

Why Use Requirement Contracts? The Tradeoff between Hold-Up and Breach

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Abstract

A requirements contract is a form of exclusive dealing in which the buyer promises to buy only from one seller if he buys at all. This paper models a most common-sense motivation for such contracts: that the buyer wants to ensure a reliable supply at a pre-arranged price without any need for renegotiation or efficient breach. This requires that the buyer be unsure of his future demand, that a seller invest in capacity specific to the buyer, and that the transaction costs of revising or enforcing contracts be high. Transaction costs are key, because without them a better outcome can be obtained with a fixed-quantity contract. The fixed-quantity contract, however, requires breach and damages. If transaction costs make this too costly, an option contract does better. A requirements contract has the further advantage that it evens out the profits of the seller across states of the world and thus allows for an average price closer to marginal cost.

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I.1. INTRODUCTION

In a requirements contract, the buyer agrees to purchase all of his requirements for a particular product from a given supplier for a specified length of time. This is one of the forms of exclusive dealing contracts, which have been much studied because they have a number of motivations, some efficiency-enhancing and some strategic (see Ramseyer & Rasmusen (2015) for a summary). One of the classes of efficiency-enhancing motivations is ways that exclusive dealing can help induce relationship-specific investments, a line of thought going back to Klein, Crawford & Alchian (1978, pp. 308-310 especially).

The well-known hold-up problem is usually explained in terms of the difficulty of determining whether a contract was breached. Suppose the seller must make a specific investment. He will be reluctant to do so if the buyer can speciously claim the quality is low and refuse delivery except after the price is bargained down. If the seller has the exclusive right to supply the buyer, the buyer's outside option is closed off and he cannot bargain the seller down to as low a price. Exclusivity helps because courts cannot tell whether the correct product has been delivered but can tell which supplier delivers it. This is the theme of a literature based on the model of Hart & Moore (1990). Segal & Whinston (2000) model this with one seller and two buyers, one of whom can make a relationship-specific investment. In the three-person bargaining specification employed, a contract binding the seller and that buyer does not change the level of investment. De Meza & Selvaggi (2007) revisit the situation with a different bargaining specification and find that exclusivity does promote investment. Other papers in this literature include Bolton & Whinston (1993) on vertical integration for supply assurance and Noldeke and Schmidt (1995) on the use of option contracts. This is distinct from another class of efficiency-enhancing reasons for exclusive-dealing based on providing incentives, e.g. Bernheim & Whinston (1998), Klein & Lerner (2007), and Marvel (1982). A typical incentive explanation is that if

a retailer binds himself to sell only one manufacturer's product, then when the manufacturer advertises and brings customers to the retailer, the retailer cannot substitute another, higher-margin, product for the manufacturer's. In the present paper, however, neither hold-up because of unenforceability of delivery nor incentives for promotion will play a role.

Another common feature of hold-up models is that the motivation for long-term contracts is the the seller's apprehension of hold-up, of being bargained down to a low price after he has sunk the cost of relationship-specific investment. A hotel chain builds a hotel next to an auto plant, and the auto company forces the price of a hotel room down to below average cost. Here, the motivation will also be hold-up, but on the opposite side: the the buyer will fear being held up because of the seller's relationship-specific investment. If the buyer needs a product with a specific investment and the seller is the only firm that makes the investment, the seller has monopoly power. Once one hotel chain builds a hotel next to the factory, no other hotel will enter and create head-to-head competition. The buyer has created a natural monopoly against himself. This is a lesson of Goldberg (1976), which compares the buyer's situation to that of the regulator of a natural monopoly in electricity or transportation. In turn, Goldberg is extending the idea of Demsetz (1968) that one way to deal with utilities is to auction off the right to be the monopoly using the contract price as the bid amount.

To avoid this kind of natural monopoly, if the buyer knows the exact quantity he wants he can contract for that quantity in advance, making various potential sellers compete to be the one to make the specific investment. If the buyer is less certain, but litigation and renegotiation are costless, we will see that a fixed-quantity contract is still a good choice for the buyer. A fixed-quantity contract does not constrain the parties to produce the quantity specified; it only provides a starting point for bargaining.

Such renegotiation is not quite the same as relational contracts. The key to a relational contract is that its most important features are those for

governance and termination, not for specific transactions. In the extreme, options are not enforced, nor requirements, nor quantities— in fact, none of those things need be specified. The contract is like a partial merger of the two parties, a contractual way to convert the external transaction contracts of Coase (1938) that are outside the boundary of the firm into his internal command-and-control governance within the boundary. The threat of the legal consequences of breach of transaction-specific terms does not even provide for a starting point for renegotiation. Rather, the contract establishes the expectations whose violation constitutes a blow to the violator’s reputation. Many contracts that are apparently fixed-quantity, option, or requirements contracts are really be of this type. Such a fixed-quantity contract would not result in the buyer accepting delivery out of a desire to avoid breach, or the seller building capacity so as to avoid being unable to deliver the quantity the buyer needs. It would all be worked out efficiently by reputation. See, e.g., Goldberg (1985) and Bernstein (2015). Such contracts do allow for efficient breach; it is just that the threat is not that of going to court. The parties have little reluctance to breach, and pay each other damages, but the “breach” must be mutually beneficial, and that Coase matters more to the damage amount than the Uniform Commercial Code does.

In the present paper, the contracts might be relational or might be transaction-specific, but when we leave the world of zero transaction costs the parties will be reluctant to breach the formal terms regardless of the immediate relational or legal penalties. They will not renegotiate. They will not even want to have to tell the other party they would like to breach. This might be because of harm to reputation— which can occur even if the other party is made whole or more than whole— or because of the managerial costs of discussing and negotiating over changes in the contract, or because of the difficulty of dealing with a change in plans in the life of managers already mired in chaos, crisis, and information overload. I will discuss this more in Section III, with references to the literatures on relational contracting and on why firms write and comply with contracts even when they do not fear

being brought before a court.

In these two worlds— that of zero transaction costs and high personal costs of breaching— we we will address the question of how the parties choose between an option contract (the buyer has the option to buy a specified amount at a specified price), a requirements contract (which adds exclusivity to the option contract) and a fixed-quantity contract (in which an exact price and quantity are specified). This question is appropriate for the most common kind of contractual situation, where a court can tell whether delivery took place or not. Like the Hart-Moore literature, we will be looking at contracts that are incomplete in the sense of failing to pin down quantity exactly, but in our context complete contracts will be feasible. Our goal will be to explain the absence of quantity terms in the contract. After the identity of the product, quantity is the most important term in a contract, the hardest for a court to fill in. A contract lacking price terms will be binding if courts think that a market price can serve as a default. Courts will fill in the price, and almost any other contract term, but not quantity.¹ An option or requirements contract, however, is clear on the quantity in the sense that it clearly says that one party may choose the quantity during the period of the contract. The intent of the parties is clear— to provide flexibility on quantity, but not on other dimensions such as price or the identity of the purchaser.

I.2. A Digression on the Law of Requirements Contracts

First, though, a legal note on the enforceability of option and requirements contracts. The antitrust problems of exclusive-dealing contracts are well-known to economists— see Ramseyer & Rasmusen (2015), for example.

¹This is a basic principle of contract law. Price can be filled in by the court (Uniform Commercial Code 2-305), as can place of delivery (UCC 3-308), time of delivery (UCC 3-309) and time of payment (UCC 3-310). For an introduction to the law, see Martin Carrara “The Basics of U.C.C. Article 2 - Sales,” <http://news.acca.com/accnj/issues/2013-06-07/3.html>.

What is less well-known is the problem of whether any kind of contract that assigns the quantity choice to one party is enforceable. In summary: the law is a mess, more resembling pre-nuptial contract law's reliance on fairness, hardship, and judicial caprice (see Rasmusen & Stake [1998]) than ordinary contract law's merciless adherence to what the parties agreed upon. Contract law does allow an exception to the rule that contracts must specify quantity in the case of requirements contracts, but it is uncomfortable with the idea that two parties can make an agreement that gives one of them the right not to perform anything—and thus might lack mutuality or consideration, *ex post*. The *Uniform Commercial Code*'s section UCC 2-306, "Output, Requirements and Exclusive Dealings" says,

(1) A term which measures the quantity by the output of the seller or the requirements of the buyer means such actual output or requirements as may occur in good faith, except that no quantity unreasonably disproportionate to any stated estimate or in the absence of a stated estimate to any normal or otherwise comparable prior output or requirements may be tendered or demanded.

(2) A lawful agreement by either the seller or the buyer for exclusive dealing in the kind of goods concerned imposes unless otherwise agreed an obligation by the seller to use best efforts to supply the goods and by the buyer to use best efforts to promote their sale.

The phrases "except that no quantity unreasonably disproportionate to any stated estimate or in the absence of a stated estimate to any normal or otherwise comparable prior output or requirements may be tendered or demanded" and "imposes unless otherwise agreed an obligation by the seller to use best efforts to supply the goods and by the buyer to use best efforts to promote their sale" make a mockery of the enforceability of requirements contracts. The official UCC commentary fails to help; it shows profound ignorance of economics, saying, "A shut-down by a requirements buyer for lack of orders might be permissible when a shut-down merely to curtail losses

would not. The essential test is whether the party is acting in good faith.” (U.C.C. §2-306 cmt. 2 (1972)). Victor Goldberg has commented on this at length. Goldberg (2002) relates numerous cases in which courts have a hard time with “mutuality”, failing to see that an option contract benefits both sides *ex ante*, even if the option is not exercised *ex post*. Goldberg (2014) is a shorter summary of the law, Goldberg & Erickson (1987) pays particular attention contracts in one industry: petroleum coke extraction, and Goldberg (2007) focuses narrowly on just the U.C.C. §2-306 problem. There are, to be sure, legitimate difficulties in interpreting requirements contracts, e.g., whether the buyer can purchase extra amounts to resell if the contract price turns out to be lower than the market price; whether the buyer can purchase a competing seller and then provide for its needs internally if the contract price is high; whether it is a violation if the buyer buys a somewhat different but substitutionary product. The courts could, however, deal with all of these by adhering to the plain language of the contract and then making reasonable interpretations of that plain language—for example, ruling on what the word “requirements” means. But practitioner lawyers, too, agree that the law has muddled the legal situation even further. Wiggin and Dana (2013) post Martini & Brown (2013), an article by two of their lawyers, on the web to note that the “stated requirements” clause is crucial and that it is wise to to the cost of writing a detailed contract to account for numerous contingencies. A leading law firm, Jones-Day, has posted a web document (Jones Day [2007]) warning businessmen and transactional lawyers about the confusion over what “best efforts” means as opposed to “reasonable efforts”, starting with contradictions in the UCC official comments themselves. Judges have tried to escape the plain meaning of “best efforts,” since it would say a party must ignore its own profits—and, indeed, the other party’s profits too—but this has resulted in “best efforts” becoming an ill-defined term of art. They even make the practical suggestion that the term be avoided, because even if one could predict what the courts would say it means, the meaning so contradicts everyday language that it can easily create bad feeling among

the businessmen who sign the contract:

If a contract contains a best efforts clause, the party receiving the benefit of the obligation may have substantial leverage over the promisor **because everyone assumes that the best efforts standard is an obligation approaching guaranteed performance.** Because contract disputes are rarely litigated, it may be practically irrelevant that a best efforts obligor is not legally bound to act in a manner that ignores reasonable consideration for its own interests. **For this reason alone, and regardless of the actual legal interpretation,** one should avoid using an undefined best efforts standard when representing a promisor. [my boldface]

Fortunately, we need not deal with this mess here. We will assume that the parties are willing to go into enough detail in writing their contracts that they can convince the courts that they really did intend to give the buyer an option to buy any quantity he desires and that if the buyer decides his requirements are zero he may buy zero from the seller, so long as he does not violate an agreement by buying from some other seller instead.

I.3. An Illustrative Case

It is useful to start with a true story that illustrates the kind of situation in which a requirements contract is used— and which illustrates how a contract can be written to escape the confusion in the courts. *Jullie G. Horn v. United States*, United States Court of Federal Claims No. 07-655C (May 3, 2011), was a lawsuit over a 2005 contract between Jullie Horn and the Federal Bureau of Prisons. Horn was awarded a contract to provide “professional dental hygiene services under the direction of the Dentist to the inmate population at the United States Penitentiary and Federal Prison Camp, Marion, Illinois. The contract specified that she was to provide a maximum of 1,560

one-hour dental hygiene sessions at a price of \$32 per session. The contract was labelled a “REQUIREMENTS” contract in capital letters. It said,

(a) This is a requirements contract for the supplies or services specified, and effective for the period stated, in the Schedule. The quantities of supplies or services specified in the Schedule are estimates only and are not purchased by this contract. Except as this contract may otherwise provide, if the Government's requirements do not result in orders in the quantities described as “estimated or “maximum in the Schedule, that fact shall not constitute the basis for an equitable price adjustment.

and

(c) The estimated quantities are not the total requirements of the Government activity specified in the Schedule, but are estimates of requirements in excess of the quantities that the activity itself furnish within its own capabilities. Except as this contract otherwise provides, the Government shall order from the Contractor all of that activity's requirements for supplies and services specified in the schedule that exceed the quantities that the activity may itself furnish within its own capabilities.

One month later, after Horn had completed and been paid for 130 teeth-cleaning sessions, the dentist told her that he had hired an in-house hygienist and her services were no longer needed. She sued in the Court of Federal Claims for breach of contract on the grounds that she had been awarded all of the prison's teethcleaning requirements.

The prison contract is the kind of requirements contract we are trying to explain. Why was there a contract at all, rather than hiring the hygienist session by session? Why wasn't the quantity pinned down precisely in the contract? Why was the contract exclusive rather than at the government's

option? Note, too, that there was no attempt to use nonlinear pricing, that is, to set different per-hour prices for different quantities of hours. And there were no lump-sum transfers. The government could have used a contract in which Horn paid a lump sum to obtain the contract and then received a very large hourly fee so she would have ample incentive to make herself available for the marginal hours. We know nonlinear-price and two-part tariff contracts are unrealistic in a context like this, but knowing why they aren't used is more difficult than known they aren't.

I think a requirements contract was used for a relatively simple reason. The government wanted some kind of contract so it could be assured of supply at a low price rather than be faced later with no seller or with just one seller who could charge a monopoly price. A fixed-quantity contract would have required renegotiation later, since the government did not know its own future demand precisely. Renegotiation would take up management time and be subject to corruption. An option contract would not need renegotiation but it would need high prices to compensate for the hygienist's risk that the government would switch to buying from someone else. A requirements contract did not have these disadvantages. It does not require renegotiation, and the price that yields zero economic profit to the hygienist could be lower because with outside supply ruled out, she could expect a higher quantity of her services to be demanded. Of course it went wrong in the end, which is why there was a lawsuit, but I will return to that at the end of the paper and describe what happened to Jullie Horn.

This motivation will be modelled below using a buyer who desires the seller to make a specific investment that will be useful if other firms in the marketplace happen to be unavailable. Here, that specific investment was hygienist Horn's dedication of her time and attention to providing the product for this particular customer, the prison. An easy way to get the first-best in such a situation is a contract in which the buyer agrees to a very high price, equivalent to its marginal consumer surplus when the social optimiza-

tion problem is solved, combined with a large advanced fixed payment from the seller to the buyer to remove seller profit. We do not observe such contracts, perhaps because of seller illiquidity (likely in *Horn*), perhaps because for agency reasons— it is dangerous for a seller firm to allow its manager to make contracts in which he pays out large lump sums in transfers for uncertain future cash flows. We will rule out side payments in bargaining. We will also rule out nonlinear option contracts, in which the buyer pays more per unit if he buys more units, but has the option to choose whichever amount he wants once he knows the state of the world. They would allow for a very high price for units unlikely to be demanded to induce the seller to choose a high capacity, combined with a price below marginal cost for a low number of units so as to reduce seller expected profits to zero. This may require too much cleverness to be practical; again, it is hard for the buyer's top manager to monitor and is complex to set up.

II. THE MODEL

II.1. Outcomes without Contracts: First-Best, Decentralized Optimum, and Spot Sale

The buyer's value for the single unit he might buy of the good is v , unknown at the time of contracting and distributed by $F(v)$ on the support $[0, \bar{v}]$, with density $F'(v) \equiv f(v)$, where $f > 0$ and $-2f(v) - (v - c)f'(v) < 0$ so that a higher price is always more profitable up to the reservation price of \bar{v} .² With probability θ , the buyer needs a specialized version of the product and the normal product is worth 0 to him. He will then be in a "thin" market with few or no sellers. With probability $(1 - \theta)$, the buyer, like other potential buyers, is indifferent between the specialized and the normal product.

The good's marginal cost is c and many firms can produce the normal version of it. A firm may try to design the specialized product by investing I , and will succeed with probability $g(I)$, where $g(0) = 0, g'(0) = \infty, g' > 0, g'' < 0$ for $I < \bar{I}$ and $g(\bar{I}) = 1$. Under these assumptions, a firm must invest a positive amount to have a positive chance of success, the marginal product of investment starts equal to infinity, and success is certain if enough is invested. Assume too that if firms 1 and 2 spend I_1 and I_2 with $I_1 < I_2$, firm 2 is successful whenever firm 1 is successful.³

We will assume that $I^* < \bar{I}$ and that $I = \bar{I}$ produces more social surplus than $I = 0$, where I^* is the decentralized optimum investment as explained below. Both players are risk neutral. Each side captures half the surplus if bargaining takes place.

²This is a standard assumption of convenience. It says that the demand curve cannot be too convex. Otherwise, we would have to deal with subcases where the buyer cannot increase a seller's profits from negative to zero by increasing the contract price.

³Thus, success depends on the product, not the individual attributes of the firm, and it is not independent across firms. "Design" here does not mean innovation, just the setting up of a specialized version of the standard product, which can always be done with enough time and trouble.

II.1a. The First Best with Vertical Integration: $P = MC$. The first best maximizes the sum of the negative investment costs, the surplus over marginal cost when the specialized product is needed and successfully produced, and the surplus when the specialized product is not needed. This is the surplus that would be achieved by vertical integration, if the buyer could make the investment and produce the product himself. We will denote this first-best investment as I^{**} .

$$Surplus(I) = \theta g(I) \int_c^{\bar{v}} (v - c) f(v) dv + (1 - \theta) \int_c^{\bar{v}} (v - c) f(v) dv - I \quad (1)$$

Maximizing the surplus has the first order condition

$$Surplus'(I) = -1 + g'(I^{**}) \theta \int_c^{\bar{v}} (v - c) f(v) dv = 0. \quad (2)$$

II.1b. The Decentralized Optimum: $P=AC$. Since we do not allow lump-sum payments, the seller makes losses and not participate if the price equalled marginal cost. In the “decentralized optimum”, the seller’s profit must be raised to zero by raising the price high enough to cover the fixed cost of investment, and the buyer cannot be forced to buy at that price. This is the “price equals average cost” equilibrium of rate-of-return regulation. Surplus will not be as high as in the first-best, since the buyer will buy less if the price is above marginal cost.

Let the price be p_1 for the normal product and p_2 for the specialized product. The maximization problem becomes to maximize by choice of I , p_1 , and p_2 ,

$$Surplus(I, p_1, p_2) = \theta g(I) \int_{p_2}^{\bar{v}} (v - c) f(v) dv + (1 - \theta) \int_{p_1}^{\bar{v}} (v - c) f(v) dv - I \quad (3)$$

such that the prices lies in $[0, \bar{v}]$ and

$$\pi = \theta g(I) \int_{p_2}^{\bar{v}} (p_2 - c) f(v) dv + (1 - \theta) \int_{p_1}^{\bar{v}} (p_1 - c) f(v) dv - I \geq 0.$$

The decentralized optimum's first order condition for choice of p_1 is (using unconventional but obvious notation, and denoting the Lagrange multiplier by μ):

$$\begin{aligned}
 Surplus'_{p_1} &= (1 - \theta)[-(p_1 - c)f(p_1)] - \mu(1 - \theta) \left[\int_{p_1}^{\bar{v}} f(v)dv - (p_1 - c)f(p_1) \right] = 0 \\
 &-(p_1 - c)f(p_1) - \mu \left[- \int_{p_1}^{\bar{v}} f(v)dv + (p_1 - c)f(p_1) \right] = 0 \\
 \mu &= \frac{(p_1 - c)f(p_1)}{(p_1 - c)f(p_1) - \int_{p_1}^{\bar{v}} f(v)dv}
 \end{aligned} \tag{4}$$

For p_2 the first order condition is

$$\begin{aligned}
 Surplus'_{p_2} &= \theta g(I)[-(p_2 - c)f(p_2)] - \mu \theta g(I) \left[\int_{p_2}^{\bar{v}} f(v)dv - (p_2 - c)f(p_2) \right] = 0 \\
 \mu &= \frac{(p_2 - c)f(p_2)}{(p_2 - c)f(p_2) - \int_{p_2}^{\bar{v}} f(v)dv}
 \end{aligned} \tag{5}$$

The first order condition for p_2 in equation (4) is the same as for p_1 in (5), which means $p_2^* = p_1^*$. Let us call this optimal price p^* . This is the same idea as in Ramsey pricing, that two medium price distortions are preferable to one big and one small because surplus loss rises with the square of the distortion. Note that the shadow price of the seller's zero-profit constraint, μ , is in $(0, 1)$. The constraint is binding and hence costly, but less than an entire unit of the buyer's surplus has to be sacrificed to the seller at the margin.

The first order condition for choice of I is (denoting the decentralized

optimum by I^*)

$$\begin{aligned}
 Surplus'_I &= -1 + \theta g'(I^*) \int_{p^*}^{\bar{v}} (v - c) f(v) dv - \mu \left(-1 - \theta g'(I^*) \int_{p^*}^{\bar{v}} (p^* - c) f(v) dv \right) = 0 \\
 (1 - \mu) \left(-1 + \theta g'(I^*) \int_{p^*}^{\bar{v}} (v - c) f(v) dv \right) &= 0 \\
 -1 + \theta g'(I^*) \int_{p^*}^{\bar{v}} (v - c) f(v) dv &= 0
 \end{aligned} \tag{6}$$

Equation (6) yields a smaller I than in the first-best of (2) because the integral is from p^* to \bar{v} , not c to \bar{v} . The buyer will not purchase if his value is between c and p , even though that would be efficient, so it is not worth investing as much in trying to obtain the specialized product.

II.1c. Spot Sale. With no contract, and thus no pre-set price, only one seller will invest, since if two do they would compete the price of the specialized good down to marginal cost, c .⁴ The seller will have profit

$$\pi_{spot}(I) = \theta g(I) \int_{\frac{v+c}{2}}^{\bar{v}} \left(\frac{v+c}{2} - c \right) f(v) dv - I \tag{7}$$

with first order condition

$$\pi'_{spot} = \theta g'(I_{spot}) \int_{\frac{v+c}{2}}^{\bar{v}} \left(\frac{v+c}{2} - c \right) f(v) dv - 1 = 0 \tag{8}$$

If $p^* < (v + c)/2$, the seller's profit will be positive and there will be moderate underinvestment compared to the decentralized optimum. If $p^* > (v + c)/2$, the seller's profit will be negative, so the problem has a corner solution and the first order condition is not relevant: the seller will choose

⁴We will ignore the mixed-strategy equilibrium where two or more sellers invest with positive probability, with resulting waste and with the price either c or $\frac{v+c}{2}$.

$I = 0$ and there is severe underinvestment. This is the hold-up problem that provides a standard explanation for long-term contracts: if investment costs are sunk at the time of bargaining over price, then investment will be inefficiently low. Thus, we will assume that $p^* < (v + c)/2$ in this paper, to focus on the opposite problem: monopoly power of the seller that results from lack of a long-term contract.

II.2. The Model with Zero Transaction Costs.

We will assume transaction costs are zero in this section. This does not mean that a player can breach without consequence; he must meet his legal obligations. Those legal obligations can be met at zero real economic cost to either party. Managers do not need to hire lawyers, discuss the breach with each other or their subordinates, estimate their own and the other party's costs from breach (either at the time of making the contract or after breach) or haggle over out-of-court settlement.

Note that the buyer will always want the price to yield zero profits to the seller who wins the contract in competition with the other sellers. The only possible benefit from a higher price would be to induce the seller to choose higher investment, but higher investment does not help the buyer because he can collect expectation damages from the seller if the seller fails in designing the specialized product.

II.2a. The Fixed-Quantity Contract, Zero Transaction Costs. Consider a fixed-quantity contract with 1 unit and price \bar{p}_{fq} (a contract for 0 units would be just like having no contract). There may be efficient breach by either side. If the buyer's value v turns out to be less than c he will breach; if the seller fails in designing the specialized product he will breach. If the seller had succeeded in designing the specialized product, the buyer would pay damages of $(\bar{p}_{fq} - c)$ to the seller. If the seller had failed, the buyer would not have to pay damages, since under standard contract law delivery

is necessary to trigger the buyer's requirement to pay.⁵

If the seller fails in designing the specialized product, he will pay compensatory damages of $v - \bar{p}_{fq}$ if the buyer values it at more than \bar{p}_{fq} , which has probability $(1 - g(I))(1 - \theta) \int_{\bar{p}_{fq}}^{\bar{v}} f(v)dv$.⁶ Note that when the buyer does not need the specialized product, if the seller breaches by supplying the unspecialized product the buyer's damages are zero. The seller will thus have expected profit consisting of the cost of investment, the profit from selling if a normal product is satisfactory, the profit from selling the specialized product if the investment is successful, and the loss from breach damages if the investment is unsuccessful:

$$\begin{aligned} \pi_{fq}(I) = & \theta g(I) \int_0^{\bar{v}} (\bar{p}_{fq} - c) f(v) dv - \theta (1 - g(I)) \int_{\bar{p}_{fq}}^{\bar{v}} (v - \bar{p}_{fq}) f(v) dv \\ & + (1 - \theta) \int_0^{\bar{v}} (\bar{p}_{fq} - c) f(v) dv - I \end{aligned} \tag{9}$$

⁵UCC 2-507(1): "Tender of delivery is a condition to the buyer's duty to accept the goods and, unless otherwise agreed, to his duty to pay for them. Tender entitles the seller to acceptance of the goods and to payment according to the contract," <https://www.law.cornell.edu/ucc/2/2-507>.

⁶UCC 2-p511(1): "Unless otherwise agreed tender of payment is a condition to the seller's duty to tender and complete any delivery. " <https://www.law.cornell.edu/ucc/2/2-511>. There is the possibility of buyer bluff: the buyer shows up with payment, the seller does not perform, and the buyer claims damages. Expectation damages would be zero, however, because the buyer would actually lose by having the contract fulfilled.

with first order condition

$$\begin{aligned}
\pi'_{fq}(I) &= \theta g'(I) \int_0^{\bar{v}} (\bar{p}_{fq} - c) f(v) dv - \theta g'(I) \int_{\bar{p}_{fq}}^{\bar{v}} (v - \bar{p}_{fq}) f(v) dv - 1 \\
&= \theta g'(I) \int_0^{\bar{p}_{fq}} (\bar{p}_{fq} - c) f(v) dv + \theta g'(I) \int_{\bar{p}_{fq}}^{\bar{v}} (\bar{p}_{fq} - c) f(v) dv \\
&\quad + \theta g'(I) \int_{\bar{p}_{fq}}^{\bar{v}} (v - \bar{p}_{fq}) f(v) dv - 1 \\
&= \theta g'(I) \int_0^{\bar{p}_{fq}} (\bar{p}_{fq} - c) f(v) dv + \theta g'(I) \int_{\bar{p}_{fq}}^{\bar{v}} (v - c) f(v) dv - 1 = 0
\end{aligned} \tag{10}$$

Recall that the decentralized optimum's first-best condition is $\theta g'(I^*) \int_{p^*}^{\bar{v}} (v - c) f(v) dv - 1 = 0$. The seller now has two incentives to make investment high. First, if the buyer needs the specialized product, the seller both gets his profit margin and avoids paying damages. Second, if the buyer doesn't need the specialized product, the seller gets the margin anyway. It is this second effect which both helps and hurts efficiency. It hurts as far as capacity is concerned, because it makes it excessive. It helps as far as the price is concerned, because it allows for a lower price. We may even be able to get the first-best, with I^{**} . In effect, the payments when the market is thick generate a fixed fee. It is not fixed—it depends on delivery of the good—but it is guaranteed to be at a price exceeding marginal cost.

II.2.b. The Option Contract, Zero Transaction Costs. We could have an option contract at price \bar{p}_{oc} . Then only the seller breaches with positive probability in equilibrium. The seller will have expected profit composed of the profit from the specialized product minus the damages he pays the buyer if he fails in designing it and it would have been useful to the buyer minus the investment cost:

$$\pi_{oc}(I) = \theta g(I) \int_{\bar{p}_{oc}}^{\bar{v}} (\bar{p}_{oc} - c) f(v) dv - \theta(1 - g(I)) \int_{\bar{p}_{oc}}^{\bar{v}} (v - \bar{p}_{oc}) f(v) dv - I_{oc} \tag{11}$$

with first order condition

$$\begin{aligned}
\pi'_{oc}(I_{oc}) &= \theta g'(I_{oc}) \int_{\bar{p}_{oc}}^{\bar{v}} (\bar{p}_{oc} - c) f(v) dv + \theta g'(I_{oc}) \int_{\bar{p}_{oc}}^{\bar{v}} (v - \bar{p}_{oc}) f(v) dv - 1 = 0 \\
&= \theta g'(I_{oc}) \int_{\bar{p}_{oc}}^{\bar{v}} (v - c) f(v) dv - 1 = 0
\end{aligned} \tag{12}$$

This is the same first order condition as for the decentralized optimum except that the price must be higher: $\bar{p}_{oc} > p^*$. That is because the seller makes a sale with lower probability— with probability $\theta g(I)$ instead of $1 - \theta + \theta g(I)$, and so to recover his investment cost he must charge a higher price. As a result, the amount of investment will also be smaller than in the decentralized optimum.

II.2.c. The Requirements Contract, Zero Transaction Costs. We could have a requirements contract at price \bar{p}_{rc} . Again, only the seller has a positive probability of breaching in equilibrium. The seller will have expected profit composed of the profit when the buyer does not need the specialized product plus the profit from the specialized product minus the damages he pays when he fails in designing the specialized product and the buyer needs it minus the investment cost:

$$\begin{aligned}
\pi_{rc}(I) &= \theta g(I) \int_{\bar{p}_{rc}}^{\bar{v}} (\bar{p}_{rc} - c) f(v) dv - \theta (1 - g(I)) \int_{\bar{p}_{rc}}^{\bar{v}} (v - \bar{p}_{rc}) f(v) dv \\
&\quad + (1 - \theta) \int_{\bar{p}_{rc}}^{\bar{v}} (\bar{p}_{rc} - c) f(v) dv - I
\end{aligned} \tag{13}$$

with first order condition

$$\begin{aligned}
\pi'_{rc}(I) &= \theta g'(I) \int_{\bar{p}_{rc}}^{\bar{v}} (\bar{p}_{rc} - c) f(v) dv + \theta g'(I) \int_{\bar{p}_{rc}}^{\bar{v}} (v - \bar{p}_{rc}) f(v) dv - 1 \\
&= \theta g'(I) \int_{\bar{p}_{rc}}^{\bar{v}} (v - c) f(v) dv - 1 = 0
\end{aligned} \tag{14}$$

This is the same first order condition as for the decentralized optimum, except that the values of the prices will be different.

II.3. Which Contract is Optimal with Zero Transaction Costs?

Proposition 1: In the specialized-product model with zero breach costs, the fixed-quantity contract is superior to the requirements or option contract in terms of total and buyer surplus.

Proof:

Lemma 1. *The option and requirements contract prices will be higher than under the fixed-quantity contract's.*

Denote the optimal investment under the option contract by I_{oc}^* . Suppose we fix $I = I_{oc}^*$, we impose the fixed-quantity-contract, and we let the players choose the fixed-quantity price in response. Competition among the sellers will, as usual, result in zero profits for the seller who wins the contract. From equation (9), profits are

$$\begin{aligned} \pi_{fq} = & \theta g(I_{oc}) \int_c^{\bar{v}} (\bar{p}_{fq} - c) f(v) dv - \theta (1 - g(I_{oc})) \int_{\bar{p}_{fq}}^{\bar{v}} (v - \bar{p}_{fq}) f(v) dv \\ & + (1 - \theta) \int_c^{\bar{v}} (\bar{p}_{fq} - c) f(v) dv - I_{oc} \end{aligned}$$

Under the option contract, profits are, from equation (11),

$$\pi_{oc} = \theta g(I) \int_{\bar{p}_{oc}}^{\bar{v}} (\bar{p}_{oc} - c) f(v) dv - \theta (1 - g(I)) \int_{\bar{p}_{oc}}^{\bar{v}} (v - \bar{p}_{oc}) f(v) dv - I_{oc} = 0$$

The difference between the profits if the two prices were both equal to \bar{p}_{oc} would be

$$\pi_{fq} - \pi_{oc} = \theta g(I_{oc}) \int_c^{\bar{p}_{oc}} (\bar{p}_{oc} - c) f(v) dv + (1 - \theta) \int_c^{\bar{v}} (\bar{p}_{oc} - c) f(v) dv > 0 \quad (15)$$

Since $\pi_{oc} = 0$ with $p = \bar{p}_{oc}$ and $I = I_{oc}$, it must be that $\pi_{fq} > 0$ with those two variable values. If we still impose $p = \bar{p}_{oc}$ but allow the seller to choose I freely under the requirements contract, his profits will rise even further above zero. To reduce them to zero, it must be that $\pi_{fq} < \pi_{oc}$.

Now do the same for the requirements contract. From equation (??) its profit is

$$\begin{aligned} \pi_{rc}(I) &= \theta g(I_{rc}) \int_{\bar{p}_{rc}}^{\bar{v}} (\bar{p}_{rc} - c) f(v) dv - \theta (1 - g(I_{rc})) \int_{\bar{p}_{rc}}^{\bar{v}} (v - \bar{p}_{rc}) f(v) dv \\ &\quad + (1 - \theta) \int_{\bar{p}_{rc}}^{\bar{v}} (\bar{p}_{rc} - c) f(v) dv - I_{rc} = 0 \end{aligned}$$

Impose $I = I_{rc}$ and $p = \bar{p}_{rc}$ for the fixed-quantity contract. The difference in profits between the two contracts is then

$$\begin{aligned} \pi_{fq} - \pi_{rc} &= \theta g(I_{rc}) \int_c^{\bar{v}} (\bar{p}_{rc} - c) f(v) dv + (1 - \theta) \int_c^{\bar{v}} (\bar{p}_{rc} - c) f(v) dv \\ &\quad - \theta g(I_{rc}) \int_{\bar{p}_{rc}}^{\bar{v}} (\bar{p}_{rc} - c) f(v) dv - (1 - \theta) \int_{\bar{p}_{rc}}^{\bar{v}} (\bar{p}_{rc} - c) f(v) dv \\ &= \theta g(I_{rc}) \int_c^{\bar{p}_{rc}} (\bar{p}_{rc} - c) f(v) dv + (1 - \theta) \int_c^{\bar{p}_{rc}} (\bar{p}_{rc} - c) f(v) dv \end{aligned} \tag{16}$$

This is positive, and becomes more positive if the fixed-contract seller is allowed to optimize his choice of I . Hence, it must be that $\bar{p}_{fq} < \bar{p}_{rc}$

Lemma 2. *Investment will be lower under the option and requirements contracts than under the fixed-quantity contract.*

Equating the contract prices, the three contracts' first order conditions for choice of I are, from equations (10), (12) and (14),

$$\pi'_{fq}(I) = \theta g'(I) \int_0^{\bar{p}} (\bar{p} - c) f(v) dv + \theta g'(I) \int_{\bar{p}}^{\bar{v}} (v - c) f(v) dv - 1 = 0, \tag{17}$$

$$\pi'_{oc}(I) = \theta g'(I) \int_{\bar{p}}^{\bar{v}} (v - c) f(v) dv - 1 = 0 \quad (18)$$

and

$$\pi'_{rc}(I) = \theta g'(I) \int_{\bar{p}}^{\bar{v}} (v - c) f(v) dv - 1 = 0 \quad (19)$$

Since $g'(I) > 0$, $g''(I) < 0$, and the option and requirements contracts' first order conditions lack the first term of the fixed-quantity contract's, they are solved by a smaller I when the prices in all three contracts are equal.

In fact, the price is lower under the fixed-quantity contract by Lemma 1, so even its second term is greater than the second term of the marginal profit of the option and requirements contracts if the investments are equal, so a fortiori the fixed-quantity contract's investment must be bigger.

(3) Consider the total surplus in real terms, which can ignore payments between the parties since they cancel out. Total surplus under any contract consists of the the buyer surplus when the specialized product is needed and and the seller has successfully produced it plus the buyer surplus when the specialized product is not needed, minus the investment cost. The seller surplus is zero. Under the fixed-quantity contract, the buyer buys whenever his value v exceeds c , whether the market is thin or thick, so

$$\text{Total surplus}_{fq} = \theta g(I_{fq}) \int_c^{\bar{v}} (v - c) f(v) dv + (1 - \theta) \int_c^{\bar{v}} (v - c) f(v) dv - I_{fq} \quad (20)$$

Under the option contract, the buyer buys in the thin market only if his value is at least \bar{p}_{oc} , so total surplus is

$$\text{Total Surplus}_{oc} = \theta g(I_{oc}) \int_{\bar{p}_{oc}}^{\bar{v}} (v - c) f(v) dv + (1 - \theta) \int_c^{\bar{v}} (v - c) f(v) dv - I_{oc} \quad (21)$$

From Lemma 2 we know that I_{fq} is bigger and thus closer to the first-best level and preferable to I_{oc} . Moreover, the lower bound of the first integral is

c for the fixed-quantity contract but $\bar{p}_{oc} > c$ for the option contract, so that portion of the surplus is lower. Hence, the fixed-quantity contract has higher surplus than the option contract.

Under the requirements contract, whether the market is thick or thin the buyer will only buy if his value is at least \bar{p}_{rc} , so

$$\text{Total surplus}_{rc} = \theta g(I_{rc}) \int_{\bar{p}_{rc}}^{\bar{v}} (v - c) f(v) dv + (1 - \theta) \int_{\bar{p}_{rc}}^{\bar{v}} (v - c) f(v) dv - I_{rc} \quad (22)$$

From Lemma 2 we know that I_{fq} is bigger and thus closer to the first-best level and preferable to I_{rc} . Moreover, the lower bound of both integrals is c for the fixed-quantity contract but $\bar{p}_{rc} > c$ for the requirements contract, so that portion of the surplus is lower. Hence, the fixed-quantity contract has higher surplus than the requirements contract. Hence the fixed-quantity contract is superior to both alternatives. Q. E. D.

III. The Model with High Personal Costs of Breach

III.1. A Discussion of the Personal Costs of Breach We will now assume that neither party will breach the contract. This might be because breaching creates a bad reputation and hinders future contracting. Or, it could be that the other party will sue to enforce the contract, not because it is directly profitable but in order to preserve a reputation for enforcing contracts, and the resulting litigation costs in terms of legal fees and managerial time would make the breach unprofitable even if it would be efficient in the absence of transaction costs. Charny (1990) surveys informal reasons why firms do not breach contracts. It is well known that although businesses often devote great care to writing legally enforceable contracts with each other, they rarely go to court to enforce them except in end-games—bankruptcy, or the collection of bad debts. Macaulay (1963) is the standard cite. In a later article, Macaulay (1977) says (citing Llewellyn [1931] and Kurczewski & Frieske [1977]),

The contract litigation process may also maintain a vague sense of threat that keeps everyone reasonably reliable (see Llewellyn, 1931:725 n.47). For this process to operate, it is not necessary that business managers understand contract norms and the realities of the litigation process. Perhaps all that is needed is a sense that breach may entail disagreeable legal problems. The Polish managers described by Kurczewski and Frieske reflect this when they tell us that “one needs to threaten [to use contract penalties] intelligently.” The authors go on to remark, somewhat paradoxically, that the “system works well so long as the penalties [for breach of contract] are not actually applied. They work well as a threat, but their application will injure the relationship with the cooperating enterprise so that in the future it will seek contacts with other directors who have a more conciliatory approach” (1977:497).

One way to understand this situation is as the equilibrium trigger strategies of a prisoner’s dilemma. As explained in Bull (1987), MacLeod & Malcomson (1988, 1989), and Baker, Gibbons & Murphy 1994), the two parties both wish the relationship to continue, and fear of falling into mutual distrust can prevent either from taking the small windfall profit from cheating. Articles followed that showed how writing a legally enforceable contract can be useful even if it is the threat of dissolving the relationship rather than the threat of court that is fundamental to maintaining cooperation— see Bernheim & Whinston (1998a), Baker, Gibbons & Murphy (1999, 2002, 2011), Levin(2003), Gilson, Sabel & Scott (2010), Baker & Choi (2014), and Gil & Zananone (2014). A distinct though complementary motivation for good behavior is fear of losing not just the particular relationship but one’s reputation with outsiders, the argument from the literature starting with Klein & Leffler (1981). The literature is surveyed by MacLeod (2007) and Malcomson (2012).

What is most interesting is the difficulty of attaining efficient breach by these means. It is relatively easy to understand how trigger strategies and

reputation make the parties adhere to their promises. What is harder is to understand what happens when a party wants to break a promise but is willing to compensate the other party and, in fact, to make them benefit by the breach. The Coase Theorem says that in the absence of transaction costs this is what will happen when the promise does not maximize surplus. It also says that transaction costs can block efficient renegotiation. It is clear how the transaction costs of going to court prevents efficient breach. What is less clear is how the transaction costs of going to the other party to request mutually beneficial modification prevents efficient breach, but it seems that it often does. I speculate that the basic problem is just that requesting *any* change in a relationship is disruptive. It requires the parties to rethink their actions and to re-open negotiations over how to split the surplus. These renegotiations are about “taking surplus” rather than “making surplus”, and though businesses have no qualms about taking surplus, they know that usually in our present economy making surplus is where the real profit lies and managerial attention is limited.

For the present purpose of discussing requirements contracts, what is relevant here is the relevance to the business world of the assumption managers not only dislike going to court, but dislike breaching contracts even if they have no fear of being sued and at the same time dislike notifying their contractual partners that they would like to renegotiate the contract and offer a trade of compensation for breach. Recent scholarship has provided evidence for this. It is routine for businesses to negotiate detailed contracts that they never intend to enforce in court. Compensation for breach, whether imposed by the court or offered by the breaching party to preserve its reputation, seems not to be a tool for successful business. Bozovic & Hadfield (2015) and Bernstein (2015) have studied business to business contracts via interviews and looking at particular contracts. Whether businesses use detailed contracts, spot purchases, or simple purchase orders, and how closely the actual transactions follow the written records differs depending on the type of business, but a common practice seems to be for a business to write down all relevant

details for the planned relationship so that both sides are clear about what is expected, not because they intend to use the document in court (with the important exception of what happens if the entire relationship terminates, as in bankruptcy). Once those expectations are set, both parties try very hard to meet them, and while many details must be left incomplete because they depend on as-yet-unavailable information, they depend heavily on each other doing what is promised, and the biggest risk to reputation is perhaps that of being unable— as opposed to unwilling— to meet expectations. As a result, businesses are reluctant not only to break the agreement but to suggest dropping agreed terms in exchange for voluntarily paid damages.

Bozovic & Hadfield (2013) say,

The formal contracts that the businesses involved in innovation-oriented relationships spend significant resources to create and amend are not documents that lie dormant in a drawer once they have been drafted. Instead, we heard, they are frequently consulted by these businesses to understand their own obligations and those of their partners. They are expressly brought out to help settle disputes that arise during the course of the relationship.

Managers for online collaboration platforms told them, for example, that:

I would use [the contract] as a reference document. It wouldn't be I never go back to these things, they are in a file drawer. I dig them out when I have to, when there is some reason: what did we do? I can't remember, what did we agree to? Oh, that's what we agreed to. All right, well that's the deal. Get on it with it. (Appendix item 26)

and

[You find yourself] calling these lawyers [for advice in the context of a dispute] who say these are non-enforceable contracts... I always

hear lawyers say: don't do MOUs — memoranda of understanding — they are worthless; they are not legally enforceable by law. Well they're right. They are not. But that's not why we're doing it. This memorandum of understanding - it's a memo that says what we've been talking about, what we agreed to, and we want to be clear with each other. So it's all about clarity...and so those types of things become useful instruments for communication clarity. [Even if they] become a contract; well, I'd argue they are still for communication clarity. (Appendix item 43)

As this suggests, the businesses write contracts carefully, and keep referring to them. The reason is not to plan lawsuits or how to opportunistically breach in a way that is legal but unexpected, however. Rather, managers from high-tech consumer electronics firms said:

I cite contracts all the time; you are in breach of this and that... but I've never actually said we are going to use the contract to extract something from you and enforcing it in a court of law. I have never done that. (Appendix item 22)

Have I ever thought I would end up in court? No! We have spent a lot of time on [the contract] and neither party has any intent to use this contract because by the time you get to the point where you are [going to court], now you have a public relations issue. We are a consumer electronics company. You view those kinds of things...it has impact far beyond the contract: other people don't want to do business with you, you could stifle innovation, you could have a public relations or consumer products problem... (appendix item 34)

A big concern is to make the agreed-to transactions are automatic and smooth as possible, avoiding non-performance, haggling, and delay. The biggest concern is not about price— something easy to specify— but predictability and speed. An online collaboration platform said:

The fundamental problem [with litigation], and again, this is very much a Silicon Valley perspective, is: the things that delay you are as bad as the things that don't happen. They're kind of equivalent. So, the minute you open litigation, you've put in this time delay. [Moreover] if [your customers see you involved in all kinds of legal problems, they start to wonder] 'what's going on?'... then they [decide] I'm not going to do business with them." If somebody views you as high-risk it's absolutely deadly for small companies to start up in anything to do with litigation...

Bernstein pays particular attention to the extraordinary documentation that procurement managers provide their suppliers as education, not as constraint. The manufacturer buyer wants the components it needs to arrive on time and able to be combined with components from other suppliers. It knows that even if the supplier is trying its best, the buyer needs to teach what it needs and how to supply it. "Scorecard" reports are a common means of notifying suppliers how well they are complying. As in grade school, high school, and college, a big purpose of grades is to let the "student" know how well he's doing so he can improve, and to provide a warning about slack behavior. These even (again like GPA's) help the graded subject do better in selling his services in other contexts:

The incentives created by the scorecard are reinforced by buyers practice of granting status designations, like "partner-level supplier or certified supplier to suppliers who continue to meet or exceed specified performance criteria. Some of these designations come with a valuable benefits, such as better or more extensive information sharing, more frequent contact, dock-to-stock status, and the award of business even when they are not the low bidder so long as they are within a specified range of the low bidder. In addition, some buyer questionnaires for new suppliers ask if the supplier is a "certified supplier to any of its customers, thereby making such certification a valuable business asset.

The concern is with information, not incentive. The supplier who fails

to meet expectations cannot simply offer monetary compensation. “Saying you’re sorry” is not a big enough part of the rating, or at least not a major component, even if it happens to get a subcomponent grade:

Under the scorecard system, the highest rated suppliers are eligible for new business. Those with adequate ratings can keep their existing levels of business, but are expected to improve. And suppliers with lower ratings are warned that their business will decrease if improvements are not quickly made. It is only after a few rounds of low ratings (accompanied, in transactions with the largest buyers, by consulting services designed to improve their operation) that suppliers are terminated.

Even though contracts may specify damages, those too are sometimes used for information, not compensation and incentivization. Damages are a dollar-amount summary of poor performance. Stuart, Deckert, Mcutcheon & Kunst (1998, p. 85) say that a manufacturer of factory automation parts would notify suppliers of the dollar cost of remedying the defect, but would not make the supplier actually pay; the idea was “to use the figures to foster awareness rather than to assess penalties” like a boss who tells a blundering employee how much the mistake cost the company as part of an implicit threat he will be fired if it happens again. Bernstein (2015) also found this: “As one procurement manager explained, her firm tended to impose these fines only when the relationship with the supplier was deteriorating and/or she wanted to get the attention of managers higher up in the organization in the hope that they would correct the underlying problem.”

Finally— and most important for the present papers— Bozovic and Hadfield tell us that though trust is key, that doesn’t mean renegotiation is easy. Parties do not want to reveal adverse information to each other even if they trust each other to keep their promises. The business relationship is more like trying to get asked out on another date than like give-and-take in a marriage, so the parties can and do conceal their weak points as far as they can.

Admitting failure is worse than muddling through and taking a short-term loss.

What is revealing about our interviews is the emphasis respondents placed on the barriers they perceived to ex post negotiation and re-contracting. It was very clear that at the time of initial contracting, the parties who described innovative relationships to us often felt they knew little about what it would be best to do in the future. They anticipated that each of the contracting parties would learn more privately as the future unfolded. But, they reported, sharing information with a contracting partner ex post is potentially very costly; there are lots of reasons, they indicated, for continuing to withhold information even if it would improve ex post decision-making. One source of such costs is somewhat mundane: engaging in ongoing negotiations and recontracting burns time and money and generates delay; with complex interactions and many dimensions of uncertainty, it is simply not worth discussing everything. More fundamentally, however, ongoing uncertainty about the durability of the relationship makes it costly to reveal one's thinking as private information about the costs and bene-

fits of the collaboration accumulates, particularly relative to alternative opportunities such as taking a piece of the currently-contracted work in-house or adding it to the scope of the collaboration with another contractual partner.

This provides some basis for it being worthwhile, as in the present paper, to carefully analyze what happens if the parties to a contract not only do not wish to go to court but also do not wish to renegotiate for mutually beneficial changes in the contract.

Without renegotiation, fixed-quantity contracts are in trouble. Such a contract is informationally demanding and vulnerable to transaction costs. If the buyer wishes to breach because demand is low, the damages he pays

depend on c , the marginal cost of the seller. Realistically, they would also depend on whether the seller could sell at the contract price to some other buyer, though that is not in the model. The seller's choice of k is based on the incentive that if it breaches, it will have to pay damages that depend on v , the marginal benefit of the buyer. Again, realistically, they would also depend on whether the buyer could have obtained the good at some price less than v even if the market were not thick. Not knowing these parameters is something of a problem for designing the contract, since it means that each side is vulnerable to the other side's superior information. The buyer knows less accurately than the seller what damages the buyer would pay in case of breach. The seller knows less accurately than the buyer what damages the seller would pay in case of breach. Trying to learn more or to deduce hidden information from the other side's behavior creates transaction costs. In addition, resorting to court to enforce contracts is costly, and so most cases settle—that is, the parties bargain, so again, bargaining is costly. What a contract does, then, is to create a fixed price, a price which requires no future bargaining, and particular rights to buy and sell quantities, rights which again do not need future bargaining. One's first thought is that it would be wonderful to have a world in which everyone keeps their contracts perfectly. In the present model, however, that outcome will turn out to be worse than in our previous case where transaction costs were low enough to result in efficient breach.

III.2a. The Fixed-Quantity Contract, High Breach Costs. We could have a fixed-quantity contract with 1 unit and price \bar{p} . The seller does not wish to breach, so he will choose $I = \bar{I}$, which is enough to guarantee success in producing the specialized product. Nor will the buyer breach. Thus, the seller's expected profit is

$$\pi_{fq}(I) = (\bar{p}_{fq} - c) - \bar{I} = 0, \quad (23)$$

so

$$\bar{p}_{fq} = c + \bar{I}. \quad (24)$$

Recall that the first-best condition for I is $\theta g'(I) \int_{\bar{p}}^{\bar{v}} (\bar{p} - c) f(v) dv - 1 = 0$. This makes I^* less than \bar{I} , so we now have overinvestment.

There is another source of loss, however. The surplus is

$$\begin{aligned} \text{Total surplus}_{fq} &= \int_0^{\bar{v}} (v - \bar{p}_{fq}) f(v) dv \\ &= \int_{\bar{p}_{fq}}^{\bar{v}} (v - \bar{p}_{fq}) f(v) dv - \int_0^{\bar{p}_{fq}} (\bar{p}_{fq} - v) f(v) dv \end{aligned} \quad (25)$$

The buyer will be buying sometimes when the product is useless. The buyer, as in the case where there are no breach costs, will set \bar{p} so that seller profits are zero.

III.2.b. The Option Contract, High Breach Costs We could have an option contract at price \bar{p}_{oc} . As with the fixed-quantity contract, the seller will choose $I = \bar{I}$ to avoid the possibility of breach. The seller will have expected profit

$$\begin{aligned} \pi_{oc}(I) &= \theta(\bar{p}_{oc} - c) - \bar{I} \\ &= \theta(\bar{p}_{oc} - c) - \bar{I}, \end{aligned} \quad (26)$$

and the buyer will choose \bar{p} to make seller profit equal to zero, yielding

$$p_{oc} = c + \frac{\bar{I}}{\theta} \quad (27)$$

Since $\theta < 1$, it follows that the price is higher under the option contract than under the fixed-quantity contract.

The buyer never has to buy an unwanted specialized product, so that source of welfare loss is absent. He will, however, have to pay indirectly for the excess investment, so this contract will not achieve the decentralized optimum. The surplus is

$$\text{Total surplus}_{oc} = \theta \int_{\bar{p}_{oc}}^{\bar{v}} (v - \bar{p}_{oc}) f(v) dv + (1 - \theta) \int_c^{\bar{v}} (v - c) f(v) dv \quad (28)$$

III.2c. The Requirements Contract with High Breach Costs. We could have a requirements contract at price \bar{p} . As with the other two contracts, the seller will choose $I = \bar{I}$ to avoid the possibility of breach.

The seller will have expected profit

$$\pi_{rc}(I) = (\bar{p}_{rc} - c) - \bar{I} \quad (29)$$

and the buyer will set this equal to zero in the contract, yielding

$$p_{rc} = c + \bar{I} \quad (30)$$

Note that this price is identical to the price in the fixed-quantity contract.

Surplus is

$$\text{Total surplus}_{rc} = \int_{\bar{p}_{rc}}^{\bar{v}} (v - \bar{p}_{rc}) f(v) dv \quad (31)$$

Since the price is the same as in the fixed-quantity contract and the surplus there is expression (31) minus a positive term, the surplus is higher with the requirements contract.

How about the option contract? Jensen's inequality tells us that if a function $h(\cdot)$ is strictly concave then

$$\theta h(x) + (1 - \theta)h(y) < h(\theta x + (1 - \theta)y) \quad (32)$$

Let $h(x) \equiv \int_x^{\bar{v}} (v - x) f(v) dv$. This is concave because $h'(x) = (x - x)f(x) + \int_x^{\bar{v}} f(v) dv$ and $h''(x) = -f(x) < 0$.

Expression (28) is $\theta h(\bar{p}_{oc}) + (1 - \theta)h(c)$ and expression (31) is

$$h(\bar{p}_{oc}) = h(c + \bar{I}) = h\left(\theta\left(c + \frac{\bar{I}}{\theta}\right) + (1 - \theta)c\right) = h(\theta\bar{p}_{oc} + (1 - \theta)c) \quad (33)$$

Thus expression (31), the requirements surplus, is bigger.

Proposition 2: *When breach costs are high, the requirements contract is superior to both the fixed-quantity contract and the option contract.*

IV. What Happened in *Horn*?

We have seen that requirements contracts are useful when the buyer is unsure of his needs, wishes to avoid the possibility of being caught with no supplier or just one, and has a strong desire to avoid having to think about seller costs or buyer benefit again at a later time. The key elements are the buyer's uncertainty of how much he needs, his uncertainty over whether the market can supply his needs, and his demand being at least slightly elastic (which makes variation in quantity important for total surplus).

If sellers know the range of possible demands as well as the buyer does, then the problem is not lack of investment, because a seller will provide for the buyer's need speculatively, but the buyer will pay a high price if no price has been arranged in advance. Nor is the problem just that the buyer is unsure of his needs, because a fixed-quantity contract can pin down a price and efficient breach would allow the quantity to be adjusted up or down. The cost of such breach in terms of managerial attention, however, is high enough that the buyer may prefer to pay extra for the option of deciding later how much to buy. This, in turn, leaves the seller vulnerable to being undercut by other sellers, so it will result in a high price unless they go one step further and make it a requirements contract, so that the seller will always earn the contract profit margin and the quantity he sells will depend only on the buyer's needs, not whether competitors are available.

Let us now return to *Horn v. United States*. It illustrates the peril of one party accepting the other party's standard-form contract. As I explained in my 2001 "Explaining Incomplete Contracts as the Result of Contract-Reading Costs," a party to a contract should be wary of complicated contract language because it is harder to carefully read a complex contract than to write one. Writing a long contract is easy— with cut-and-paste, trivial.

It's only a little harder to write a long contract that benefits your side: take a little care in what you cut and paste, or insert in the middle of it whatever comes into your head that would be to your advantage. Reading the result— as opposed to sequentially staring at the words— is much harder. A complex contract may contain concealed “booby trap” language— or even unconcealed booby traps Horn’s contract contained such a boobytrap. It may even have been unknown to the particular federal officials who awarded her the contract, though the federal government’s centralized contract drafters have long been aware of it. The judge reluctantly but without doubt ruled against Horn, saying,

Although it appears that both parties entered into the contract with the intent to form a requirements contract, that fact cannot overcome the plain language of the contract....

The contract makes clear that the BOP only intended to utilize Ms. Horn for the services it could not fulfill in-house, stating, the Government shall order from the Contractor all of that activitys requirements for... services specified in the schedule that exceed the quantities that the activity may itself furnish within its own capabilities.

The plain language of the contract was clear. It addressed the question of whether the government could satisfy its requirements internally, and said it could. Labelling the contract a “requirements contract” and both parties thinking of it as such could not overrule what was written. The crucial clause was not obscurely concealed, but reading a contract incurs a transactions cost, one lower than renegotiating but costly nonetheless. Horn’s skipping the cost of reading the contract meant she incurred the cost of abiding by it. Indeed, it may have been precisely because of her mistake that she won the contract award; this may be an example of the winner’s curse.

Horn’s fallback argument was that this was an “indefinite quantities contract”, an option contract giving the buyer the option of a range of quantities, so that even if the prison was justified in meeting some of its requirements

internally it still was under an obligation to let her fulfill some too. Again, the plain language of the contract was decisive. The judge said,

In order for an indefinite quantities contract to be enforceable, it must: (1) specify the period of the contract; (2) specify the total minimum and maximum quantity of supplies or services for the Government to purchase; and (3) include a statement of work. See FAR 16.504(a)(4)(i)-(iii); see also *Varilease Tech. Group, Inc.*, 289 F.3d at 799-800. Without an expressly stated minimum quantity purchased by the contract, however, an indefinite quantities contract fails for lack of mutuality and consideration because it does not specifically define the parties obligations under the contract. See, e.g., *Maxima Corp. v. United States*, 847 F.2d 1549, 1557 (Fed. Cir. 1988) (noting a minimum quantity clause serves to ensure mutuality of obligations and to make the contract enforceable by both parties to it).”

The judge was, however, quite critical of the Government, despite ruling in its favor. Apparently, this misleading language has been deceiving unwary government contractors for over seventy years.

It is unfortunate that the Government has continued to use this standard form document that appears to the non-legal reader as a binding contract, but is in fact not. It is clear that this document misled Ms. Horn into believing she had an agreement with the Government when, in reality, the agreement was unenforceable. More to the point, even the Government officials with whom she dealt did not seem to understand the documents lack of enforceability. This point is particularly troublesome to the Court. While there are certainly instances where a contract contains a latent defect rendering it unenforceable, this is not the case here. As early as 1929, the Supreme Court put the Government on notice that this type of contractual language created an unenforceable instrument. See *Willard, Sutherland*

E Co., 262 U.S. at 493. In 1984, the Court in *Ralph Constr. Inc.* similarly declared an indefinite quantities contract unenforceable that contained seemingly identical FAR language. See *Ralph Constr. Inc.*, 4 Cl. Ct. at 731-32. Yet, more than a quarter of a century later, these FAR provisions are still rendering contracts unenforceable and unsuspecting contractors are being denied the opportunity to pursue what may be meritorious claims.

One would think that Horn could also have argued fraudulent inducement—that the government had used false statements to induce her to sign the contract— but since her lawyer did not make that argument, it must be that there is some bar to it. Perhaps the United States has not waived sovereign immunity with respect to that category of claim, or perhaps the officials who handled the procurement process did not make any positive claims about what the contract said about in-house provision of the service.

The Teethcleaner’s Case illustrates transaction costs in a variety of ways. The government wanted to obtain teeth-cleaning services at a low price by awarding a contract in advance of knowing the quantity that would be demanded. It used a simple, one-price contract, with no signing fee for either side, keeping complexity down. And it used a form of requirements contract, to induce the provider to focus her attention on the prison’s needs first. But the bureaucrats in Washington had written a requirements contract with an out, allowing the prison to hire a provider internally. Perhaps this would have been efficient even if it had been clear to both sides, but presumably the price would have been higher. I hope that Horn did not turn down attractive alternative employers in reliance on the contract, but this shows that the longer the contract, the greater the danger to the side that did not write it.

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