisions with different levels and types of detail. For example, as the partners encountered communication problems they had not anticipated they experimented with different types of communication provisions in the contract until they arrived at an effective set of communication provisions; they experimented similarly for contingency planning, task descriptions, etc.

This kind of learning about the nature of matches between combinations of governance mechanisms on the one hand and combinations of transaction features on the other is similar to what Siggelkow (2002) described

regarding learning to achieve organizational fit. For example, as contractual partners gained better understandings about the additional contingencies for which to provide in a contract, and how to best make such provisions, they were engaged in a process similar to the "thickening" process described by Siggelkow, in which core elements are reinforced by elaborating elements.

Learning about efficient matches also suggests that as they develop one category of contractual provisions for a given contract, the contracting parties may gain understandings about transaction features that are useful in the design of a different category of contractual provisions. We term this phenomenon *cross-provisional learning.* In particular, we suggest that learning about contingency planning may tend to spill over to learning about task description, and vice versa, and that this creates a relationship of complementarity that dominates any substitution effect between the two contract provisions.

A plausible economic logic behind this complementary relationship that is consistent with Mayer and Argyres (2004) is as follows: The design of a complex contract tends to parallel the planning and design of the broader transaction more generally. The buying firm describes its needs—which are often complex and uncertain—to the selling firm, while the selling firm educates the buyer about the technological possibilities and may suggest modifications to the buyer's plan, and describes its own capabilities and work procedures. The parties eventually converge on a plan for the transaction. This implies that the costs of transaction planning are largely fixed relative to the detail included in the contract. That is, greater investment in planning the overall transaction reduces the marginal cost of then codifying those additional plans in the contract. As more effort is expended in identifying and providing for additional contingencies in the contract, opportunities for clarifying the task description to avoid these contingencies are revealed, thereby reducing the marginal cost of developing terms in that category. Conversely, as greater effort is made to clarify the parties' roles and responsibilities in the project, potentially problematic contingencies are more likely to be identified, and therefore the marginal cost of including them in the contract falls. That is, opportunities for clearer and more detailed task description are often important by-products of the contingency planning activity, while opportunities for additional contingency planning are important by-products of efforts at task description.

Thus, we propose that as parties learn about the complementarities in the underlying activities necessary for their transaction, cross-provisional learning occurs between contingency planning and task description when a contract is designed. This implies that more detail in each category carries a greater net benefit in terms of contract performance when more detail in the other is present, which corresponds to an economic definition of complementarity (e.g., Marschak and Radner 1972).[3] Complementarities in the underlying transactional activities are therefore reflected in complementarity between categories of contractual provisions for governing those activities, both of which are discovered by the parties over time. We therefore begin with the basic hypothesis that

HYPOTHESIS 1 (H1). *Contingency planning and task description have reciprocal positive effects on one another, suggesting that they act as complements in complex, high-technology contracts.*

Note that our hypothesis will not be confirmed if contingency planning and task description are substitutes. It will also not be confirmed if the complementarity between our two variables of interest is weak or nonexistent. This would be the case, for example, if the kind of planning that goes into the development of task descriptions is so narrowly focused that it gives little insight into broader contingencies stemming from the firm's environment (such as changing technical standards) that are provided for in some of the contracts.[4]

A finding that contingency planning and task description tend to positively affect each other in contract designs (accounting for transaction characteristics) does not by itself unambiguously demonstrate the existence of learning spillovers as a causal mechanism driving complementarity between them. With respect to a given contract, for example, the parties may decide for some independent reason to either plan their transaction extensively, or not to do so. For example, some buyers or sellers may simply insist on more detailed contracts in all categories for their own bureaucratic reasons. If so, then one might observe high levels of both contingency planning and task description in some contracts, and low levels of both in others, but learning spillovers may not be a cause. To pin down learning effects more precisely, we investigate whether efforts at contingency planning made for one contract are associated with increases in the extensiveness of task descriptions in later contracts with the same partner.[5] Conversely, we also investigate whether more detailed task descriptions in prior contracts lead to more contingency planning in later contracts between the same partners. Of course, these comparisons between contracts over time must control for key characteristics of each transaction that would be expected to determine the degree of task description and contingency planning in each contract.

We argue that if learning spillovers between contingency planning and task description are important phenomena, then one should observe that as parties learn about the important contingencies for which to provide in a given type of transaction, task descriptions in later contracts between the same exchange partners should become more detailed. This is because the parties can use their knowledge of problematic contingencies

that were anticipated in prior exchanges to improve on the task description in subsequent contracts with the same partner—with the aim of avoiding those contingencies in the future. Conversely, as parties make greater efforts to develop task descriptions for transactions of a given type, contingency planning clauses in later contracts governing similar transactions should become more extensive. This is because efforts at constructing task descriptions for a prior contract naturally stimulate search for what might prevent the fulfillment of task obligations in the future. We expect that when the types of tasks described in prior contracts are broadly similar (e.g., both involve work on a client's mainframe), then prior experience developing task descriptions will tend to be relevant for both the more specific and more general types of contingency planning discussed above. On the other hand, when prior and current tasks are somewhat different, prior experience with task description will tend to inform the more generic type of contingency planning clauses. For example, experience with developing task descriptions in a prior contract for a different kind of task may be informative as to what would make for an effective engineering change process for IT tasks in general. Thus, we argue that contingency planning provisions and task description provisions that are more detailed are by-products of broader transaction planning and search processes that are carried out over time, and that each type of provision will therefore positively affect the other in a sequential manner. We therefore hypothesize that

HYPOTHESIS 2A (H2A). *Prior experience with contingency planning is associated with more detailed task description in subsequent contracts between the same firms.*

HYPOTHESIS 2B (H2B). *More detailed task description in prior contracts is positively associated with contingency planning in subsequent contracts between the same firms.*

Note that in the extreme case in which sequential contracts govern very different tasks (e.g., reconfiguring a client's data center versus installing a new help desk system), we would expect only limited cross-provision learning spillovers. If these cases are common enough in our sample, then H2A and H2B will not be supported.

Partner-Specific Learning

While finding support for H2A and H2B would imply support for our arguments concerning cross-provisional learning between two partners, it would not inform us as to how much of the learning in question is partner specific, and how much can be transferred to contracts with other partners. Because our sample consists of Compustar's contracts only, we cannot address this question directly. However, we are able to examine whether partners with a longer history of working together tend to

write more detailed contracts with each other that are more detailed, which would be suggestive of partner-specific learning.

Some of the recent literature on contracts and alliances suggests that such partner-specific learning may be an important phenomenon. Partner-specific learning implies that as two parties work together, they gain valuable knowledge both about the features of their transactions, and about each other's idiosyncrasies more generally. While experience may not always lead to learning (e.g., March et al. 1991), experience can lead to a greater understanding of the partner's capabilities and needs, and to the development of a common language to define process and to resolve key uncertainties (Mayer and Argyres 2004). Such uncertainties include, for example, direction of technological changes, changes in industry standards, and changes in partner-strategic priorities (Zollo et al. 2002). Moving forward, such accumulated knowledge may enable the parties to codify roles and responsibilities in more detail, as well as to identify and specify pertinent contingencies with more accuracy at a lower cost. Given the potential for more efficient design as well as the ongoing framework value of contracts (Macneil 1978), contracts may be expanded as a relationship develops (Baker et al. 2002, Poppo and Zenger 2002, Ryall and Sampson 2003).

In view of these arguments and findings, we expect that contractual partners will undertake more contingency planning as they learn to work with one another over time. As the partners learn more about each other, they become better at understanding the kinds of contingencies that could threaten the relationship, and at understanding how to efficiently adapt if those contingencies occur. In addition, their growing knowledge of each other's processes and procedures decreases the cost of negotiating contingency planning clauses (Mayer and Argyres 2004). While it is possible that over time some contingencies are found to be highly unlikely to occur and are removed, this possibility is a rare one, because a long time must pass before a previously identified contingency can be confidently declared to be highly unlikely. Similarly, as parties learn about each other and about the nature of their joint work over time, they may learn about how to write task description terms in ways that are detailed enough to provide effective guidance to the partners as they carry out their transactions. They may also learn what types of detail are needed to ensure that expectations are aligned, and that each party clearly understands its responsibilities in the transaction.

Partner-specific learning can also have a similar effect in a different way—as a source of specific investment. As the partners learn to work together, they often develop relationship-specific routines to guide their interactions (Zollo et al. 2002). Thus, as a relationship continues, it becomes easier for the parties to work together, and the costs of switching to a new partner rise. Learning may

therefore have a direct effect in helping the parties determine and negotiate the most relevant contingencies and task descriptions, but may also have an indirect effect in becoming a sunk investment that the parties will want to protect. In this case, the parties will undertake more contingency planning and craft more detailed task descriptions to prevent misunderstandings and ensure that the relationship is not terminated due to a problem that arises during an exchange. Thus, we hypothesize that

HYPOTHESIS 3A (H3A). *As an exchange relationship between two parties continues, the parties will be more likely to include contingency planning clauses in their contracts with each other.*

HYPOTHESIS 3B (H3B). *As an exchange relationship between two parties continues, the parties will include more detailed task descriptions in their contracts with each other.*

In emphasizing learning effects, our arguments relegate effects of trust to a supporting role. Sociologists and organization theorists, however, have long argued that business exchanges are strongly influenced by social relationships and social context (e.g., Granovetter 1985, Gulati 1995b, Uzzi 1996). As relationships evolve and trust develops, relational governance may become viable. Relational governance relies on trust, social expectations, and verbal promises to govern exchanges. Because relational governance is argued to provide the same safeguarding benefits as contracts without many of the disadvantages (e.g., antagonistic enforcement), it is often asserted that parties will tend to substitute relational governance for formal contracts (Ring and Van de Ven 1994, Dyer and Singh 1998). As Gulati (1995b, p. 93) succinctly concluded, "Where there is trust, people may choose not to rely upon detailed contracts to ensure predictability." Even if a contract is used initially, the parties would pay less and less attention to it, because it would become less important to the governance of the relationship over time (Larson 1992). The implication of this perspective is that partners specify fewer formal contingency planning and task description clauses as their relationship develops because they opt to rely less on formal contracts and more on relational governance.

According to Mayer and Argyres (2004), however, the managers interviewed for their study emphasized that more detailed contracts actually enhanced, rather than diminished, the trust between their own firm and their contractual partner over time. Managers explained that by clarifying each partner's expectations regarding the other's behavior in various circumstances, they could place greater trust in their partner. Therefore, greater contract detail created an environment that helped trust develop rather than contributing to its decline. One explanation for this is that trust is a specific asset that

the firms want to protect by minimizing the chances of disturbances that may threaten the relationship. Because task description and contingency planning provisions do not carry the specific negative connotations of a penalty clause, they could be used to protect the relationship without necessarily implying that a breach of trust is anticipated. In addition, recent literature on contracting has revived the emphasis of contracts as coordination devices—as mechanisms to align expectations—which was an important message of Macneil's (1974, 1978) seminal work. This coordination function is in addition to contracts' function as governance mechanisms (e.g., Sobrero and Schrader 1998, Mayer and Argyres 2004). The coordination function of contracts is not necessarily in conflict with the operation of a trust mechanism. Of course, the question of the relationship between trust and contract detail is ultimately an empirical one.

Data

The data on which we test our hypotheses were obtained from a firm we call Compustar, a supplier of IT services and computer-related hardware. During the period covered by our data set (1986–1998), Compustar's IT services business specialized in the design of customized software systems, updating and maintaining existing software and hardware systems, and assisting with network design and security. Compustar provided services for customers using IBM-compatible mainframes, OS/390 programming, Sun systems, and various database systems (e.g., Oracle, Informix, etc.). Compustar entered the IT services business in the mid-1980s, and by 1997 the annual revenues of its IT services division were approximately $100 million worldwide.

Compustar provided access to all IT services contracts in their corporate contracts library from the beginning of their IT services business in 1986 through 1998, i.e., every contract with all of Compustar's 141 different partners (henceforth referred to as customers) during the period. Most customers were large Fortune 500 companies. The data set we used for this paper is based on a sample of 405 of these agreements that were selected according to the first letter of the customer's name. In this way, an unbiased sample of approximately 25% of the population of contracts was generated. After removing 8 contracts with missing data and 11 contracts whose type was abandoned, we were left with a sample of 386 contracts.

Each contract in the data set covers one IT services project, and contains a detailed description of the project, including the type of service required and the responsibilities of the parties. A typical contract is about five pages long and is designed to support a specific task for the customer. Some projects are fixed-fee arrangements, while others stipulate an hourly wage (with or without a maximum number of hours to complete the

task). Project duration can range anywhere from one week to more than a year (mean = 14 weeks, median = 7 weeks). Project values range from about one thousand to several hundred thousand dollars.

Two Compustar engineers coded most of the variables below based on their reading of the contracts and experience with many of the projects. One of the author(s) reconciled the few discrepancies between the two engineers' coding choices in conversations with them.[6] Several of the variables were highly objective and straightforward to read off the contracts. One of the authors coded these.

Our sample of contracts is drawn from an emerging industry devoted to developing complex new technologies. We therefore expect the setting to be one in which the kinds of learning effects we hypothesize are important. Such learning effects may be much less important in well-established industries in which contract designs have stabilized over time.

Dependent and Explanatory Variables

Many of the contracts in our sample made no provision for contingency planning, while others contained clearly identified efforts to plan for future contingencies. Because the engineers had limited time, they only agreed to code our *contingency planning* variable on a binary basis: as zero if the contract in question contained no contingency planning and one if contingency planning was included.[7] Of our sample, 41% contracts contained no contingency planning.

Our second dependent variable, *task description,* was coded by our engineers on a 1–7 Likert-type scale, where 1 represents cases in which the contracts contains very little detail in the description of the task to be accomplished and 7 represents cases in which very extensive technical description was included. Examples of technical detail include references to particular types of databases or other software systems on which Compustar would work, or specific responsibilities the customer must fulfill in order for the project to be completed. This latter category might include information and resources required from the customer in order to determine the software applications that need to be migrated. Our two dependent variables are also two of our main explanatory variables in our method (see Methods section below).

We used our measures of contingency planning and task description to construct the prior contingency planning and task description variables needed to test H2A and H2B. We did this in two ways: First, we constructed a variable that measures the level of contingency planning (0 or 1) in the previous contract between Compustar and a given customer. If the contract was the first ever between the two firms, the variable was coded as missing and excluded from models that include this variable. We constructed the prior task description variable

the same way—by measuring the level of task description (1 to 7) in the previous contract between Compustar and the customer. We will expand on how we use these variables when discussing the empirical model.

Our other major explanatory variable captures the history of the exchange relationship between Compustar and a given partner. *Relationship history* measures the amount of time in weeks that Compustar had worked with a particular business unit of a partner company prior to signing the contract in question. This variable is aimed at capturing effects of partner-specific learning (or trust) over time.[8]

Control Variables

Our main objective in developing our vector of control variables was to control for the underlying characteristics of the transaction that theory would predict should affect both the degree of contingency planning and the extent of task description.[9] This is a crucial part of our empirical exercise, because there are a large number of transaction characteristics that could have such effects. We therefore included a relatively large number of control variables in order to isolate the effects of our dependent variables on each other, and thereby test for any complementarity and lagged effects between them.

As discussed above, TCE predicts that contracts governing transactions in which the threat of holdup is significant will feature contractual safeguards aimed at protecting the vulnerable party or parties (Williamson 1985, 1991). In IT service agreements of the kind we study, contingency planning and detailed task description are the two main categories of terms in which contractual safeguards are typically embedded. We control for the potential for holdup in each project using a variable called *interdependence*, which is coded as one if customer personnel are listed as being responsible for some portion of the project deliverables and zero otherwise. We expect that contracts featuring greater levels of *interdependence* are more likely to feature contingency planning and extensive task description, because the potential for holdup, and therefore the demand for safeguards, is likely to be greater for these types of projects. This variable was coded by two Compustar engineers using information in the contract itself, as well as additional records from the project file.

Transaction cost theory also predicts that appropriability concerns affect the extent of safeguards included in a contract, especially in high technology (Teece 1986). According to this aspect of the theory, the greater the extent to which parties have proprietary assets at stake in the relationship—the returns to which could be appropriated by the partner—the greater the degree to which parties will build safeguards into the contracts (Williamson 1991). Therefore, we expected that projects in which proprietary assets are developed or applied would be more likely to feature contingency planning.[10] To control

for this effect, we included a dummy variable called *proprietary* that two Compustar engineers coded as one if one or more of Compustar's proprietary technologies were required for a project, and zero otherwise. We expect a positive and significant coefficient estimate on this variable.

Both the measurement cost branch of TCE (e.g., Alchian and Demsetz 1972, Barzel 1982, North 1991) and agency theory (Jensen and Meckling 1976, Holmstrom 1979) emphasize that when output quality is difficult to verify, provisions for monitoring, special incentives, or other governance arrangements will be designed to protect the interests of the buyer or supplier, or both. To account for this effect, we included a variable, *measurement cost*, that identified whether the technology used in the project makes it difficult to verify the quality of the output generated by the project team. Compustar engineers preferred to code *measurement cost* as a binary variable: one if quality is difficult to determine and zero if it is readily apparent. Our two engineers coded this variable based on whether or not a brief, inexpensive test or inspection could determine the quality of the work done on the project. More extensive task description—detailing the actions that each party is required to take—is one means of limiting opportunistic behavior when outcome quality is difficult to verify. On the other hand, projects for which measurement is difficult are also likely to be ones for which developing detailed task descriptions is difficult. Therefore, we are agnostic about the expected effects of measurement cost on task description. It seems clearer, however, that the benefits to contingency planning as a safeguard are diluted when high measurement costs make it difficult to determine whether certain contingencies have occurred in the course of executing a project. In such instances, the transacting parties may not agree whether (or which) contingency plans should be implemented. As such, we expect a negative relationship between the measurement cost control and the level of contingency planning.

We included a variable aimed at measuring the degree of uncertainty associated with the project. *Mainframe* is a binary variable indicating whether Compustar would be working with the buyer's mainframe computer. Designing contracts for work on mainframes is particularly challenging because mainframes are often maintained haphazardly or have been heavily customized—both of which affect the conditions of work significantly. Because it is often difficult to assess the level of prior maintenance and types of customization before actually beginning work, designing contracts for mainframe work is especially challenging. In principle, this uncertainty could lead to greater efforts at providing safeguards for such transactions, or could lead to less detailed contracts, reflecting the lack of knowledge with which parties initiate their transaction. Given that greater uncertainty could increase both the costs and benefits of incorporating

more contingency planning and task description into the contract, we had no a priori expectations about the sign of the *mainframe* variable.

We included a related variable, *innovation,* that captures the degree to which the project in question required innovation from Compustar. This variable was coded by the two Compustar engineers on a seven-point Likert-type scale. Projects that required more innovation from Compustar involved greater technical difficulty and complexity, and partners therefore tended to possess less knowledge about the relevant contingencies. We therefore predict that projects that require more innovation would be associated with less contingency planning. Such projects also require more intensive communication of customer needs to Compustar, because more customization is typically associated with them. We thus predict that *innovation* will have a positive effect on the level of task description.

We also included a variable that measures aspects of the incentive structure of the contracts. Some of the contracts featured payment terms in which the parties agreed to a fixed fee before commencing the work for the project. Other contracts stipulated payments based on time and materials, or on time and materials, subject to a price cap. We expect that fixed-fee contracts would be characterized by a greater degree of task description, because when fees are fixed in advance, the seller has stronger incentives to assess project costs carefully ex ante (e.g., Eswaran and Kotwal 1985, Banerjee and Duflo 2000). Detailed task descriptions would be required to generate accurate estimates of project costs. In unreported regressions, we included a dichotomous variable called *fixed fee,* which takes the value of one if the contract was based on a fixed fee and zero otherwise. Because such payment terms are likely to be chosen simultaneously with the extent of task description and contingency planning, however, we only report regressions with a lagged variable called *previous fixed fee*—the number of fixed-fee contracts that the parties to a given contract have used in the past. We expect this variable to be less endogenous to task description than the contemporaneous measure.[11]

We controlled for the total monetary value of the project (*dollar value*) because larger projects might require longer contracts. We are missing dollar value for some projects, so we used the mean value to fill in missing data. The results do not change if we simply leave out these contracts. Because the *dollar value* variable is highly skewed (skew $= 5.6$), we entered logged values in the regressions. We also included a variable, *programming*, that was coded by the engineers as one if the primary task of the project involved programming and zero otherwise. Projects requiring more programming may require less task description, because for such projects Compustar was often asked to assign programmers whose efforts were directed by the customer. However, we did not expect these project characteristics to be

associated with the presence or absence of contingency planning.[12] Finally, *time* measures the passage of time from 1986 to 1998 to account for any time trends and is coded as zero for 1986, one for 1987, etc.

Methods

The main goal of our estimation approach was to test whether the existence of contingency planning and the detail of task description have positive and significant reciprocal effects on each other in our data, after controlling for variables representing the key transaction characteristics that theory (or practical considerations) suggests might influence each of these main variables. We began by estimating the effects of our various factors on the extent of task description in our contracts. We followed convention in treating our Likert-scale measure of task description as a continuous variable (e.g., Johnson and Creech 1983, Zumbo and Zimmerman 1993). Our first concern was that in estimating the effect of contingency planning on task description in an OLS regression we would face an endogeneity problem that would bias our OLS estimates, and would indicate the need for simultaneous-equations estimation. We therefore conducted a Durbin-Wu-Hausman (DWH) specification test to examine the endogeneity of the *contingency planning* variable in the *task description* equation (Davidson and MacKinnon 1993, STATA 1999). This test is accomplished in STATA 8.0 by first specifying a two-stage least squares (2SLS) regression model, and then using a program called ivendog, which performs the test automatically.[13] The program examines whether the residuals of a regression of all the exogenous variables on the suspected endogenous variable are significant when included in the original model. *F*- and chi-square tests confirmed that these residuals were not significant in the original model, indicating that *contingency planning* is exogenous in the *task description* model of interest ($F = 0.584$, *p* value $= 0.445$; $\chi^2 = 0.604$, *p* value $= 0.437$). Because 2SLS can yield inefficient estimates when endogeneity is not significant, we report OLS estimates for our *task description* regression (Davidson and MacKinnon 1993).[14] Our basic OLS regression is, therefore,

$$
\begin{aligned}
task\ &description_i \\
&= \alpha_i + \beta_{1i}contingency\ planning_i + \beta_{2i}Time \\
&\quad + \beta_{3i}interdependence_i + \beta_{4i}dollar\ value_i \\
&\quad + \beta_{5i}innovation_i + \beta_{6i}measurement\ cost_i \\
&\quad + \beta_{7i}mainframe_i + \beta_{8i}relationship\ history_i \\
&\quad + \beta_{10i}prev\ fixed\ fee_i + \beta_{11i}programming_i + \varepsilon_i, \quad (1)
\end{aligned}
$$

where i indexes the individual contracts and ε_i is an error term. Because the error terms may not be independent

due to the fact that many customers engaged in multiple contracts with Compustar, we clustered the error terms by partner, using the cluster command in STATA.

To test H2A and H2B, we examined the lagged effects of contingency planning on task description. We first formed a variable called *prior contingency planning*, which is equal to zero if the previous contract that Compustar signed with the customer in question did not contain contingency planning and one otherwise. We then replaced the *contingency planning* variable with this lagged version in Equation (1), expecting to estimate a positive and significant coefficient on it in an OLS regression. This approach is intended to capture possible cross-provision learning over time with a given customer—i.e., having performed contingency planning for the immediate prior contract with a given customer is expected to provide ideas for crafting more detailed task descriptions in the next contract with that customer. Note that concerns about endogeneity do not arise for this lagged version of the contingency planning variable.

Our next step was to estimate the effects of *task description* on *contingency planning*. Because *contingency planning* is a dichotomous variable in our data, we used probit regression to estimate the effects of our various factors on it. We were again concerned that our main explanatory variable of interest in this kind of regression, *task description*, would be endogenous, and therefore its inclusion would lead to biased estimates. We therefore performed an endogeneity test commonly used with probit models, the Smith-Blundell test (Smith and Blundell 1986). A program to perform this test, called probexog, is available for STATA. The results of this test suggested that *task description* is indeed endogenous in a probit model of *contingency planning* ($\chi^2 = 4.75$, *p* value $= 0.029$). To address this problem, we followed Maddala's (1983) suggestion to form the best instrument for *task description* by obtaining a predicted value for *task description* from a regression on all the exogenous variables thought to affect it. We then reestimated our basic probit model, replacing *task description* with *predicted task description*. Our basic probit model for *contingency planning* was therefore specified as follows:

$$
\begin{aligned}
contingency\ &planning_i \\
&= \delta_i + \gamma_{1i}predicted\ task\ description_i + \gamma_{2i}time_i \\
&\quad + \gamma_{3i}interdependence_i + \gamma_{4i}dollar\ value_i \\
&\quad + \gamma_{5i}proprietary_i + \gamma_{6i}innovation_i \\
&\quad + \gamma_{7i}measurement\ cost_i + \gamma_{8i}mainframe_i \\
&\quad + \gamma_{9i}relationship\ history_i + \varepsilon_i, \quad (2)
\end{aligned}
$$

where i again indexes the contracts and ε is an error term. Once again, we clustered the error terms by customer.

Table 1   Descriptive Statistics

	Mean	Std. dev.	Min	Max
Task description[1]	3.40	1.87	0	7
Contingency planning[2]	0.557	0.632	0	1
Time	8.14	2.88	0	12
Mainframe[2]	0.262	0.440	0	1
Programming[2]	0.459	0.499	0	1
Interdependence[2]	0.101	0.302	0	1
Measurement cost[2]	0.439	0.497	0	1
Proprietary[2]	0.153	0.361	0	1
Fixed fee[2]	0.558	0.497	0	1
Dollar value[3]	10.72	1.41	5.30	14.46
Relationship history[4]	30.77	46.82	−1.61	234
Innovation[1]	2.52	1.20	0	7

[1] Likert scale variable.
[2] Indicator variable.
[3] Thousands (log).
[4] Weeks.

Next, we formed a variable to capture lagged effects of *task description* on *contingency planning: Prior task description.* This variable corresponds to the lagged version of the *contingency planning* variable mentioned above, and replaced *predicted task description* in Equation (2). Once again, endogeneity concerns do not arise for this lagged variable.

Therefore, our main hypotheses are that the coefficients on *contingency planning* in Equation (1) (i.e., β_1), on *task description* in Equation (2) (i.e., γ_1), and on the lagged versions of these variables in those equations will be positive and significantly different from zero. Hypotheses 3A and 3B predict that the coefficient on *relationship history* will be positive and significant in all regressions.

Results

Table 1 shows descriptive statistics, and Table 2 shows correlations between the variables in our models. The positive correlation between contingency planning and task description is a preliminary indication that they may be positively affecting each other, but a fuller assessment awaits the regressions. Note as well that the correlations suggest that contingency planning is becoming

Table 3   OLS Estimates, Models of Task Description Detail

	Model 1	Model 2	Model 3
Contingency planning		0.823***	
		(0.270)	
Prior contingency planning			0.485**
			(0.292)
Time	−0.117***	−0.160***	−0.153***
	(0.034)	(0.036)	(0.057)
Interdependence	0.722***	0.480**	0.826***
	(0.286)	(0.280)	(0.350)
Dollar value	0.384***	0.352***	0.363***
	(0.060)	(0.059)	(0.076)
Innovation	0.364***	0.364***	0.499***
	(0.090)	(0.091)	(0.111)
Measurement cost	−0.779***	−0.667***	−0.998***
	(0.183)	(0.164)	(0.243)
Mainframe	−0.006	0.091	−0.056
	(0.206)	(0.206)	(0.236)
Relationship history	0.001	−0.0005	0.0001
	(0.002)	(0.002)	(0.003)
Previous fixed fee	0.048	0.003	0.038
	(0.191)	(0.190)	(0.242)
Programming	−1.06***	−0.927***	−1.09***
	(0.204)	(0.210)	(0.279)
Constant	0.012	0.258	0.172
	(0.652)	(0.650)	(0.905)
R^2	0.253	0.287	0.305
No. of obs.	386	386	242
Prob. > χ^2	0.0000	0.0000	0.0000

Notes. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$; standard errors in parentheses, one-tailed test.

more common over time (across all customers), whereas task description detail is not.

Table 3 contains OLS estimates of the models of task description. Model 1 shows estimates from a regression that includes the control variables only. Model 2 adds our contemporaneous measure of task description, while Model 3 replaces this measure with a lagged variable. The positive and significant coefficient on the *contingency planning* variable in Model 2 implies that contracts containing contingency planning tend to include more detailed task description, controlling for key transaction

Table 2   Correlations Between Variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. *Task description*	1											
2. *Contingency planning*	0.2127	1										
3. *Time*	−0.1444	0.3718	1									
4. *Mainframe*	−0.0287	−0.0923	0.0326	1								
5. *Programming*	−0.2318	−0.1222	0.0356	0.0555	1							
6. *Interdependence*	0.0875	0.1043	−0.0166	0.0416	0.1832	1						
7. *Measurement cost*	−0.1906	−0.1800	−0.1173	0.0539	0.2703	0.1959	1					
8. *Proprietary*	0.0419	0.0158	0.0794	0.0118	−0.0555	0.0230	−0.1273	1				
9. *Fixed fee*	0.0359	0.0377	−0.0861	−0.0485	−0.0244	−0.0324	−0.0561	−0.0065	1			
10. *Dollar value*	0.0179	0.2844	0.3863	−0.0691	0.0670	−0.0102	−0.0889	0.0349	0.0001	1		
11. *Relationship history*	−0.0147	0.3473	0.3540	−0.0538	−0.0338	−0.0574	−0.0428	0.0191	0.0146	0.0231	1	
12. *Innovation*	0.1530	−0.0507	−0.0927	−0.0541	0.2739	0.1398	0.3585	−0.1362	−0.0021	0.0145	−0.0352	1

characteristics. Thus, support is found for one side of the hypothesized relationship of complementarity between task description and contingency planning (H1).[15] A positive and significant coefficient is also estimated for the *prior contingency planning* variable.[16] This suggests that the existence of contingency planning clauses in the prior contract written with a given customer is associated with great task description in the subsequent contract. We interpret this finding as evidence of learning spillovers from contingency planning to task description for the same customer, and therefore support for H2A.

Turning to the control variables, the effects of *time* are very consistent across the three models in Table 3. Task descriptions are getting less detailed over time in these data. We discuss this finding in more detail. The effects of *interdependence* are also positive and significant in all models. This relationship was anticipated based on TCE, which suggests that transactions involving greater partner interdependence require more involved safeguards, such as those that contingency planning and task description can provide. Consistent with our expectations, the coefficients on *dollar value* are positive and significant, indicating that higher value projects feature more detailed task description. Also consistent with expectations, transactions requiring more innovation featured more detailed task descriptions, as suggested by the positive and significant coefficients on *innovation* in all models. The coefficients on *measurement cost* are consistently negative and significant across Models 1–3, suggesting that projects for which measurement is difficult also pose difficulties for developing detailed task descriptions. The *programming* variable is consistently negative and significant across all regressions, indicating that many programming projects involved customer-assigned personnel, as Compustar engineers had indicated to us. The effects of payment structure were not significant in any of the models. Finally, the *relationship history* variable carries a positive nonsignificant coefficient in Models 1 and 3, and a negative nonsignificant sign in Model 2, implying an absence of support for H3A.

Table 4 presents the coefficient estimates for regression models predicting *contingency planning*. Model 5 shows the estimates for a model including the control variables only. The positive and significant coefficient on *predicted task description* in Model 6 provides support for the second half of H1. More detailed task description is associated with contingency planning, after controlling for transaction characteristics that affect task description detail separately.[17] Therefore, H1 is supported overall; we have found reciprocal positive effects of each on the other, controlling for factors thought to affect each of them separately. Moreover, the positive and significant coefficient estimated for *prior task description* suggests that learning spillovers are occurring. As the parties plan for contingencies in one contract, they are

Table 4 Maximum-Likelihood Estimates, Probit Models of Contingency Planning

	Model 4	Model 5	Model 6
Predicted task description		0.614*** (0.175)	
Prior task description			0.102** (0.059)
Time	0.155*** (0.040)	0.235*** (0.051)	0.106** (0.064)
Interdependence	0.804*** (0.303)	0.445* (0.325)	0.892*** (0.354)
Dollar value	0.092** (0.055)	0.016 (0.065)	0.095 (0.067)
Proprietary	0.159 (0.219)	0.232 (0.211)	−0.023 (0.357)
Innovation	−0.038 (0.085)	−0.257*** (.089)	−0.023 (0.119)
Measurement cost	−0.544*** (0.232)	0.141 (0.255)	−0.417 (0.284)
Mainframe	−0.367** (0.193)	−0.389** (0.196)	−0.237 (0.257)
Relationship history	0.008*** (0.002)	0.006*** (0.002)	0.008*** (0.003)
Constant	−2.17*** (0.690)	−3.75*** (0.938)	−2.12** (0.989)
No. of obs.	386	386	242
Log likelihood	−208.11	−197.23	−136.45
Prob. $> \chi^2$	0.0000	0.0000	0.0000

Notes. $*p < 0.1$; $**p < 0.05$; $***p < 0.01$; standard errors in parentheses, one-tailed test.

gaining knowledge useful for designing task description terms for the subsequent project. This provides support for H2B.

The estimates in Table 4 also provide support for H3B. The coefficient on the *relationship history* variable is positive and significant in all regressions. Thus, partners that have worked together for a longer period are more likely to include contingency planning in their contracts with each other.

Turning to the control variables, the coefficient on *time* is positive and significant in all regressions, indicating that the inclusion of contingency planning provisions increased in frequency over time (regardless of contractual partner). We discuss this result further below. *Interdependence* has a positive and significant effect on *contingency planning* in Models 4 and 6, as we expected from TCE. Its loss of significance in Model 5 may be due to its use in constructing the *predicted task description*. The *measurement cost*, coefficient is significant only in Model 1. The *mainframe* variable carries consistent negative sign, and is significant in Models 3 and 4. We had been agnostic about the likely sign of this variable, but perhaps contingency plans are somewhat more difficult to make before a mainframe system is examined closely.

Discussion

Our main findings are that contingency planning and task description tend to act as complements in contract design, and that this complementarity likely results from learning spillovers between these two categories of contractual provisions. The existence of learning spillovers is suggested by the finding that contingency planning in prior contracts is associated with more detailed task description in subsequent contracts with the same partner, controlling for key transaction characteristics, and vice versa. These complementarities between contractual provisions that are generated by learning are in turn suggestive of the idea that organizations learn to achieve fit in their contract designs as they do in their activity systems more generally. A second set of findings suggesting that the firms in our sample were learning to contract is that contingency planning becomes more prevalent in our sample of contracts over time, controlling once again for transaction characteristics. In addition, contingency planning was more likely to be included in contracts between partners with longer relationship histories. These findings appear to contradict theories of contract evolution from management and sociology that predict that as a contractual relationship continues, trust will gradually replace detailed contract terms as a form of transaction governance. To the extent that trust may have developed in the relationships studied, our analysis suggests that contracts often fulfill an important coordination role—in the sense of aligning expectations—in addition to their governance role, and that this coordination role need not be at odds with the formation of trust.

The unexpected finding in our empirical analysis is that task descriptions tended to become less detailed over time as Compustar gained more experience in contracting in the IT services industry. One possible explanation for this finding is that over time Compustar's reputation for honest dealing became stronger among buyers, leading buyers to be less demanding of detailed task description. Another possibility is that Compustar over time began to learn that some types of detail were unnecessary in the contract, and buyers agreed. We also found, however, that the development of a relationship between Compustar and a given customer had a positive, though insignificant, effect on the detail of the task description. This result may be due to a strong learning effect within contractual dyads, in which greater task description detail helps better align expectations and offsets the reputation effects on task description. The later effects come through in the cross-section because learning across partners is weaker.

One general implication suggested by our results is that studying the determinants of each term in a contract, or each category of terms, as if it were independent of other term categories, can miss much of the action in contract designs. For example, using a regression model to predict the intellectual property rights allocation in a set of contracts based on transaction characteristics alone—omitting characteristics of other contract terms that might also contribute to addressing the governance problems associated with the transaction—could result in specification error, and therefore to a misunderstanding of the contractual design. In the contracts we studied, different categories of contract terms worked together in the overall contract design. While there is clearly value in studying the determinants of contract provisions individually, our study highlights the value of studying contracts as governance systems. A second implication is that studying contract designs assuming that they are equilibrium outcomes can be misleading if the parties in question are still in the process of learning to contract. This may well be the case in emerging industries, and perhaps for newer firms in existing industries.

A more specific set of implications concerns the particular categories of contract terms we studied: contingency planning and task description. There has been very little study of what determines the degree of contract detail in these categories, yet each of these categories of terms is crucial to the design of complex contracts, especially in high-technology areas such as IT services. Our premise is that contingency planning and drafting detailed task descriptions are costly activities, and therefore ones in which firms and their managers may not choose to invest. We suggest that an investment in contingency planning is a learning investment (Zollo and Winter 2002) that is likely to produce a payoff with regard to more complete contingency planning. We found evidence for this idea in our result that those contractual partners in our data that had a longer history of transacting with each other were more likely to include contingency planning in their contracts. Learning investments in contingency planning, however, may also yield a payoff in terms of task descriptions that are more precise. We also found evidence for this relationship. Therefore, a key implication of our study is that understanding contract design can require going beyond equilibrium analysis to seek an understanding of the nature of contractual learning processes.

Conclusion

Contract design has rarely been studied with an organizational learning lens, yet we provide systematic evidence that contract structures do evolve significantly over time in ways consistent with learning behavior, after accounting for the key underlying features of the transactions that they govern. For example, we find that the processes of learning to transact and to contract reveal complementarities between different contractual elements, which presumably reflect underlying complementarities in transactional activities. By providing insight into how contract designs evolve over time, our

study is suggestive of the kinds of directions in which learning processes affect such designs, and of how firms can learn to use contracts to govern their exchange relationships.

Future research on learning to contract should explore relationships between other types of contract provisions that may be important in different industrial contexts. For example, biotechnology contracts have been studied in order to examine how intellectual property rights are allocated in them (Lerner and Merges 1998). First, it would be interesting to investigate how such terms evolved, and how long it took for something like efficient allocations of property rights to emerge. Second, it would be interesting to study how processes of learning to design property rights provisions might interact with processes of learning to design, say, dispute resolution provisions. Similarly, studies of the determinants of payment terms have treated such terms as equilibria. Do payment terms approach their equilibrium design faster than contingency planning or property rights allocation terms? Moreover, does the design of payment terms sometimes reflect learning that spills over from other provision categories, such as task description, for example, or does learning tend to be more provision specific?

These kinds of questions are interesting from a strategy perspective because answering them is the first step toward investigating how contract innovations are introduced, by whom, and who appropriates the benefits. For example, do firms tend to appropriate returns from contract design innovation, or do outside law firms capture most of the value? Perhaps in engineering-intensive firms, the firms themselves may become the key loci of contract design knowledge, whereas in other industries other patterns may hold. Only by recognizing the possible role of learning to contract, however, can one understand whether and how contract design capabilities may contribute to firm competitive advantage.

One limitation of our study is that, because we lack a measure of trust and a sample period that is long enough, we are unable to fully investigate various possible interactions between learning, trust, and contract design. For example, we are unable to examine whether, over time, trust effects come to dominate learning effects, leading to less detailed contract terms. Another limitation of our study is that we lack data on the performance of the projects for which we have contracts. Were these data available, we would have been able to observe not only whether contingency planning and task description were positively associated with one another after controlling for effects on them individually, but also whether increases in one tended to lead to better performance when the level of the other was higher. A positive finding would have provided even stronger evidence for the complementarity and associated learning effects we

hypothesize. Future research should examine when different components of a contract such as task description, contingency planning, etc.—as well as interactions between those components—have a greater effect on performance. The need to understand how such relationships operate is arguably only becoming more important as more business activity is undertaken via alliances and other interfirm contractual arrangements.

Acknowledgments

Endnotes

[1]Crocker and Reynolds (1993) found empirical evidence consistent with the importance of these key trade-offs in a sample of military procurement contracts. In particular, they found that transactions characterized by greater uncertainty, for which including additional contingencies in the contracts was especially costly, tended to be more incomplete than contracts governing less uncertain projects. Crocker and Reynolds's empirical measure of incompleteness, however, was based entirely on pricing procedures in the contracts they studied. They therefore could not study the degree of incompleteness of other key contract terms such as the extent of contingency planning and task description that are important in many contexts such as ours.

[2]Klein (1993) pointed out that including additional terms in a contract can sometimes succeed in merely shifting the margin at which opportunism can occur. Our arguments, however, only require a negative correlation between contract completeness and opportunism, not perfectly negative correlation.

[3]Because we do not have access to data on contract performance, we cannot observe marginal net benefits of more detail in either category of contract terms. Similar to Poppo and Zenger (2002), therefore, we seek evidence of complementarity by observing whether the degree of contingency planning and the degree of task description are statistically associated with each other in our sample, controlling for all the characteristics of the transaction that are expected to affect each of those categories of terms.

[4]We expect that eventually the learning processes underlying contract design will begin to slow, as contract designs approach their equilibrium structures. Given that the IT services industry remained dynamic at the end of our sample period, however, we expect learning effects to be prominent throughout the period. We did test, however, whether the complementarity between contingency planning and task description weakened over time, and rejected this hypothesis. For details on this test, see Endnote 15.

[5]We are unable to examine learning spillovers across contracts with different partners, because our data consist of a sample, rather than all of Compustar's contracts.

[6]The coding process was as follows. Each engineer coded the same 80 contracts (randomly selected). Then one author and

both engineers went through all 80 and compared the coding of all variables. The following disagreements were found: three for *measurement cost,* one for *interdependence,* and two for *innovation* (these variables are discussed). After a brief discussion, the engineers clarified the discrepancies and felt very comfortable that they were using the same criteria as they coded the remaining contracts.

[7]A subset of contracts contained especially detailed contingency planning, but it was too small to justify a separate category. In any case, our main results are unchanged when we code *contingency planning* on a 0-2 scale.

[8]In addition to measures of the total amount of time worked together in the past, we also assembled measures of the number of contracts entered into by the parties in the past. Our econometric results do not change significantly when these alternative measures are entered in place of the time-worked-together measures. We report the results with the original measures only (see Results section), because actual time working together would seem to be a more precise measure of interpartner learning opportunities than number of previous contracts (some of which may have been short).

[9]Except for our control for payment terms, *fixed fee* (see Control Variables section), we are not concerned about endogeneity of the control variables. These variables were coded based on the Compustar engineers' understandings about the type of project that the contract in question was governing. In reviewing the various projects, the engineers did use the task descriptions in the contracts to stimulate their memories, but they also relied on other information and their own experience in making judgments about the transaction characteristics. (Recall that many contracts had thin task description sections, so often the engineers had to be drawn on a wider base of their knowledge anyway.) Note as well that the way these projects were set up was as follows: The parties first decided on the buyers' needs. This determined the degree of customer interdependence required, the amount of proprietary knowledge to be applied, whether a mainframe was involved, etc. Once these issues were decided, the parties drafted contractual clauses. It is therefore reasonable to treat the variables representing transaction characteristics as exogenous, and the contractual structure as endogenous.

[10]We did not expect that the *proprietary* variable would affect task description detail, because describing a task in great detail may require revealing proprietary information. In such cases, the safeguarding function of detailed task description would be compromised. Still, in unreported regressions, we included the *proprietary* variable as an explanatory variable in the regressions predicting *task description*. The variable was never close to significance, and we dropped it in the reported regressions.

[11]Our main estimation results do not change if our payment term measures are excluded entirely or if the contemporaneous measure is included. Kalnins and Mayer (2004) report regressions on the same data set we use here, in which the payment structure is the dependent variable, and the various project characteristics described in this paper are explanatory variables. In those regressions, the coefficient on *previous fixed fee* appears as significant, indicating some inertia in the payment terms used by two parties over time. This supports the treatment of the *previous fixed fee* as partly exogenous to the choice of other contract terms in this data.

[12]For example, contingency planning might be necessary even in these more limited contracts in order to prevent the customer from exploiting the use of Compustar's programmers. We included the *programming* variable in unreported regressions predicting *contingency planning*, but the variable's coefficient was never significant, and our other results were not affected.

[13]Our 2SLS model was identified by including *previous fixed fee* and *programming* in the *task description* equation, but not in the *contingency planning* equation. *proprietary* was included in the *contingency planning* equation, but not the *task description* equation. Our rationales for these choices are explained in the Control Variables section.

[14]It is useful to note that while our theory might imply some endogeneity of *contingency planning*, the DWH test only examines whether a variable is endogenous enough to bias OLS estimates (e.g., Johnston and Dinardo 1997). We do find evidence of endogeneity of *task description* in a regression in which *contingency planning* is the dependent variable.

[15]We also looked for evidence that the complementarity between contingency planning and task description strengthened or weakened over time. We examined this question by including interaction terms between each of these variables of interest and *time* in the relevant equation. The coefficients on these interaction terms were never significant, and we do not report them.

[16]Models 3 and 6 were estimated on a smaller number of observations because nonrepeated transactions had to be eliminated to test H2A and H2B.

[17]This result is not robust to the substitution of the logged value of relationship history for the nonlogged value in the regression. Mayer (2006) worked with the logged value. The paper's other findings are, however, robust to this substitution. One implication is that that prior contingency planning has a stronger impact on task description detail than vice versa.

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