

# Choosing Procurement Contracts To Facilitate Self-Enforcement: Evidence from Information Technology Outsourcing\*

Lan Shi

University of Washington

Anjana Susarla

University of Washington

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## Abstract

We augment existing studies of spot procurement contracts by introducing relational contracting. We first show that at intermediate interest rates, the form of procurement contract affects the parties' reneging temptation on a given relational contract, and hence affects the best relational contract that is sustainable. We also show that relational contracts make contracts less complete and complexity plays a lesser role in the choice between fixed-price versus cost-plus contracts with relational contracting. Using a novel data set on information technology outsourcing contracts, we find that lower reneging temptation, measured by narrowly varying alternative vendors' modification costs, favors relational fixed-price contracts. Second, we find that a vendor with high reputation capital in fair bargaining (cost-cutting) is more likely to be awarded a fixed-price (cost-plus) contract. Lastly, we find that complexity matters less in the choice between fixed-price versus cost-plus contracts with relational contracting. JEL Codes: D2, D86, L24, M15

## 1 Introduction

As Macaulay (1963) has noted, implicit contract, that is, contract based on observable but unverifiable information, is an important part of the exchange between firms. Bull (1987) has examined the implicit contract within a firm. On another line, economists have examined the issue of make or buy

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using transaction-cost theory (Williamson 1975, 1985, 1996, Klein et al, 1978) and property-right theory (Grossman and Hart, 1986). Klein and Murphy (1997) and Baker, Gibbons, Murphy (2002) further our understanding of make or buy by treating the outsourcing decision in a self-enforcing environment, rather than in a static setting. That is, whether to outsource or not depends on whether it help facilitates implicit contract. In addition, Baker, Gibbons, Murphy (1994) examined the use of compensation contracts in a self-enforcing employment environment, and MacLeod (2007) examined the use of efficiency wage or bonus in a self-enforcing buyer-seller setting. Few studied the contracts in a self-enforcing outsourcing environment, and this is what our paper attempts to achieve. Given that the decision to outsourcing is already made, we examine the choice of procurement contracts, in particular, fixed-price or cost-plus, in a self-enforcing environment. We find that whether to use one contract or the other depends on whether it helps facilitate implicit contracts between the buyer and the seller.

We do it in an information technology (IT) outsourcing setting. IT outsourcing contracts, particularly the large ones, are characterized by long-term interaction between the buyer and the seller. Thus the role that contract plays is better explained by a model of repeated interactions than a one-time transaction where parties use contract to protect itself from the other's opportunistic behavior; rather, the choice of contract is to facilitate the relational contracts.

We have a large literature of forms of procurement contracts in a static setting. In an insightful paper, Bajari and Tadelis' (2001) examined fixed-price (FP) and cost-plus (CP) contracts, variants of which cover the vast majority of procurement contracts. Fixed-priced contracts necessitate that a detailed specification is spelled out and a price is determined (usually through bidding) when the contract is signed. If the client finds out that it needs a change in the specification, it has to write out a detailed specification again and negotiate a price to the amendment. Contracts for outsourced IT services can be incomplete in its initial specification. The rate of business environment creates a need for newer features and technological change creates compatibility requirements by the time the project is underway.

The weaknesses of a spot fixed-price contract thus are two. First, technology-wise, it is much harder to incorporate a change when the framework has been fixed (likely in a fixed-price contract) than when it is not (likely in a cost-plus contract). Second is the transaction (renegotiation) cost associated with a change order: Anticipating buyers' need of changes, the seller engage in activities that enhance its bargaining position when the need for amendments arises, which is unproductive to the relation.<sup>1</sup> The

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<sup>1</sup>There are various ways to model the transaction cost associated with outsourcing. Williamson (1975, 1985, 1996) and Klein et al (1978), who pioneered transaction cost economics, modeled it as costly renegotiation, or haggling over "appropriable quasi-rents." Grossman and Hart (1986), in property right theory, emphasized the effect of (efficient) renegotiation in distorting (unverifiable) ex-ante investment decisions. For an excellent review, see Gibbons (2005). Bajari and Tadelis (2001) modeled the cost of renegotiation as costs associated with information asymmetry. Similar to Baker,

strength of fixed-price contracts, meanwhile, is that it offer vendors strong incentives to cut costs.

By contrast, in cost-based contracts, a project can begin without a detailed specification. The vendor is compensated the costs plus a fee. The client can submit a change of order without worrying about the pricing of it. Thus the possibility of costly renegotiation is greatly reduced. A potential weakness of cost-based contracts though is that vendors have little incentives to cut down costs. So the trade-off is between stronger cost-cutting incentives in fixed-price contracts and lower renegotiation costs in cost-plus contracts. These are the predictions from a static analysis.

As described earlier, an IT outsourcing contract is incomplete; information becomes available with time, hence there is a need for contracts to allow the parties to use the new information and be flexible or adaptive without sticking to the original contract. That is, there is a role for relational contracts; the two transacting parties can potentially achieve greater efficiency by contracting on measures that are observable to the transacting parties but are unverifiable to a third party.<sup>2</sup>

In a one-shot transaction that uses fixed-price contract, the seller will use the chance of amendments to benefit itself at the cost of the buyer.<sup>3</sup> And knowing that, the buyer will be strict with order for changes, that is, the contract is not conducive to accommodate change. When relational contracting is feasible, when the need for change arises, the seller accommodate buyer's need for change, and the buyer reward seller's cooperative behavior. In terms of modelling, in relational fixed-price contract, the buyer observes whether the vendor engaged in rent-seeking or costly renegotiations when it comes to amendments, and thus can form an "implicit" agreement to reduce such behavior. In a cost-plus contract, the transacting parties observes signals of whether the vendor worked hard on cutting down costs and thus can form an "implicit" agreement to encourage cost-cutting behavior.

Since the seller's behavior measures are observable yet unverifiable by a court, such a contract needs to be self-enforcing, which is made possible if the two parties will transact again or form a long-term relationship. We consider a trigger strategy: In relational fixed-price contracts, the vendor agrees to fairly accommodate change orders and buyer agrees to reward vendor's fair bargaining, and if either party reneges they fall back to spot fixed-price contracts; in relational cost-plus contracts, the vendor agrees to cut down costs and buyer agrees to reward low costs, and if either party reneges they fall back to spot cost-plus contracts.<sup>4</sup>

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Gibbons, and Murphy (2002), this paper models costly renegotiation by introducing total-resource-depleting (rent-seeking) behavior, along the tradition of the Property Right Theory.

<sup>2</sup>The earliest papers on this include Macaulay (1963). See MacLeod (2007) for an excellent survey on relational contracts.

<sup>3</sup>Even worse, the seller will withhold information so that there is more need to change after the contract is fixed.

<sup>4</sup>It is possible that there is no future business between the two parties. But then the seller can start new transactions with other buyers, which we interpret as spot transactions (since there is no trust in this new relationship.) The analysis then applies.

The form of outsourcing contracts is shown to affect the parties' reneging temptation, hence the best relational contract feasible. In particular, a vendor in a relational fixed-price contract faces incentives to engage in total-surplus-depleting bargaining by affecting an alternative vendor's cost of modifications: The vendor can deliberately make the system opaque so that modifications become difficult for other sellers to do, or the vendor can use proprietary technologies that are not used by other vendors, increasing the latter's compatibility costs, or the vendor will be lukewarm to impart its know-how of the IT system to the potential new vendor. As a result, the uncertainty in alternative vendors' modification costs affects the vendor's incentives to renege in relational fixed-price contracts. At the same time, a buyer in a relational cost-plus contract has incentives to renege on paying high bonus, thus limiting the cost-incentives that can be provided. Therefore the new predictions from our model of relational contracts compared with spot outsourcing are i) at low interest rate, or with the possibility of future interactions very likely, the first-best will be achieved under either relational fixed-price or cost-plus contracts, and ii) at intermediate interest rate, if the uncertainty in alternative vendors' modification costs is greater, vendor has greater incentives to renege under relational fixed-price contracts, thus it is efficient to use relational cost-plus contracts.

The above model only characterizes the equilibrium outcome and does not describe the process of reaching that equilibrium. A vendor may accumulate reputations for individual dimensions, specifically fair bargaining and cost-cutting. Then the prediction is that a vendor with high reputation capital in fair bargaining should be awarded (relational) fixed-price contracts and a vendor with high reputation capital in cost cutting should be awarded (relational) cost based contracts.

We also show that relational contracts impact contract completeness, which is the degree of completeness in outlining product or service specifications. A spot fixed-price contract is characterized with contract completeness, rigidity in changes, and little communication between parties after contracts are signed. Under a relational fixed-priced contract, the vendor is trusted to accommodate changes fairly, thus the original contract is less complete and more communication is under way to adjust to changes from the environment. For the same reason, with relational contracting, complexity ceases to be a factor deciding the choice between fixed-price versus cost-plus contract.

This paper tests these predictions using a novel data set of firms' SEC filings of information technology (IT thereafter) procurement contracts. IT outsourcing is an ideal setting to test the impact of relational contracts on procurement contracts: In our data, a median contract lasts 48 months, and when parties enter a transacting relation, they consider the possibility that they will transact again in the future. Also, contracts tend to be incomplete. Further, our data provides rich details on the pricing, the past relations, the performance in past relations, the possibility of future interactions, complexity,

contracting completeness, and communication between parties.

Our results find support for the predictions from the model described above. First, we find evidence that less reneging temptation, measured by the less variability in cost of modifications, favors relational fixed-price contracts. Second, we find that a vendor with a reputation in fair bargaining (cost-cutting) is more likely to be awarded a fixed-price (cost-plus) contract. Lastly, we find that while spot fixed-price contracts are associated with a higher degree of completeness, with relational contracting, the contract will become less complete. And while complexity matters in the choice of spot fixed-price and cost-plus contracts, they do not matter in the choice between relational fixed-price and relational cost-plus contracts.

Closest and contemporaneous theoretical paper is Corts (2007). We differ from Corts in introducing uncertainty in production and making contracting completeness endogenous. We differ from Baker et al. (2002) in that we examine the impact of relational contracts on procurement contracts instead of the decision to make or buy.

Several empirical papers examined related questions. Banerjee and Duflo (2000) offered evidence that vendors with high reputation in sharing cost overrun are more likely to be awarded cost-plus contracts. Corts and Singh (2004) and Kalnins and Mayer (2004) found that the number or the amount of past transactions favor the use of cost-plus contracts, which we are able to confirm. We differ from them in several ways. First, we focus on relational contracts and reputation within the relation rather than a reputation in the market. Second, we measure relational contracts using the possibility of future interactions. Past literature has proxied for relational contracts using past interactions between parties. Third, this papers provides a variety of measures of reputation capital (within a relation) and examine their impact on the form of procurement contracts. Lastly, besides pricing, we are able to test the impact of relational contracts on contract completeness, communication, and the effect of complexity on contract choice.

The remaining paper is organized as follows. Sections 2 provides a model on the interaction between relational contracts and procurement contracts. Sections 3 explains the data and variable measurements. Section 4 provides results and Section 5 concludes.

## 2 Model

We consider an economic environment where a buyer, interchangeable with a client, decides to outsource an information-technology project to a vendor. Both parties live forever. Both parties are risk-neutral and share the interest rate  $r$  per period.

## 2.1 Production Technology and Preferences

Each period the cost of the project ( $c$ ) is either high or low ( $c_H$  or  $c_L$ ). It is then natural to define the vendor's action ( $e$ ) to be the probability that low value will be realized:  $prob(c = c_L) = qe$  and  $prob(c = c_H) = 1 - qe$ , where  $q$  is the effectiveness of effort ( $0 < q < 1$ ), and  $0 \leq e \leq 1$ . With this technology, even with  $e = 1$ , there is still possibility of high cost. Two examples of uncertainty are that of raw material prices and technological complexity.

It is costly to anticipate what is to be delivered in an IT outsourcing contract, one reason being the evolving business environment and the other the pace of technological innovation. Further, IT systems tend to be highly specific to each firm, also increasing the difficulty of exhaustively defining the services to be delivered by the vendor. In this sense, the contract is incomplete and needs to be adaptive. In particular, with probability  $\tau$ , the original contract covers the situation on hand, and with probability  $(1 - \tau)$ , there is a need for the buyer to modify the original contract to adapt to the arising situation, for instance, to drop a feature or add another feature or both. The value of the project is  $v$ ; with probability  $(1 - \tau)$ , modification is needed for the value of the project to be  $v$ . The cost of writing up the contract is  $d(\tau, T)$ , where  $T$  is the complexity of the project. In particular, we assume  $d(\tau, T) = \frac{\tau^2}{2}T$ . The cost of finishing the modification is either high or low ( $c_H^m$  or  $c_L^m$ ). The vendor's cost-cutting effort in the stage of modification ( $e^m$ ) affects the probability of the cost of modification; in particular,  $prob(c^m = c_L^m) = q^m e^m$  and  $prob(c^m = c_H^m) = 1 - q^m e^m$ , where  $q^m$  is the effectiveness of effort in modifications and  $0 < q^m < 1$ , and  $0 \leq e^m \leq 1$ . And  $v > c_H^m$ , hence it is efficient to do the modification.

The modification can also be done by an outside vendor. Being the incumbent one, the seller is able to engage in rent-seeking behavior ( $e_b^m$ ) to enhance its bargaining position when the buyer requests a change. For example, the vendor can deliberately make the system opaque so that modifications become difficult for other sellers to do, or the vendor can use proprietary technologies that are not used by other vendors, increasing the latter's compatibility costs, or the vendor will be lukewarm to impart its knowhow of the IT system to the potential new vendor. Such kinds of activities affect the outside vendor's estimated cost of modification ( $d^m$ ), which can be  $d_H^m$  or  $d_L^m$ . In particular, the seller's rent-seeking effort ( $e_b^m$ ) affects the probability that the outsider vendor's expected cost of modification is high:  $prob(d^m = d_H^m) = \rho^m e_b^m$  and  $prob(d^m = d_L^m) = 1 - \rho^m e_b^m$ , where  $\rho^m$  is the effectiveness of vendor's rent-seeking effort in affecting  $d^m$  with  $\rho^m < 1$  and  $0 \leq e_b^m \leq 1$ .<sup>5</sup> Denote  $\Delta d = d_H^m - d_L^m$ , which can be

<sup>5</sup>This rent-seeking behavior is along the same line as Baker, Gibbons, Murphy (2004), yet differs slightly. In Baker, Gibbons, Murphy (2004), a seller faces several buyers. And knowing that the buyer might renege on its promise, the seller engages in activities to raise its market value so that its bargaining position is enhanced, and such behavior is unproductive to the relation yet is taken by the seller to benefit itself. Here, a buyer faces several sellers. And knowing that the buyer

thought as the variability in the alternative vendor's cost of modification.

Maximizing total surplus then is to

$$\begin{aligned} & \underset{e, e^m, e_b^m, \tau}{Max} \quad v - [qe * c_L + (1 - qe) * c_H] - \frac{e^2}{2} - \\ & (1 - \tau)[q^m e^m c_L^m + (1 - q^m e^m) c_H^m - \frac{1}{2}(e^m)^2 - \frac{1}{2}(e_b^m)^2] - \frac{\tau^2}{2} T, \end{aligned}$$

where  $TS$  refers total surplus and  $FB$  refers to first-best. Hence,

$$e^{FB} = q(c_H - c_L) = q\Delta c, (e^m)^{FB} = q^m(c_H^m - c_L^m) = q^m \Delta c^m, (e_b^m)^{FB} = 0, \text{ and } \tau^{FB} = \frac{c_H^m - \frac{(q^m \Delta c^m)^2}{2}}{T}.$$

First-best total surplus then is

$$v - c_H + \frac{q^2(\Delta c)^2}{2} - c_H^m + \frac{(q^m \Delta c^m)^2}{2} + \frac{(c_H^m - \frac{(q^m \Delta c^m)^2}{2})^2}{2T} = TS^{FB},$$

The vendor's rent-seeking behavior in renegotiations ( $e_b^m$ ) is unobservable by the buyer, but the realized modification costs ( $d^m$ ) is. However they are not verifiable to a third party, hence the role for a relational contract. Likewise, cost-cutting effort ( $e$ ) is unobservable, but project costs ( $c$ ) are observable to the contracting parties yet un-verifiable to a third party, hence the role for a relational contract.<sup>6</sup>

Two commonly used payment methods are fixed-price contracts and cost-plus contracts.<sup>7</sup> Therefore four governance structures are feasible in this environment. Spot fixed-price (cost-plus) contract is a transaction where the two parties have no trust between them and it is governed by a fixed-price (cost-plus) contract. Relational fixed-price contract is a transaction where the seller is trusted to accommodate changes reasonably and if otherwise the transaction is governed by fixed-price contract. Relational cost-plus contract is a transaction where the seller is trusted to cut down costs and if otherwise the transaction is governed by a cost-plus contract. Below, we analyze the four governance structures.

might switch sellers, the seller engage in activities to raise the expected costs of potential other sellers to enhance its bargaining position.

<sup>6</sup>For example, the bill for the project turns out to be high. Part of the high cost may be attributed to the vendor's poor effort in cutting costs and part of it may be due to miscalculation or arbitrariness or caprices on the part of the buyer. The two parties are able to observe who is responsible for what part, but an independent third party may not be able to verify that information.

<sup>7</sup>A potential incentive contract is of form: payment = costs -  $\alpha(\text{costs} - \overline{\text{costs}})$ , where  $\overline{\text{costs}}$  is the expected costs and  $0 \leq \alpha \leq 1$ . A fixed-price contract corresponds to the case of  $\alpha = 1$ , in which the contract needs to be complete enough for an estimate of  $\overline{\text{costs}}$  to be made. The cost-plus contracts correspond to the case of  $\alpha = 0$ , in which there is no need of information on  $\overline{\text{costs}}$ . Any incentive contract involving an estimate of  $\overline{\text{costs}}$ , including a fixed-price contract, will encounter the problem of renegotiation when a modification of the original contract is needed. For simplicity, this paper focuses on the comparison between fixed-price and cost-plus contracts. A related point is that it is exactly for the unverifiability of  $\text{costs} - \overline{\text{costs}}$  that relational contract has a role to play.

## 2.2 Spot Fixed-price Contract (SFP)

We first consider spot fixed-price contracts. When there is a need for modifications, the buyer either asks the vendor or an alternative vendor to do it and need to negotiate a price for the modification (amendment). We assume that the seller estimate the cost of doing the modification to be  $c_m$ . Meanwhile, an alternative firm can potentially do the modification at cost  $d_i^m$ , where  $i = H, L$ . Possessing knowledge of the project, the seller now is in a position to engage in behavior ( $e_b^m$ ) to enhance its bargaining position. The seller The buyer and the seller observes  $c_m$  and  $d_i^m$  yet they are unverifiable. We use Nash bargaining solution (with equal bargaining powers) to arrive at this price – the re-negotiation during the modification stage results in a price ( $p_m$ ) that is equal to  $\frac{c^m+d_i^m}{2}$ .<sup>8</sup> Anticipating this, the vendor will then choose  $e, e^m, e_b$  to solve

$$\begin{aligned} \underset{e, e^m, e_b, \tau}{Max} \quad & price - [qe * c_L + (1 - qe) * c_H] - \frac{e^2}{2} + (1 - \tau)[\rho^m e_b^m \frac{c^m+d_H^m}{2} + (1 - \rho^m e_b^m) \frac{c^m+d_L^m}{2} - q^m e^m c_L^m - \\ & (1 - q^m e^m) c_H^m - \frac{1}{2}(e^m)^2 - \frac{1}{2}(e_b^m)^2] - \tau^2 T \equiv \pi^{SFP}, \end{aligned}$$

where *price* is the promised (fixed) payment for this project. Taking first-order condition on  $e, e^m$  and  $e_b^m$ , we get

$$e^{SFP} = q\Delta c, (e^m)^{SFP} = q^m \Delta c^m, (e_b^m)^{SFP} = \rho^m \frac{\Delta d}{2}, \text{ and } \tau^{SFP} = \frac{c_H^m - \frac{(q^m \Delta c^m)^2}{2} + \frac{1}{2}(\rho^m \frac{\Delta d}{2})^2}{T}.$$

Note that the vendor's rent-seeking behavior ( $e_b^m$ ) raises the vendor's price yet reduces the total surplus. The buyer  $Max v - price - (1 - \tau)[\rho^m e_b^m \frac{c^m+d_H^m}{2} + (1 - \rho^m e_b^m) \frac{c^m+d_L^m}{2}]$ , taking the seller's effort as given and the participation constraint that the seller earns zero expected profit. Define it as  $u^{SFP}$ , then the total surplus under spot fixed-price contract is

$$v - (c_H - \frac{q^2(\Delta c)^2}{2}) - [c_H^m - \frac{(q^m \Delta c^m)^2}{2} + \frac{1}{2}(\rho^m \frac{\Delta d}{2})^2] + \frac{[c_H^m - \frac{(q^m \Delta c^m)^2}{2} + \frac{1}{2}(\rho^m \frac{\Delta d}{2})^2]^2}{2T} = TS^{SFP}. \quad (1)$$

## 2.3 Spot Cost-plus Contract (SCP)

A cost-plus contract compensates the vendor for costs incurred. Given the nature of a cost-plus contract, the buyer's request for modification does not involve a renegotiation of the price; expenses incurred for the modification will just be sent to the buyer. Then vendor chooses  $e, e^m, e_b$  to

$$\begin{aligned} \underset{e, e^m, e_b}{Max} \quad & [qe * (c_L - c_L) + (1 - qe) * (c_H - c_H)] - \frac{e^2}{2} + (1 - \tau)[q^m e^m * (c_L^m - c_L^m) + (1 - q^m e^m) * (c_H^m - c_H^m) - \\ & \frac{1}{2}(e^m)^2 - \frac{1}{2}(e_b^m)^2] \equiv \pi^{SCP}. \end{aligned}$$

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<sup>8</sup>For example, suppose that the incumbent vendor's expected cost of modification, which is observed by the two parties, is \$1,000,000, and the best alternative vendor's expected cost of modification, which is also observed by the two parties, is \$2,000,000. Then by Nash-bargaining, the final price for the modification is \$1,500,000.



F.O.C. on  $e, e^m, e_b$ , we get  $e = 0, e^m, e_b = 0$ , and  $\tau^{SCP} = \frac{c_H^m}{T}$ . That is, a cost-plus contract per se is not free of vendor's rent-seeking behavior ( $e_b^m$ ); it is just that fixed-price contract involves negotiating the price again when the need for modifications arises, whereas cost-plus is a well-defined payment method for such an occasion. The buyer  $Max v - [qe * c_L + (1 - qe) * c_H] - (1 - \tau)[q^m e^m * c_L^m + (1 - q^m e^m) * c_H^m]$ , taking the seller's effort as given. Define it as  $u^{SCP}$ , then the total surplus under spot cost-plus contract is

$$TS^{SCP} = v - c_H - c_H^m + \frac{(c_H^m)^2}{2T}. \quad (2)$$

Comparing Equation (1) and (2) shows that there is a tradeoff between the use of spot fixed-price and cost-plus contracts. Spot fixed-price contracts offer strong incentives for cost-cutting, but performs badly on the dimension of renegotiation costs. Spot cost-plus contracts are poor for cost-cutting but performs better in renegotiation costs. Hence the predictions from the static analysis are (proofs provided in the Appendix):

Prediction 1: When cost-cutting efforts have bigger impact ( $q\Delta c$  or  $q^m\Delta c^m$ ), fixed-price contracts become more attractive compared with cost-plus contracts.

Prediction 2: When the gain from rent-seeking (total-surplus-depleting) behavior ( $\rho^m\Delta d$ ) is greater, fixed-price contracts become less attractive compared with cost-plus contracts.

Prediction 3: If renegotiation cost is great in the sense of  $\rho^m\Delta d > 2q^m\Delta c^m$ , then when the project is more complex ( $T$  is higher), fixed-price contracts become less attractive compared with cost-plus contracts. The reason is that when  $T$  is high, it is hard to anticipate all possible states. But since  $\rho^m\Delta d > 2q^m\Delta c^m$ , spot fixed-price contracts become unattractive. When  $T$  is low, then  $\tau$  can be high, then spot fixed-price contracts become attractive.

While we confirm Bajari and Tadelis (2001)'s predictions on spot contracting, this paper's main contribution lies in introducing relational contracts, which we discuss below.

## 2.4 Relational Fixed-price (RFP) Contracts

Relational fixed-price contracts are fixed-price contracts with a relational contract on how to discourage costly renegotiations when it comes to modifications. Specifically, the relational fixed-price contract takes this form: The vendor is paid a fixed price, and in the case of modification, if the buyer observes (yet unverifiably)  $d_H^m$ , then the buyer pays  $c^m + \beta_H$ ; if the buyer observes  $d_L^m$ , then the buyer pays  $c^m + \beta_L$ , where  $\beta_H$ , and  $\beta_L$  are bonuses for observed  $d_H^m$  and  $d_L^m$ , respectively.

We construct a repeated-game model of such a relational contract between buyer and vendor. An important part of this calculation is the payoff after renege. We analyze trigger-strategy equilibria, in which the party who did not renege refuses to enter into any new relational contract with the party who

renege.<sup>9</sup> This trigger-strategy assumption implies that the parties live under spot governance forever after one reneges. For simplicity, we assume that the parties will use the spot fixed-price contracts. The core of the analysis is therefore in establishing whether reputation concerns, in fact, outweigh the temptation to renege on a given relational contract.

Believing that the buyer will indeed honor the relational contract, the vendor will choose  $(e, e^m, e_b)$  to solve

$$\begin{aligned} & \underset{e, e^m, e_b}{Max} \text{ price} - [qe * c_L + (1 - qe) * c_H] - \frac{e^2}{2} + (1 - \tau)[\rho^m e_b^m (\beta_H) + \\ & + (1 - \rho^m e_b^m) \beta_L - q^m e^m c_L^m - (1 - q^m e^m) c_H^m - \frac{1}{2}(e^m)^2 - \frac{1}{2}(e_b^m)^2] - \frac{\tau^2}{2} T, \end{aligned}$$

Denoting  $\Delta\beta = \beta_H - \beta_L$  and taking F. O. C. on  $e, e^m, e_b$ , we have

$$e^{RFP} = q\Delta c, \quad e^m = q^m \Delta c^m, \quad e_b^m = \rho^m \Delta\beta, \quad \text{and} \quad \tau^{RFP} = \frac{c_H^m - \frac{1}{2}(q^m \Delta c^m)^2 + \frac{1}{2}(\rho^m \Delta\beta)^2}{T}.$$

The buyer  $Max v - price + (1 - \tau)[\rho^m e_b^m (-\beta_H) + (1 - \rho^m e_b^m)(-\beta_L)]$ , taking the seller's participation constraint (expected profit being zero) and effort as given. Define it as  $u^{RFP}$ , then the total surplus under relational fixed-price (RFP) contract is

$$v - c_H + \frac{q^2(\Delta c)^2}{2} - c_H^m + \frac{1}{2}(q^m \Delta c^m)^2 - \frac{1}{2}(\rho^m \Delta\beta)^2 + \frac{[c_H^m - \frac{1}{2}(q^m \Delta c^m)^2 + \frac{1}{2}(\rho^m \Delta\beta)^2]^2}{2T} = TS^{RFP}.$$

The relational fixed-price contract is self-enforcing if both parties choose to honor the contract for all possible realization of  $d^m$ . The vendor reneges (in the modification stage) on the relational fixed-price contract if the promised payment ( $\beta$ ) is less than  $\frac{c^m + d_j^m}{2}$ . Thus potential vendors' expected cost,  $d^m$ , affects the renege decision under relational fixed-price contracts. If vendor reneges, she will earn the utility of spot fixed-price contracts thereafter. Thus the vendor will honor rather than renege on the relational contract when, for all  $i$  and  $j$ ,

$$\frac{c^m + d_j^m}{2} - c_i^m + \frac{\pi^{SFP}}{r} \leq \beta_j - c_i^m + \frac{\pi^{RFP}}{r}. \quad (3)$$

The buyer reneges if he refuses to pay the promised bonus  $\beta$  to the vendor, in hope of paying a lower price through bargaining. The buyer will honor rather than renege on the relational contract, for all  $i$  and  $j$ ,

$$\frac{c^m + d_j^m}{2} - c_i^m + \frac{u^{SFP}}{r} \leq -\beta_j - c_i^m + \frac{u^{RFP}}{r}. \quad (4)$$

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<sup>9</sup>There may exist other forms of relational contracts. For example, the harmed party may decide to spare the renege party once and not to sever the relation despite the renege, possibly because the former realizes that he or she is partially responsible for the partner's renege. One such example is inadequate communication between the parties. More on this in conclusion.

If (3) holds for all  $i$  and  $j$ , then it must hold for the smallest value of  $\beta_j - \frac{c^m + d_j^m}{2}$ , while if (4) holds for all  $i$  and  $j$ , then it must hold for the largest value of  $\beta_j - \frac{c^m + d_j^m}{2}$ . Combining these two extreme versions of (3) and (4) yields a single necessary condition for the *RFP* to be self enforcing (proofs in Appendix):

$$\Delta\beta + \frac{\Delta d}{2} \leq \frac{TS^{RFP} - TS^{SFP}}{r}, \quad (5)$$

where  $\Delta TS^{RFP} = TS^{RFP} - TS^{SFP}$ .<sup>10</sup> The left-hand side is the maximum total temptation to renege on the RFP, and the right-hand side is the difference in the present value of the total surplus of relation versus spot fixed-price contracts.<sup>11</sup> First-best requires  $e_b^m = 0$ , thus  $\Delta\beta = 0$ . For the first-best to be feasible, from Equation (5), it is needed that

$$\frac{\Delta d}{2} < \frac{TS^{FB} - TS^{SFP}}{r}. \quad (6)$$

It is evident from equation (6) that a relational fixed-price contract is more likely to be sustained if i)  $r$  is lower, and ii)  $\Delta d$  is smaller.

## 2.5 Relational Cost-plus (RCP) Contracts

Relational cost-plus contracts are cost-plus contracts with a relational contract to provide the vendor incentives to cut down costs. Specifically, the relational contract takes this form: The vendor will exert effort in cutting costs, and the buyer will compensate the observable yet unverifiable vendor's cost of the project, and gives the vendor a bonus. In particular, the buyer will reward the vendor this way: for the covered situation (with probability  $\tau$ ), if the buyer observes  $c_H$  then the buyer gives  $c_H + b_L$ ; if the buyer observes  $c_L$  then the buyer gives  $c_L + b_H$ ; in the case that modifications arise (with probability  $1 - \tau$ ), if the buyer observes  $c_H^m$  then the buyer gives  $c_H^m + B_L$ ; if the buyer observes  $c_L^m$  then the buyer gives  $c_L^m + B_H$ , where  $b_H$ ,  $b_L$ ,  $B_H$ , and  $B_L$  are bonuses for realized  $c_L$ ,  $c_H$ ,  $c_L^m$ , and  $c_H^m$ , respectively. If any party deviates from the "agreed upon" behavior, they will switch to spot cost-plus contracts.

Believing that the buyer will pay  $(b, B)$ , the vendor chooses  $e, e^m, e_b$  to solve

$$\text{Max}_{e, e^m} [qe*(c_L - c_L + b_H) + (1 - qe)*(c_H - c_H + b_L)] - \frac{e^2}{2} + (1 - \tau)[q^m e^m (B_H) + (1 - q^m e^m)(B_L) - \frac{1}{2}(e^m)^2] \equiv \pi^{RCP}.$$

Simplifying, we have  $b_L + qe\Delta b - \frac{1}{2}e^2 + (1 - \tau)[B_L + q^m e^m \Delta B - \frac{1}{2}(e^m)^2]$ . F. O. C. on  $e, e^m, \tau$ , we have

$$e = q\Delta b, \text{ and } e^m = q^m \Delta B, \text{ and } \tau^{RCP} = \frac{c_H^m - (q^m)^2 \Delta B \Delta c^m + \frac{1}{2}(q^m \Delta B)^2}{T}.$$

<sup>10</sup>It is also the sufficient condition since the division of total surplus can be achieved by adjusting the level of  $\beta_L$ .

<sup>11</sup>This is a re-curring result in papers on relational contracts, including in recent work by Baker, Gibbons, Murphy (2002) and Levine (2003).

The buyer  $Max v - [qe*(c_L + b_H) + (1 - qe)*(c_H + b_L)] - (1 - \tau)[q^m e^m*(c_L^m + B_H) + (1 - q^m e^m)*(c_H^m + B_L)]$ , taking the seller's effort as given. Define it as  $u^{RCP}$ , the total surplus of RCP is

$$v - c_H + q^2 \Delta b \Delta c - \frac{1}{2}(q \Delta b)^2 - c_H^m + (q^m)^2 \Delta B \Delta c^m - \frac{1}{2}(q^m \Delta B)^2 + \frac{[c_H^m - (q^m)^2 \Delta B \Delta c^m + \frac{1}{2}(q^m \Delta B)^2]^2}{2T} = TS^{RCP}.$$

The relational cost-plus contract is self-enforcing if both parties choose to honor the contract for all possible realizations of  $c^m$ . The vendor reneges on the relational cost-plus contract by refusing to accept a promised payment  $b$ ,  $B$  when they were offered, earning spot cost-plus utility thereafter. Thus, the vendor will honor rather than renege on  $b$  and  $B$  in the relational contract when, for all  $i$  and  $j$ ,

$$-b_i + \frac{\pi^{SCP}}{r} \leq \frac{\pi^{RCP}}{r} \quad \text{and} \quad -B_i + \frac{\pi^{SCP}}{r} \leq \frac{\pi^{RCP}}{r}. \quad (7)$$

where  $\pi^{SCP}$  and  $\pi^{RCP}$  refer to vendor's utility from spot and relational cost-plus contracts, respectively.

The buyer reneges if he refuses to pay the promised bonus  $b$  and  $B$  to the vendor. The buyer will honor rather than renege on  $b$  in the relational contract when, for all  $i$  and  $j$ ,

$$b_i + \frac{u^{SCP}}{r} \leq \frac{u^{RCP}}{r} \quad \text{and} \quad B_i + \frac{u^{SCP}}{r} \leq \frac{u^{RCP}}{r}. \quad (8)$$

If two equations in (7) hold for all  $i$  and  $j$ , then it must hold for the smallest  $b_i$  and  $B_i$ , while if the two equations in (8) hold for all  $i$  and  $j$ , it must hold for the largest  $b_i$  and  $B_i$ . Combining these two extreme versions yields two necessary condition for the relational cost-plus contract to be self-enforcing:

$$\Delta b \leq \frac{\Delta TS^{RCP}}{r} \quad \text{and} \quad \Delta B \leq \frac{\Delta TS^{RCP}}{r}.^{12} \quad (9)$$

For first-best outcome to be feasible in relational cost-plus contracts, it is needed that

$$\Delta c \leq \frac{TS^{FB} - TS^{SCP}}{r} \quad \text{and} \quad \Delta c^m \leq \frac{TS^{FB} - TS^{SCP}}{r}. \quad (10)$$

From (6) and (10) we see that at sufficiently small discount rates the first-best is achievable under either relational fixed-price or cost-plus contracts. The difference between the two lies in the feasibility – as shown in Equation (6) versus (10). Hence,

**Proposition 4:** Suppose that spot cost-plus and spot fixed-price contracts are equally attractive, that is,  $TS^{SFP} = TS^{SCP}$ , then the conditions for first-best in RFP and RCP hinges on  $\Delta d$ . If  $\frac{\Delta d}{2} > \Delta c^m$ , then there exist intermediate discount rate where the first-best is achievable under relational cost-plus but not under relational fixed-price contracts; and if  $\frac{\Delta d}{2} < \Delta c^m$ , then there are discount rates where the first-best is achievable under relational fixed-price but not under relational cost-plus contracts (Formal proof shown in Appendix).

This is the main prediction from this stylized model: When the variability of the cost of modification ( $\Delta d$ ) is higher, the seller's reneging temptation in relational fixed-price contract is higher, thus a cost-plus contract facilitates the relational contract better.

## 2.6 Implications of the Model

**The Formation of Trust Within the Relation** The above theory yields predictions on the equilibrium of relational contracts. Or to put it in another way, a relational contract assumes that the two parties will start by behaving cooperatively and then terminate when either one reneges. An equally important question is the process through which they reach that cooperative state. Suppose the two parties initially know nothing about each other and decide to contract. Through transactions, the vendor's reputation capital in fair renegotiation accumulates with the buyer, then this reputation capital (within this relation) favors the fixed-price contracts since the reputation capital helps take care of the weakness of fixed-price contracts. Similarly, a vendor with a past history of good performance in cost-cutting would be awarded a cost-plus contract. These are predictions 5 and 6.

**The Completeness of Contracts** We examine the impact of relational contracts on the completeness of fixed-price contracts. From the text, we have  $\tau^{SFP} = \frac{c_H^m - \frac{(q^m \Delta c^m)^2}{2} + \frac{1}{2}(\rho^m \frac{\Delta d}{2})^2}{T}$  and  $\tau^{RFP} = \frac{c_H^m - \frac{1}{2}(q^m \Delta c^m)^2 + \frac{1}{2}(\rho^m \Delta \beta)^2}{T}$ . In RFP it is optimal to set  $\Delta \beta = 0$ , therefore,  $\tau^{SFP} > \tau^{RFP}$ . Hence we have the prediction 7: Relational fixed-price contracts are less complete than spot fixed-price contracts. That is, in relational fixed-price contracts, buyers trust the vendor to accommodate changes fairly thus leave the initial contract less complete.

Related to contract completeness is communication. In a spot fixed-price contract, contracts are more complete, changes are tightly controlled, and there is little communication after the contract is signed. For the same reasoning as that in the above paragraph, we have Proposition 8: While communication is positively associated with spot cost-plus contracts, with relational contracting, it ceases to be so.

**The Impact of Complexity on Form of Contract as a Function of Spot versus Relational Contracting** As we have shown in Section 2.3, complexity  $T$  makes spot fixed-price contracts less desirable compared with spot cost-plus contracts if  $\rho^m \Delta d > 2q^m \Delta c^m$ . In RFP, the renegotiation cost ( $\rho^m \Delta d$ ) does not matter any more, thus  $\tau$  (the degree of completeness) matters less and hence  $T$  matters less.

### 3. Data and Measures

#### 3.1 Sample construction

The data used in this study is drawn from public filings of companies. The U.S. Securities and Exchange Commission (SEC) mandates that firms disclose material contracts, defined as a contract with a “substantial likelihood that a reasonable shareholder would consider it important in making an investment decision”. Firms tend to file such contracts as a part of either their annual reports in 10-K, current reports in 8Q and quarterly reports in 10Q filings. Firms have considerable discretion in terms of which contract activity is disclosed, and while this results in only a sample of all outsourcing activity being reported, this database provides a comprehensive source of contract data from both vendors and clients.

The data in our sample is drawn from outsourcing agreements of complex and large scale IT services reported to the SEC. To collect a sample of representative contracts, we downloaded filings from the SEC’s EDGAR Database. We began with all contracts that were classified in the SIC categories 737, which denotes that the contract is for computer related services. Details of large firms outsourcing IT services were identified based on datasets of press releases of outsourcing announcements compiled by a professional advisory firm and a trade journal that lists publicly announced outsourcing deals. A total of 1724 vendors and 1024 clients were identified. Examination of the SEC filings resulted in a large sample of material contracts filed by the above set of registrants. From an overall sample of roughly 3800 contracts deemed ‘material contracts’, the screening process resulted in 466 contracts. This is because contracts classified as material contracts can consist of a range of contracts such as asset purchase agreements, license transfers, executive compensation, contracts for non-IT related services etc. Thus, we removed all agreements do not represent IT outsourcing where a vendor is hired to perform a contracted service; thus they are not characterized by the complexity and potential for rent seeking that we consider in this paper. We then screened the sample to include only those contracts where the identities of the vendor and the client were clearly specified. Thus the sample only consisted of contracts that pertained to information systems outsourcing agreements and explicitly indicated that the client is engaging the vendor as an independent contractor. The data was further screened to remove contracts for outsourcing that also involved inter-firm agreements involving alliances, joint ventures, mergers or acquisition related agreements that pose substantially different challenges in contracting such as intellectual property issues and contracting of research-intensive activities<sup>1</sup>. Filings with a substantial amount of the contract details were missing were removed from the sample<sup>2</sup>. The end sample contained 149 outsourcing relationships (representing 149

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<sup>1</sup> Azoulay (2004) and Lerner and Malmiendier (2008) examine contracts in such settings.

<sup>2</sup> The SEC allows separate filing of portions that are deemed confidential, and such filings are not part of a public disclosure by firms.

SEC filings) between a total of 239 clients and vendors with clearly defined service obligations<sup>3</sup>. Firm and vendor specific information for each contract was supplemented with data from trade and industry databases such as the One Source Online Business Information database and the Hoovers database. Table 1 provides details of the data gathering approach.

We are interested in obtaining a complete relationship history between parties. The SEC filings provide information about prior contracts, if any, between the vendor and client as well as the client's assessment about the prior performance of the vendor in providing the outsourced functions. We supplemented this data with data from a number of publicly available databases that aggregate news and press releases such as Dow Jones Interactive, Factiva database and industry reports and trade and business press that reports on outsourcing deals. Whenever possible, we verified this data by examining press releases from either clients or vendors as well as press releases posted on the archived websites of vendors and clients. Our source of archived Internet web pages is the Internet archive, which is a non-profit group that maintains archived web pages of businesses ([www.archive.org](http://www.archive.org)).

The data was validated against several external sources to ensure data quality and validity. The contracts in our sample were compared at the aggregate level to those of contract databases maintained by IT consulting companies that specialize in industry analysis, such as Gartner Research and Forrester research. While such databases do not contain the level of detail about contracts such as those in our sample, they provide a useful benchmark to assess the types of services outsourced, characteristics of vendors and clients, contract duration and the prevalence of repeated relationships. Medians, standard deviations and the 25<sup>th</sup> and the 90<sup>th</sup> percentile values were compared. Overall, our sample consists on average of slightly smaller contracts, which can be explained by the fact that very large IT outsourcing deals, referred to in the trade and industry press as mega deals, are sometimes spread across more than one vendor and could be handled by foreign subsidiaries, which results in such contracts not being reported to the SEC. Comparisons of the data used in this paper with industry level databases are provided in Table 2.

### **3.2 Contract Structure and Variables**

Typically, a contract between a client and a vendor consists of a formal contract, that identifies responsibilities both parties and a payment schedule, and a statement of work (SOW) that focuses on the technical details of the system. The SOW specifies vendor's activities to be recorded, typically under a consultant activity report (CAR) that includes a detailed description of the technical deliverables by a vendor, such as the object code to be delivered and the written updates to be provided by the vendor as to progress of critical milestones in the contract (defined in the contract document). Thus, the contract represents a formalized statement of expectations

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<sup>3</sup> Contracts with no specified service duration could be little more than asset purchase agreements where there is a transfer of technology developed by one party, rather than outsourcing agreements.

between parties while the SOW includes the day-to-day operational details of how the client and the vendor interact with each other.

Contracts for outsourced IT services can be incomplete in initial specification. The rate of technological change creates a need for newer features and compatibility requirements by the time the project is underway, increasing the incompleteness of the initial specification. Creating a new information system also involves some change in the way a buyer conducts a facet of her business, which also increases the difficulty in ex-ante design specification and in setting up processes to measure vendor performance. While the vendor may have expertise in designing and building an information system, the design and development of the system needs intense participation by the buyer of the service. Creating an information system also involves some sort of transition management involving changes in people and processes. Thus, another commonly observed feature is the need for intense communication between buyers and suppliers during the length of the outsourced agreement. Several measures that are tailored to the IT outsourcing context were developed that we discuss next.

### **Dependent Variable**

The dependent variable we examine is the contract type, i.e., fixed price or cost plus contracts, which is coded from the contract document obtained from the SEC filings. Fixed price contracts specify a defined payment schedule for services specified in the contract<sup>4</sup> while cost plus contracts pay the vendor a markup based on realized costs, i.e., compensate the vendor when buyers require additional services that are not defined in the original agreement.

### **Key Explanatory Variables**

*Prior Relationships:* Information on the history of interaction between parties was collected from the years 1992 to 2005. The SEC filings and the data from public databases provide information on whether the vendors and clients have contracted with each other before. The prior contract filings with SEC also provide us with a data source for the contract type in the prior relationship. Based on the relationship history, we first categorize whether parties had prior relationships with each other. For parties with a history of interaction, a detailed examination of public data sources, financial statements and documents filed with the SEC provide evidence of (i) whether parties had to amicably renegotiate or terminate<sup>5</sup> an earlier contract and (ii) whether the vendor's performance on cost cutting in an earlier contract was favorably mentioned by the client.

*Amicable amendments:* When a publicly filed contract is renegotiated, parties are required to file the amendments with the SEC. We therefore examine amendments in a previous contract as a

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<sup>4</sup> Fixed price contracts may include terms for inflation sensitivity and cost of living adjustments to reflect changes in prices of inputs such as hardware and software and costs of hardware upgrades. Mixed contracts are rarely used in practice. Invoices by the vendor typically include a description of the type of service rendered, a brief description of the out of pocket costs, the billing period, and any other information requested by the client.

<sup>5</sup> Most contracts include clauses for early termination for cause and/or convenience, which provide a means by which contracts can be easily terminated before the contract term.



proxy for amicable bargaining between parties. This measure is coded from data obtained from the SEC's EDGAR database as well as press releases by client firms. Amendments can include modifications of service scope and add greater detail to the service description such as detailing development, pre-release testing and acceptance criteria that have not been defined at the start of the outsourcing initiative. For instance, one of the amendments states, "*(Vendor) will deliver to (Client) software in accordance with acceptance criteria that will be defined as part of the Work Authorization ("WA") exercise. (Vendor) will deliver this software no later than (date specified in the contract).*" We code a binary variable if there are amicable agreements filed for an earlier contract between parties, which denotes whether the vendor has a reputation in fair bargaining.

*Fair cost performance:* To obtain data on vendors' perceived behavior in cost cutting; we relied on an additional source of data, the annual financial reports and investor statements released by clients and vendors. Vendors regularly highlight favorable performance in terms of cost savings in their press releases and such information is corroborated by the investor briefings and annual reports, disclosed as part of 10-K filings where clients report assessments of vendors' performance<sup>6</sup>. For instance, one of the press filings by a client of IBM, as part of the form 8K, reported that the IBM's favorable performance would add \$0.03 earnings per share. These sources provide a measure to assess a vendor's performance in cost cutting in an earlier contract.

*Expectation of Future Business:* The contract documents indicate whether firms and vendors expect to transact with each other after the contract is completed. Typically contracts include an extendibility provision that allows the parties to extend the outsourcing arrangement with minimal renegotiation costs at the end of contract duration, which provides an indication of parties' expectations of future business. We also examined press releases from buyers and news reports in the trade and business press suggesting that parties expect to continue their contractual relationship into the future.

*Prior Contract termination:* When contracts are terminated early, clients (and usually vendors) disclose such terminations in their press filings and investor briefings, which provided us with the data to code contract cancellations in a prior relationship.

### **Other explanatory variables**

The complexity of fulfilling the responsibilities of the contract depends on the business objective sought. In some of the contracts, the objective is transformational (i.e., Linder 2004), i.e., vendors are expected to contribute their expertise to realize key business objectives of the client. For instance, one of the contracts specifies that the vendor, EDS, "*conduct a comprehensive assessment of the client's information technology systems in light of the business priorities and competitive market conditions and growth requirements*" before creating a technology plan and implement the proposed solutions over a period of time.

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<sup>6</sup> We coded a relationship history as one where the vendor achieved cost savings only if we were able to match the data from clients with that gathered from vendors.

*Complexity:* Contracts for IT outsourcing tend to be incomplete in initial specification, and both parties may have limited understanding of what the completed system would contain (Banerjee and Duflo 2000). When the objective of the IT outsourcing is to leverage strategic objectives as opposed to cost considerations, the ambiguity in specifying contract outcomes increases the incompleteness of contracts with which contracts can be specified. At the same time the criticality of such services to the client also increases the need for cost-reducing effort by the vendor. We therefore computed a measure of complexity according to the following: (1) Where the objectives of the contract are defined in terms of strategic goals or organizational effectiveness, (2) where contracts state the dedicated expertise of the vendors in fulfilling the objectives of the outsourcing arrangements is predominantly transformational and (3) when the contract involves systems development that involves considerable process change.

*Communication:* Contracts can stipulate channels of communication that help inter-firm interactions and lessen some of the difficulties in contracting. For instance, a contract between Coors and EDS states that each will designate an individual as its project executive. Contracts typically stipulate that such individuals have day-to-day authority of handling project and contract management and serve as the single point of accountability. The purpose of creating such roles and responsibilities is to designate a single point contact that is authorized to act as the primary contact for each company. Therefore we coded a measure denoting whether contracts include processes for inter-firm communications. Contracts also stipulate the frequency of meetings between such key personnel representing the client and the vendor. For example one clause states that *meetings will be held to discuss daily performance and planned or anticipated activities and changes that might adversely affect performance.*

*Maturity:* Technological maturity denotes how well the client understands the technology and systems architecture used by the vendor, and the stability of the underlying technology used for the contracted task. Both these factors would raise the difficulty for rent seeking by the vendor.

### **Control Variables**

The public databases provide a rich source of data to examine whether a given client and a vendor have other ongoing relationships, such as marketing alliances, business partnership, and strategic relationships in tandem with the outsourcing initiative. We therefore coded a measure for contemporaneous relationships between clients and vendors. About 29 of the firms in the sample have a contemporaneous relationship in addition to the contract activity. Contracts include detailed descriptions of the services to be delivered by the vendor. We classify services delivered along a typology of 14 different types of sub-services that constitutes IT outsourcing. Contracts in our sample involve one or more of the following activities: (1) Systems planning (28.5%), (2) Application analysis and design (23.1%), (3) Application development (46.25%), (4) Systems integration (13.6%), (5) Operation and maintenance (37.5%), (6) Data center operations (19.7%), (7) Telecommunications management (11.2%), (8) Software and data licensing (44.2%), (9)

Hardware products (24.4%), (10) IT facilities management (19%), (11) Basic support (61.2%), (12) Training and documentation (32.7%), (13) Advanced support (53.7%) and (14) E-marketing and e-advertising (21.1%). From the list above, we coded a measure denoting the breadth of activities under a contract. The contract documents also provide us with the contract duration and contract value. When we could not find the contract value from the documents filed with the SEC, we examined public databases to infer the value of the outsourced transaction. Firm Size and Vendor Size were obtained from the Hoovers database. We coded a measure of industry reputation of the vendor from firms such as Gartner and Forrester that publish quarterly rankings of the vendor. Firm Size and Vendor Size were obtained from the Hoovers database. To assess the extent to which a client can assess the performance of a contracted task, we coded whether the contract contains (i) performance milestones that are tied to specific outcomes (e.g., Lichtenstein 2004), (ii) contract clauses facilitating monitoring, such as audit rights and inspections. From the relationship history, we obtained the type of contract employed in the prior relationship.

### **3.3 Descriptive Statistics**

Contracts in our sample were written during the period from 1998 to 2005. A majority of firms only have one contract in the sample while the remaining have about two to five contracts. The contracts in our sample represent a broad spectrum of outsourcing activities ranging from a comprehensive information technology services agreement involving parties such as General Motors and Electronic Data Systems (EDS) to smaller contracts for fairly standard data processing services such as that involving a small California-based bank. Large clients in our sample include several Fortune 500 firms such as Coors and Goldman Sachs. Large vendors in our sample include EDS, IBM and Computer Sciences Corporation.

Table 3 summarizes the measure development and provides a sample coding procedure with examples of contractual clauses. Table 4 provides the descriptive statistics of contract terms. The sample exhibits considerable variation along the types of vendors and clients as well as the type of services that are being delivered in the outsourcing agreement. About 60% of our sample contains fixed price contracts. In about 53% of the contracts, the parties expect to transact with each other in the future. Firms frequently transact with vendors that they have interacted with in the past (about 49% of contracts). In the earlier relationships, we observe that 67% of contracts that were amended were fixed price contracts. Contract renegotiation in a past transaction is fairly common. On average, contracts for greater complexity of services, those with a prior relationship between parties and those where the vendor performed favorably in cost cutting in an earlier contract are more likely to be cost plus contracts. Table 5 presents several cross-tabulations of contract characteristics with several dimensions of prior relationships.

## **4 Econometric Approach and Results**

Our empirical identification strategy relies on cross-sectional variation in IT contracting. We estimate a binary choice model of contracting to test the predictions from the model. The

variation in the type of services provided as well as the degree of past and future interactions between clients and vendors provides a rich source of heterogeneity at the contract level. Our empirical approach hinges upon a detailed understanding of the outsourcing and information technology development context. We adopt an econometric specification of the form:

$$y_{ijt} = \beta_1 I_{ij}(prior) + \beta_2 I_{ij}(fair - barg) + \beta_3 I_{ij}(reputation - cost) + \alpha X_{ij} + \mu V_i + \lambda C_j + \varepsilon_{ij}$$

where  $i$  refers to the client and  $j$  to the vendor,  $y_{ijt}$  refers to the form of the contract between the client  $i$  and the vendor  $j$  with  $t: 1$  being fixed price and  $t:0$  is cost plus contract,  $V$  is a vector of vendor specific characteristics,  $C$  is a vector of client characteristics and  $X_{ij}$  refers to the characteristics of the contract between the vendor  $i$  and client  $j$ . The indicator variables denote prior relationship between the parties, fair bargaining in an earlier contract, and the client's perception of the vendor's reputation in cutting costs, respectively. The results are presented in Tables 6, 7 and 8.

Table 7 presents the coefficients in the baseline model of the spot contract choice controlling for the complexity, breadth of services, contract length, communication, vendor size, and client size. The coefficients on the control variables are consistent with prior literature and Propositions 1-3 developed in this paper. Both contract length and complexity of the project is positively associated with cost based contracts, confirming the predictions of theoretical models such as Bajari and Tadelis(2001) and empirical literature (e.g., Crocker and Reynolds 1993). The scope of a contract is positively associated with fixed price contracts, since a broader scope of activities under a contract does not necessarily increase the complexity in task description, but increases the need for incentives to the vendor to cut costs, confirming Proposition 1. The coefficient on complexity is negative, implying that a more complex project is associated with less use of fixed-price contract, due to both the smoother renegotiation as well as lowered rent seeking associated with cost plus contracts, confirming Propositions 2 and 3.

Larger buyers are positively associated with fixed price contract, contrary to prediction from risk-based theories, yet consistent with a market that is characterized as a buyers' market. Larger suppliers are positively associated with cost based contract, also contrary to prediction of risk-based theory, yet consistent with a story that larger supplier have more bargaining power. Another possibility is that larger suppliers are perceived to be more trustworthy, and thereby more likely to be awarded a cost based contract. Frequent communication between the vendor the client is positively associated with cost based contract, consistent with the need for cost-control in cost based contract and also the information-facilitating effect of a cost based contract.

Column 2 of Table 6 introduces the impact of prior relationships between parties as an indicator variable denoting whether the two parties dealt with each other before. The coefficient on the prior relationship variable is negative, indicating that the impact of prior relationships makes the likelihood of a cost plus contract more likely, consistent with prior findings from

Banerjee and Duflo (2000) and Kalnins and Mayer (2004). The magnitude of the impact is that that having a prior relationship increases the probability of a cost based contract by 60%.

The results provide some evidence for trust building between parties. Column 3 of Table 6 introduces the measure of fair bargaining between parties. The coefficient on the fair bargaining reputation is positive, suggesting that a vendor having a high reputation capital of fair bargaining is more likely to be awarded fixed price contract. The estimated coefficient suggests that a vendor with a reputation for fair bargaining is 45% more likely to be awarded a fixed price contract. That is, the lower the evidence of rent-seeking by the vendor during renegotiation, the more likely that parties use fixed price contracts. Comparing columns 2 and 3 in Table 6 we find that the impact of a prior relationship is strengthened when we include the impact of fair bargaining in an earlier contract. Thus, it is possible that the reputation variable used in previous literature contains both with the impact of general reputation (extent of prior interaction between parties) and reputation in bargaining; by including the latter, the former is strengthened.

Columns 4 and 5 of Table 6 introduce the measure of fair cost performance by the vendor. We find that a vendor's reputation in cost cutting weakly favors a cost plus contract, which is in line with the predictions from the model, confirming Proposition 6. The estimated coefficients suggest that a vendor with good reputation for cost cutting is 20% more likely to be awarded a cost-based contract. The magnitude of vendor's reputation in fair bargaining is greater than that of the reputation in cost cutting, likely due to the disruptive impact of rent-seeking by the vendor on the success of outsourcing initiatives.

Column 7 in Table 6 introduces the impact of potential future business on the form of contract. The coefficient is significant and negative, indicating the existence of potential future business makes a cost based contract more likely, suggesting that with the feasibility of relational contracting, relational cost-plus contracts may be sustained more easily than relational fixed-price contracts<sup>7</sup>. Column 8 of Table 6 introduces a measure of other relationships contemporaneous to the contract. We find that when clients and vendors undertake business initiatives unconnected to procurement in tandem with the contracted task, there is a stronger likelihood of cost plus contract. The results suggest that reputation building between parties' leads to cost plus contracts.

Table 8 introduces several specifications estimating the impact of relational contracting on formal contracts. The interaction effects highlight several differences between spot contracts and relational contracts. In Column 1 of Table 8 we consider the impact of technological maturity of the outsourced task, which is a proxy for lower  $\Delta d$ , or lower variability of cost of an outside vendor doing the modification, which lowers gains from rent seeking and hence the renegeing

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<sup>7</sup> Comparing columns 6 and 7 we find that the impact of future business potential lowers the coefficients on past performance, possibly since the feasibility of relational contracts between parties reduces the reliance on reputation between parties (formed through earlier contracts). We also find the interaction term between fair bargaining and future business predicts fixed price contracts. In other words, good reputation in bargaining in an earlier contract matters even with the prospect of future interaction.

temptation by the vendor. This is because, a more stable technology is relatively well understood, and therefore it would be difficult for the vendor to engage in rent-seeking activities such as manipulating bids from rivals. We find that greater technological maturity predicts fixed price contracts, further supporting Proposition 2. More importantly, in Column 5 of Table 8 we find that the coefficient on the interaction term between maturity and future business is positive. We interpret it as evidence that a lower reneging temptation due to a lower  $\Delta d$  brought about by a more stable technological environment that makes it more attractive to use relational fixed-price contract sustained by future business.

According to the predictions from theory, we should also expect that spot fixed price contracts are more complete compared to relational fixed price contracts. When implicit contracts are fostered through the promise of relationship continuity, it is not necessary for clients and vendors to incur costs in delineating contingencies in contracts. Contracts can be incomplete ex ante and clients and vendors will painlessly renegotiate as contingencies unfold. In other words, amendments will be more likely for relational fixed price contracts as opposed to spot fixed price contracts. Since we have data on the earlier contract, we can test this prediction. We regress the probability of amendments in an earlier contract on the form of the earlier contract and the presence of extendibility provisions (in the earlier contract) denoting the expectations of future business between parties. The results are presented in Table 9. For identification, we included as explanatory variables the presence of monitoring mechanisms by the client included in the contract, such as audit rights and clauses specifying how the vendor's performance is assessed. We find that amendments are more likely with the possibility of future interactions, confirming proposition 7 that relational fixed price contracts are less complete than spot fixed price contracts.

Since cost plus contracts are not well defined in initial specification, we should expect that there is a greater need for continual interaction between the vendor and the client. Contractually mandated communication clauses smooth interactions between the client and the vendor after the contract is signed and ensure that parties are in agreement about the outcomes of the outsourcing initiative. However, with the possibility of implicit contracts fostered through expectations of continued interaction, contractually mandated communication clauses are less important. The empirical analysis finds a negative coefficient on the communication variable in Column 1 of Table 6 and a statistically insignificant coefficient on the interaction term between communication and the possibility of future business in Column 3 of Table 8. That is, without relational contracting, communication is positively associated with spot cost-plus contracts, but when relational contracting becomes sustainable by the promise of future business, communication ceases to be a deciding factor in the choice of contract form, supporting Proposition 8.

When relational contracting is made possible by future business, complexity ceases to be a deciding factor in choosing between fixed-price versus cost-plus contracts. In Table 6 we find

that complexity has a significant and negative impact on the choice of contract, indicating that cost plus contracts become more likely with complexity of tasks. However, Column 2 of Table 8 highlight that the interaction term between complexity and future business does not have a significant impact on the form of contracts, confirming Proposition 9. This suggests that when relational contracts are feasible, parties may be less concerned about the likelihood of vendor rent-seeking in renegotiations due to the complexity of the outsourced task.

To examine whether there is simultaneity between contractually designated communication processes and the forms of incentives in the explicit contract, we conducted a seemingly unrelated bivariate probit using an exclusion restriction for communication processes. The results are presented in Table 10. The negative estimated value of the correlation coefficient,  $\rho$ , suggests that the factors that lead to fixed price contracts also make it less likely that the contract demarcates processes for communication between the vendors and clients.

## **5 Concluding Remarks**

This paper examines relational contracts between buyers and IT service providers, and in particular, the interaction between relational contracts and form of explicit contracts, namely, fixed-price contract or cost-plus contract. We show that the form of explicit contract affects the parties' reneging temptation on a given relational contract, and hence affects the best relational contract the parties can sustain. Reputation capital in fair bargaining and cost-cutting favor the use of fixed-price and cost-plus, respectively, and relational contracting makes the contracts in particular fixed-price contracts become less complete with the possibility of relational contracting, and the importance of complexity in deciding spot fixed-price and cost-plus is lessened by relational contracting. Using an original data set from IT outsourcing, we find support for the above predictions.

Future work can consider a more realistic form of relational contract in which the party harmed could provide the reneging party a chance to redeem the damage, instead of the usual assumption of trigger strategies, and the impact of such a relational contract on formal contracts. Mayer (2007) offers a case study of an evolving relationship involving "give and take" between parties, and how that impacts the design of contract clauses. The evolution of such relationships appears to be an under-explored area and we aim to undertake future research on this aspect.

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## Appendix

### Spot Fixed-Price versus Cost-Plus Contracts: Proof of Propositions 1 to 3

From Equation (1), we have

$$TS^{SFP} - TS^{SCP} = \frac{q^2(\Delta c)^2}{2} - \left[ \frac{1}{8}(\rho^m \Delta d)^2 - \frac{1}{2}(q^m \Delta c^m)^2 \right] \left[ 1 - \frac{[c_H^m - \frac{(q^m \Delta c^m)^2}{2} + \frac{1}{2}(\rho^m \frac{\Delta d}{2})^2] + c_H^m}{2T} \right].$$

Since  $\tau^{SFP} < 1$  and  $\tau^{SCP} < 1$ , we have  $[1 - \frac{[c_H^m - \frac{(q^m \Delta c^m)^2}{2} + \frac{1}{2}(\rho^m \frac{\Delta d}{2})^2] + c_H^m}{2T}] > 0$ . Then  $\frac{\partial(TS^{SFP} - TS^{SCP})}{\partial(q\Delta c)} > 0$ , and  $\frac{\partial(TS^{SFP} - TS^{SCP})}{\partial(\rho^m \Delta d)} < 0$ , and  $\frac{\partial(TS^{SFP} - TS^{SCP})}{\partial(q^m \Delta c^m)} > 0$ , and  $\frac{\partial(TS^{SFP} - TS^{SCP})}{\partial T} < 0$  if  $\rho^m \Delta d > 2q^m \Delta c^m$ .

### The Conditions for Non-reneging in Relational Fixed-price Contracts

Equations (3) and (4) provide the necessary and sufficient condition for the relational fixed-price contract to be self-enforcing. Summarizing, we need the following four equations:

$$\begin{aligned} \beta_L + \frac{(\Delta \pi^{RFP})}{r} &\geq \frac{c^m + d_H^m}{2}; \\ \frac{c^m + d_L^m}{2} &\geq \beta_H - \frac{(\Delta u^{RFP})}{r}. \end{aligned}$$

Adding up, these can be simplified to  $\frac{\Delta TS^{RFP}}{r} \geq \Delta \beta + \frac{\Delta d}{2}$ .

### The Best Relational Fixed-price and Cost-plus Contract

The best relational fixed-price contract is thus to

$$\begin{aligned} \underset{\Delta \beta}{Max} \quad & v - c_H + \frac{q^2(\Delta c)^2}{2} - c_H^m + \frac{1}{2}(q^m \Delta c^m)^2 - \frac{1}{2}(\rho^m \Delta \beta)^2 + \frac{[c_H^m - \frac{1}{2}(q^m \Delta c^m)^2 + \frac{1}{2}(\rho^m \Delta \beta)^2]^2}{2T}. \\ \text{s.t.} \quad & \Delta \beta + \frac{\Delta d}{2} < \frac{\Delta TS^{RFP}}{r}. \end{aligned}$$

The first-best level of  $\Delta \beta$  is 0. Then the total surplus of RFP is  $v - c_H + \frac{q^2(\Delta c)^2}{2} - (c_H^m - \frac{(q^m \Delta c^m)^2}{2}) + \frac{(c_H^m - \frac{(q^m \Delta c^m)^2}{2})^2}{2T}$ , which is equal to  $TS^{FB}$ , and  $\tau^{RFP} = \frac{c_H^m - \frac{(q^m \Delta c^m)^2}{2}}{T}$ , which is equal to  $\tau^{FB}$ . The best relational cost-plus contract is to

$$\begin{aligned}
& \underset{\Delta b, \Delta B}{Max} \quad v - c_H + q^2 \Delta b \Delta c - \frac{1}{2}(q \Delta b)^2 - c_H^m + (q^m)^2 \Delta B \Delta c^m - \frac{1}{2}(q^m \Delta B)^2 + \frac{[c_H^m - (q^m)^2 \Delta B \Delta c^m + \frac{1}{2}(q^m \Delta B)^2]^2}{2T} \\
& \text{s.t.} \quad \Delta b \leq \frac{\Delta TS^{RCP}}{r}, \\
& \quad \Delta B \leq \frac{\Delta TS^{RCP}}{r}.
\end{aligned}$$

The first-best level of  $\Delta b$  and  $\Delta B$  is  $\Delta c$  and  $\Delta c^m$ , respectively. Then the total surplus of RCP is  $v - c_H + \frac{q^2(\Delta c)^2}{2} - (c_H^m - \frac{(q^m \Delta c^m)^2}{2}) + \frac{(c_H^m - \frac{(q^m \Delta c^m)^2}{2})^2}{2T}$ , which is equal to  $TS^{FB}$ , and  $\tau^{RFP} = \frac{c_H^m - \frac{(q^m \Delta c^m)^2}{2}}{T}$ , which is equal to  $\tau^{FB}$ . Looking at the constraints, we find that If  $\frac{\Delta d}{2} > \Delta c^m$ , then there exist intermediate discount rate where the first-best is achievable under relational cost-plus but not under relational fixed-price contracts; and if  $\frac{\Delta d}{2} < \Delta c^m$ , then there are discount rates where the first-best is achievable under relational fixed-price but not under relational cost-plus contracts.

**Table 1: Sample Construction**

<i>Sample Construction from SEC Filings</i>	<i>Observations</i>
Total number of registrants	1724
Total number of clients	1024
Total number of material contracts filed with the SEC from the above list of registrants (clients and vendors)	3800
Sample after removing all non-IT outsourcing material contracts such as asset purchase agreements, compensation contracts, service outsourcing other than IT, wage agreements, security agreements etc.	466
Sample after removing other types of arrangements such as alliances, joint ventures that do not constitute outsourcing agreements; removing contracts without detailed information about vendors and clients	169
Less contracts without financials related data and company information (Data obtained from Hoovers and One Source Business Databases)	161
Less contracts without a detailed history of interaction (Contracts cross-validated against data from Public Databases that aggregate news and press releases such as Factiva, ABI Informs Trade and Industry)	149

**Table 2: Sample Validation and Comparison with Other Data Sources**

	Duration (in Years)		Contract Value(\$million)		Client Size # Employees(1000's)		Vendor Size	
	This Study	Industry Database	This Study	Industry database	This Study	Industry Database	This Study	Industry Database
Mean	3.92	4.21	54.6	66.29	22.20	18.59	14.91	30.70
Std. Dev	2.95	2.87	19.8	17.17	70.97	80.32	40.71	44.21
Min	0.25	0.42	0.30	0.29	0.12	0.009	0.032	0.38
Max	10	12	200	450	475	505.77	332.55	443
N	<b>161</b>	2500	161	210	161	1544	161	316

**Table 3: Variable Definition and Excerpts from Contract Clauses, Press Releases and Financial Statements**

Variable	Data Source	Measure Development	Examples
Fixed Price Contract	Contract document	Example of Fixed Price Example of Cost Plus	Buyer shall pay Vendor the agreed upon charge per month as set forth in Schedule C. PROVIDING PARTY shall invoice RECEIVING PARTY on a monthly basis for the Corporate Service Fees, plus the Transition Assistance Fees, as calculated in accordance with Section 3.1 and Schedule 1.1(a). In addition, PROVIDING PARTY shall promptly notify RECEIVING PARTY, no more frequently than monthly, of the aggregate amount of Out of Pocket Costs to be reimbursed or paid. All invoices shall include, without limitation, the category of applicable Corporate Service or Transition Assistance Service (as the case may be), a brief description of the Out of Pocket Costs (if applicable), the billing period, and such other information as RECEIVING PARTY may reasonably request.
Prior Relationship	Contract Documents and Press Releases	Coded as 1 when parties to a contract have a prior contracting relationship	
Amicable Amendments (proxy for reputation in fair bargaining)	Amicable Amendments in an earlier contract filed with SEC	Coded as 1 when parties to a contract have had amicable amendments in a prior contracting relationship that led to (i) enhancements in service scope and (ii) incorporating service modifications	The Services and the matters addressed in the (earlier) Agreement including the Transaction Documents and the Supplement and Schedules are superseded and merged into the (current) Agreement including the Transaction Documents and the Supplement and Schedules thereto. Schedule A, Section 1 will be replaced by (Additional service specification and vendor deliverables added)..Acceptance of deliverable at milestone 1 (estimated date)...Acceptance of deliverable at milestone 2 (estimated date)... Additional services described in the amendments PIN Based Transactions at \$*** (Increase of \$*** from original agreement). Off Line Debit Transactions at \$*** (Increase of \$*** from original agreement). (Vendor) provided (Client) significant cost savings and operational flexibility by consolidating, automating and managing a large portion of its mainframe operating systems and hardware operations... The company has factored the cost savings (from outsourcing agreement) into its quarterly guidance...
Fair Cost performance by the vendor	10-K statements Cross-checked with Press releases	Coded as 1 when the buyer indicates satisfaction with the vendor's performance with respects to cost targets in a prior contracting relationship	...The term of this Agreement will be extended for additional .... periods unless Buyer or Vendor gives notice to the other at least ....months prior to the then-current Termination Date of its intention to allow this Agreement to expire at the end of the Initial Term or then-current Renewal Term.
Expectation of future business potential	Contract (validated with press releases)	Coded as 1 if (a) the contract indicates that the relationship might continue into the future, and (b) press releases and news reports in the trade and business press suggest that parties expect to continue their contract into the future.	Excerpt: "To enable this function (application development) to be more responsive to the business, (the project) has been transferred back to Client to support high-level design activities" Coded from the service description and the deliverables provided by the vendor.
Prior Contract Termination Technological Maturity	Press releases, litigation filings and 10-K Contract Document	Indicates whether a prior contract was terminated prior to the term Indicates that the technology and the platforms used for the contracted task are relatively stable and less	

		innovative.	
Complexity	Contract	Complexity is based on the objectives of the contract, such as (i) Changing the corporate strategy (ii) Process changes that will shift how the company operates.	Provider shall provide systems development, quality assurance, staffing, reporting, planning and oversight activities under this Agreement, and further including acceptance testing and quality assurance procedures approved by the Client... The purpose of this agreement is to provide world class service delivery based on industry best practices and standards, specifically aimed at improving information technology productivity and reliability, and speed to market of new products
Communication	Contract Document	Contracts that specified the frequency of interactions between the buyer and supplier, such as frequent status and review meetings and channels of communication such as designating key personnel to oversee responsibilities	The Client and Vendor shall hold the meetings set forth in Schedule 9.5 (or the applicable Schedule 9.5(LCA)) at the frequency set forth therein. [*****] An EDS Provider shall distribute an agenda sufficiently before each meeting to enable the participants to prepare for it. An EDS Provider shall distribute minutes of each meeting within seven days after its conclusion, and the meeting participants shall sign such minutes once they have been approved. Buyer will specify and designate authorized personnel on or before the date of the implementation for reporting problems and the vendor shall make reasonable efforts to resolve the problem.
Contract Duration	Material Contract filed with the SEC	Term of the Contract as stated in the agreement	This Agreement shall have a term commencing on the Effective Date and continue until the end of the Transition Period (the "Term"). Unless earlier terminated as herein provided, the Transition Period shall commence .... months after the Effective Date;
Contract Value	Contract document validated with press releases		Log transformed monetary value of the contract
Prior Cost Fixed Price	Prior Contracts and Relationship History from Public Databases	Coded as 1 when Prior contract is FP	Coding similar to the coding of Fixed Price Contracts
Prior Contract Cost Plus	-do-	Coded as 1 when prior contract is cost plus	Coding similar to the coding of Cost plus contracts
Firm Size, Vendor Size	Hoovers and One Souce	Number of employees (log transformed)	
Breadth of Service	Contract document validated with press releases	Contract involves a number of different IT tasks to be performed within a contract	Coded 14 sub-categories of IT outsourcing tasks as listed in the measure development section of the paper. The breadth measure is a summation of the number of tasks listed in a particular contract divided by 14
Milestones	Contract Document	This measure denotes whether the contract contains performance milestones that are tied to specific outcomes Example: Customer will demarcate particular milestones in a statement of work (SOW) as dependent upon completion of tasks and/or performance by the Vendor	
Monitoring Provisions	Contract	Audit rights whereby clients have the right to inspect and validate service delivery by the vendor	Customer will inspect and review all reports and other output created by the vendor. Customer will reject all incorrect reports or output within two (2) Business Days after receipt of daily reports or output, within five (5) Business days after receipt of annual, quarterly or monthly reports or output, and within three (3) Business Days after receipt of all other reports or output
	Contract	Use of performance monitoring tools and guidelines to assess performance execution.	Customer will monitor and Vendor will report the performance using performance monitoring tools available for such Software as of the Effective Date. Should the Customer not have performance tools available for the Vendor's use in performing the Existing Services, then Vendor shall recommend such tools to Client.

**Table 4: Descriptive statistics (N=151)**

Variable	Mean	Std. Dev.	Min	Max
Prior Relationship	0.49	0.50	0	1
Fair bargaining	0.21	0.40	0	1
Vendor cost performance	0.20	0.32	0	1
Contemporaneous Relationship	0.197	0.39	0	1
Prior Contract Cancellation	0.095	0.29	0	1
Contract Type (Coded as 1 if fixed price)	0.61	0.49	0	1
Contract Value (in millions of dollars)	49.12	18.50	0.5	180
Contract Length (in months)	46.64	31.60	3	120
Breadth of contract	0.38	0.48	0	1
Communication	0.58	0.49	0	1
Complexity	0.95	1.06	0	3
Expectation of future business	0.53	0.47	0	1
Vendor Industry Reputation	0.33	0.45	0	1
Client Size	13444.36	42490.45	120	475000
Vendor Size	12680.29	43587.28	32	332548
Milestones	0.267	0.451	0	1
Technological Maturity	0.29	0.43	0	1
Contract Detail (Number of pages)	32	34.85	4	194
Monitoring provisions in Prior Contract	0.267	0.441	0	1
Industry Reputation	0.33	0.45	0	1

**Table 5: Cross-tabulations of relationships and contract types**

Likelihood of contract characteristics with prior relationships			Test of difference: t-statistic (p value)
Cost plus contract	0.62	Otherwise 0.14	6.78 (0.000)
Contracted task is more complex	0.63	Otherwise 0.19	3.09 (0.003)
Contract length greater than 3 years	0.44	Otherwise 0.23	1.57 (0.11)
Contract value greater than median	0.57	Below median 0.25	3.21 (0.001)
Likelihood of contract characteristics with amicable amendments in a prior relationship			Test of difference: t-statistic (p value)
Cost plus contract	0.58	Otherwise 0.30	2.41 (0.001)
Contracted task is more complex	0.38	Otherwise 0.28	1.09 (0.231)
Contract length is greater than 3 years	0.55	Otherwise 0.38	1.61 (0.109)
Contract value greater than median	0.68	Otherwise 0.43	2.29 (0.012)
Contracts with vendor fair cost performance in a prior relationship			Test of difference: t-statistic (p value)
Cost plus contract	0.92	Otherwise 0.32	5.31 (0.000)
Contracted task is more complex	0.53	Otherwise 0.27	2.17 (0.031)
Contract length is greater than 3 years	0.47	Otherwise 0.42	0.37 (0.705)
Contract value greater than median	0.76	Otherwise 0.46	2.38 (0.018)

**Table 6: Impact of reputation measures on contract form<sup>1</sup> (N=149)**

Dependent: Fixed Price	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	1.07(0.18)***	1.741(0.70)***	1.728 (0.876) **	1.407(0.705)**	1.523 (0.808)*	1.547 (0.893)*	1.754 (0.931)**	1.742 (0.966)*
Prior Relationship	-1.38(0.23)***	-1.287 (0.260)***	-2.147 (0.334)***		-1.93 (0.374)***	-1.926 (0.375)***	-1.803 (0.390)***	-1.720 (0.400)**
Fair bargaining			1.866 (0.362)***	0.551(0.260)**	1.662 (0.392)***	1.675 (0.392)***	1.645 (0.401)***	1.632 (0.423)***
Fair cost performance				-1.453(0.329)***	-0.500 (0.350)*	-0.513 (0.36)*	-0.545 (0.418)*	-0.487 (0.436)
Prior Cancellation						-0.186 (0.417)	-0.211 (0.423)	-0.021 (0.459)
Future bus. Potential							-0.737 (0.315)**	-0.684 (0.319) **
Contemp. Relationship								-1.150 (0.449)***
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Pseudo R Squared</b>	0.20	0.27	0.35	0.38	0.41	0.44	0.49	0.50

Coefficients shown are based on two-tailed t-tests \*\*\* 1% level of significance, \*\* 5% level and \* 10%);  
Standard Errors displayed in parentheses

**Table 7: Coefficients of control variables in the baseline model - column (2) in Table 6**

Variable	Coefficient
Communication	-0.425(0.119)**
Ln (Contract Length)	-0.151(0.110)*
Breadth of services	0.220 (0.186)*
Complexity	-0.301(0.113)***
Buyer Size	0.03(0.02) *
Supplier Size	-0.02(0.046)
Ln (Contract Value)	-0.100(0.081)*
Industry reputation	-0.031(0.20)

<sup>1</sup> Variables are defined in Table 3 and earlier in this paper. A positive coefficient indicates greater likelihood of fixed price contracts. Control variables and coefficients are presented in Table 7.

**Table 8: The Interaction between Relational Contracts and Form of Contracts (Number of observations=149)<sup>2</sup>**

<b>Dependent: Fixed Price</b>	(1)	(2)	(3)	(4)	(5)
Constant	1.292 (1.033)	2.016 (1.130)*	2.509 (1.200)**	2.333 (1.209)**	1.355 (1.060)
Prior Relationship	-2.072 (0.473)***	-2.094 (0.480)***	-2.02 (0.492)***	-2.048 (0.496)***	-2.205 (0.486)***
Fair bargaining	1.465 (0.464)***	1.487 (0.461)***	0.546 (0.334)*	0.527 (0.536)	1.648 (0.510)***
Fair cost performance	-0.236 (0.468)	-0.192 (0.481)	-0.168 (0.490)	-0.146 (0.494)	-0.054 (0.480)
Prior Cancellation	-0.142 (0.470)	-0.150 (0.469)	-0.009 (0.489)	-0.125 (0.509)	-0.268 (0.497)
Future Business	-0.610 (0.327)**	-0.894 (0.444)***	-1.270 (0.518)***	-0.997 (0.603)*	-0.540 (0.300)*
Contemp. Relationship	-1.215 (0.465)***	-1.173 (0.460)***	-1.272 (0.483)***	-1.292 (0.489)***	-1.126 (0.465)***
Complexity	-0.087(0.107)	-0.370 (0.290)*	-0.480 (0.300)*	-0.494 (0.310)*	-0.069 (0.120)
Communication	0.120 (0.320)	0.035 (0.310)	0.064 (0.318)	0.468 (0.579)	0.046 (0.325)
Technological. Maturity	0.455 (0.300)*				
Maturity *Future Business					1.806 (1.005)*
Complexity*Future Business		0.324 (0.343)	0.365 (0.358)	0.405 (0.354)	
Fair Barg* Future Business			1.456 (0.779)**	1.454 (0.772)**	
Communication*Future Bus				-0.576 (0.685)	
Controls	Yes	Yes	Yes	Yes	Yes
<b>Pseudo R-Squared</b>	0.41	0.47	0.49	0.49	0.55

<sup>2</sup> Control variables are the same controls used for Table 6 and reported in Table 7.



**Table 9: Probability of Amendments in a FP contract as a function of Relational Contracting (N=73)**

Variables	(1) Probability of Amendments in earlier contract	(2) Probability of Amendments in earlier contract
Prior Contract is FP	2.41(0.378)***	2.41(0.390)***
Expectations of future business	-0.314(0.386)	-0.335(0.397)
Prior Contract FP*Future business		0.670(0.405)*
Client Size	0.776(0.403)**	0.838(0.414)**
Vendor Size	-0.331(0.501)	-0.285(0.500)
Monitoring Provisions	-0.252(0.363)	-0.307(0.370)
Development Contract	-0.237(0.683)	-0.178(0.694)
Breadth of contract	0.141(0.151)	0.146(0.153)
Constant	-1.610(0.411)***	-1.702(0.430)***

Coefficients shown (based on two-tailed t-tests \*\*\* 1% level of significance, \*\* 5% level and \* 10%); Standard Errors displayed in parentheses

**Table 10: Seemingly unrelated bivariate probit (N=149)**

Variables	Fixed Price Contracts	Communication
Log(Contract Length)	-0.074(0.125)	-0.163(0.103)*
Log(Contract Value)	-0.137(0.106)	0.149(0.104)
Vendor is a Fortune 1000 firm	-0.614(0.248)**	0.190(0.270)
Client is a Fortune 1000 firm	0.128(0.267)	-0.126(0.249)
Milestones specified in contract	-0.850(0.254)***	
Other controls	yes	yes
Constant		-0.169(0.688)

Likelihood test:  $\rho = -0.325(0.127)$ ;  $\chi^2(1) = 5.773$  \*\*\*

Coefficients shown (based on two-tailed t-tests \*\*\* 1% level of significance, \*\* 5% level and \* 10%); Standard Errors displayed in parentheses