

# A Theory of Bargaining Costs and Price Terms in the Absence of Specific Investments

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## Abstract

Firms often bring pre-existing capabilities such as brand and market strength into business ventures. We model price terms in these ventures as a choice between ex ante design costs and ex post opportunism, in the shadow of judicial behavior. On the one hand, to save on design costs, parties can leave price open for future negotiations and face ex post dilution in their pre-existing capabilities, due to wasteful haggling. On the other hand, parties can go through the effort of fixing the contract price ex ante and, that way, prevent opportunistic renegotiations through a credible threat of having the contract reinstated by courts. We show that firms prefer to specify the contract terms ex ante when the value of their pre-existing capabilities is high and the environment is not complex. Our theory adds to Transaction Cost Economics by (1) formalizing the idea that specific contracts can reduce haggling costs and (2) extending Transaction Cost Economics rationale to settings where the assets brought into production are *non-specific*.

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# 1. Introduction

Coase (1937) argues that firms exist because transactions in the market are costly and emphasizes bargaining as a major source of such costs. Since then, much of Transaction Cost Economics (TCE) has presumed the existence of bargaining costs and proposed vertical integration and long-term contracts as alternative organization solutions (Klein et al. 1978; Williamson 1971, 1975). Despite the abundant evidence supporting the TCE predictions on governance choice,<sup>1</sup> the issue of how bargaining costs are generated and how contracts neutralize them are rarely formalized (e.g., Hart 2008, p.406). This paper joins an emerging stream of work that formalizes bargaining costs and how they affect contract forms (Masten 1988, 2009; Bajari and Tadelis 2001; Hart and Moore 2008), thus making progress on this agenda.

Consider a seller and a buyer who bring their pre-existing *generic* assets, such as engineering know-how and brand strength (hereafter, “capabilities”), in a trade (e.g., Madhok and Tallman 1998) and decide on whether to specify the price terms ex ante or leave them open. We model price terms as a choice between ex ante contract-design costs and ex post opportunism. By specifying price and other terms of the transaction ex ante, the parties incur greater contract-design costs, but limit dilutions in their capabilities that may result from ex post renegotiations through a credible threat of having the original contract reinstated by courts.

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<sup>1</sup> See Shelanski and Klein (1995) and Macher and Richman (2008) for surveys of empirical TCE.

Our paper makes three main contributions to the literature on contracting. First, we extend classical TCE, which focuses on asset specificity as the main driver of contract design, to settings where assets brought into production are *non-specific*. Second, we show how the law of contract modification, whereby courts refuse to enforce modifications of price terms when the parties are locked into a bilateral monopoly and there are no substantial changes in the nature of the traded good, turns specific price provisions into a commitment device against post-contractual opportunism.

Last but of potential greatest interests, we envision a novel way to model bargaining costs. Specifically, we model bargaining as a two-stage process. At the first stage, the parties spend resources to build up capacities that can be later used to harm each other (namely “positioning”). For instance, an Original Equipment Manufacturer (OEM) and a component supplier may frequently communicate or even visit each other’s plants to insure that the component fits the OEM’s needs. In the process, they may acquire sensitive information on each other’s production processes and know-how. In addition, both parties may spend time and effort studying loopholes in the contract, which will later enable them to chisel performance without breaching. Once uncertainty is resolved, and given the acquired positioning capacities, a party may threaten to engage in hostile actions that dilute his counterpart’s pre-contractual capabilities unless the latter agrees to more favorable price terms (namely “retaliation”) (e.g., Masten 1988; Lyons et al. 1990, p. 34; Helper and Levine 1992; Ghosh and John 2005, 2009; Myers and Cheung 2008, p. 68; Lo et al. 2011). For instance, the buyer may threaten to badmouth the seller to prospective clients or sue him over trivial non-performance issues based on information he collected during the exploratory stage, while the seller may threaten to exploit loopholes in the contract and

“work by the book”, causing delays in the OEM’s delivery to final customers, diluting the OEM’s reputation. These hostile activities might not be profitable in some states but, given that the costs of gathering the necessary information have been sunk ex ante, they could act as a credible threat to renegotiate on prices. Crucially, there may be some states of the world where the parties have an incentive to harm each other, instead of merely *threatening* to do so. For instance, the supplier may find an opportunity to reveal the OEM’s trade secrets or technological weaknesses to his seller’s competitors in exchange for money, or use the acquired knowledge to set up his own brand and thus compete with the OEM (Arruñada and Vázquez 2006). In some cases, the supplier may simply exploit the good relations established with the OEM’s key employees to escape controls and chisel quality (Anderson and Jap 2005). Insofar as these privately beneficial hostile decisions are non-contractible, neither party can commit to withdraw them in exchange for a better price; therefore, ex post dilutions in the parties’ capabilities will occur in equilibrium.

One way to reduce both the ex ante “rent-seeking” inefficiency – given by positioning effort – and the ex post inefficiency – given by dilution in pre-contractual capabilities – is for the parties to specify their transaction price ex ante. Fixing the price helps because, under the legal doctrines of good faith and economic duress, courts would be reluctant to enforce price modifications that are not accompanied by modifications in the nature of exchange and, therefore, would be ready to reinstate the original contract if such modifications are litigated by one of the parties. Knowing this, the parties can employ specific-price contracts as a commitment device against wasteful positioning and retaliation activities: in the shadow of judicial reinstatement, they would have weaker incentives to position themselves for bargaining ex ante and, having limited retaliation capacity, they

would also have less opportunity to harm each other ex post. The upshot is that specifying the price ex ante forces parties to incur upfront the costs of describing the details of the transaction, even though there may be states where the gains from trade are small relative to such costs, so it would be efficient for the parties not to contract.<sup>2</sup> This tradeoff is central to our theoretical predictions.

Our model differs from, and yet complements recent formal models of ex post inefficiencies in bargaining, such as Bajari and Tadelis (2001), Masten (1988, 2009), and Hart and Moore (2008). While Bajari and Tadelis (2001) model ex post inefficiencies as negotiation breakdowns due to asymmetric information, we show that they may arise even under symmetric information during renegotiation because of hostile, but privately beneficial retaliation activities like those described at the beginning of this paper (see also Goldberg 1985 and Masten 1988). Although we obtain similar comparative statics on the (inverse) relation between fixed-price contracts and complexity, our rationale for fixed-price contracts contrasts that in Bajari and Tadelis (2001). In Bajari and Tadelis (2001), fixed-price contracts *exacerbate* ex post inefficiencies – in the form of negotiation breakdowns – by inducing parties to bargain more aggressively; hence, they should be used in exchanges with few contingencies, which are unlikely to be renegotiated. Conversely, in our model, fixed-price contracts *reduce* ex post inefficiencies – in the form of harmful activities – by preventing opportunistic renegotiations through the threat of judicial reinstatement, at the cost of forcing the parties to describe their transaction from the outset.

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<sup>2</sup> Absent sufficiently comprehensive descriptions of the transaction, courts may not consider price terms alone as valid contracts for lack of consideration and thus the reinstatement doctrine could not be invoked against opportunistic renegotiations. A cursory description of the transaction might also be insufficient, because the defendant in a reinstatement action could argue that the renegotiated contract is in fact governing a new transaction and courts may then reject the plaintiff's claim.

Hence, as in Bajari and Tadelis (2001), fixed-price contracts in our model are used in transactions that are simple to describe and monitor (such as those for commodities, as opposed to innovative and customized products) but, unlike in Bajari and Tadelis (2001), fixed-price contracts are also used in transactions where ex post opportunism is severe.

Like us, Masten (1988, 2009) models bargaining costs as ex post harmful activities under symmetric information. However, it is unclear why informed parties in his models cannot seal their contracts immediately after uncertainty is resolved and thus prevent wasteful ex post rent-seeking behavior (Hart 2008). Our model is robust to this criticism, because the capacity to threaten and harm one's counterpart is acquired, and the related costs sunk at the positioning stage, when uncertainty over the state of the world has not yet been resolved. Therefore, the parties have no incentives, ex post, to "rush" to seal their contract. Rather, each party has an incentive to exploit his positioning capacity to pursue private benefits.

Finally, in Hart and Moore (2008), contracting parties negotiate price terms in a competitive market and use the initial contract as a reference point to determine how much they can expect to gain from renegotiations after they are locked into a bilateral monopoly. A party who does not obtain what she expects from ex post negotiations will feel aggrieved and retaliate against the other by withdrawing non-contractible performance. This generates a tradeoff between rigid contracts, which allow for one or few possible prices for trade and thus minimize grievement and wasteful retaliation at the cost of preventing efficient trade in some states, and flexible contracts, which insure trade in more states at the cost of increasing grievement and retaliation due to more frequent negotiations. We show that, even without relying on the behavioral assumption that contracts are reference points for

future negotiations, our two-stage bargaining approach, in conjunction with the legal reinstatement doctrine, can deliver a tractable model of ex post inefficiencies and explain many business contracts observed in reality.

The rest of this paper is organized as follows. Section 2 presents our theoretical model. Section 3 describes its results. Section 4 discusses empirical and casuistic evidence. Section 5 concludes.

## 2. The Model

A buyer (B) and a seller (S), both risk-neutral, are about to start a joint venture to produce a good. Both B and S bring to the joint venture their pre-existing capabilities. These capabilities, such as superior engineering design or constituent brand strength, are unique to the respective contracting party. However, they are *non-specific*, since they can be used to produce goods outside the focal relationship, and the value of such goods is independent of whether they are produced by B and S together or by each with a third party. We denote the values of B's and S's pre-existing capabilities as  $\omega_B$  and  $\omega_S$  respectively. We assume that the joint venture follows these stages:

1. *Contracting*: B and S decide whether to join their pre-existing capabilities to produce a good.

If they do so, they sign a contract  $(t_c, p_c)$ , where  $t_c \in \{0, 1\}$  denotes the decision on whether to trade the good or not ( $t_c = 1$  means trade), and  $p_c \in \mathbb{R}$  denotes the price to be paid from B to S upon delivery;

2. *Positioning*: B and S simultaneously choose their “positioning” actions  $a_B \in \mathbb{R}^+$  and  $a_S \in \mathbb{R}^+$ , respectively. Party  $i$  incurs an immediate cost  $L_i(a_i)$  by choosing positioning action  $a_i$ , and gains the capacity to “retaliate” against party  $j$  at stage 4;
3. *State realization*: B and S observe the state of the world  $k = (V_k, C_k, \pi_{ik}(a_i), \alpha_{ik}(a_j))$ , drawn with probability  $q_k$  from the finite set  $K$ , where  $V_k$  denotes the value of the jointly-produced good to B,  $C_k$  is the production cost to S, and  $\pi_{ik}(a_i)$  and  $\alpha_{ik}(a_j)$  will be defined momentarily;
4. *Bargaining and Retaliation*: B and S may negotiate via Nash bargaining a new contract  $(t_k, p_k)$ . Moreover, party  $i$  chooses the decision  $h_{ik} \in \{0, 1\}$ , where  $h_{ik} = 1$  denotes that party  $i$  retaliates against party  $j$ . If  $h_{ik} = 1$ , party  $i$  obtains a payoff  $\pi_{ik}(a_i) \geq 0$  and causes a harm  $\alpha_{jk}(a_i)\omega_j$  in the value of party  $j$ 's pre-existing asset, where  $\alpha_{jk}(\cdot) \in [0, 1]$  for any  $j$  and  $k$ ;
5. *Implementation*: If B and S trade at price  $p_k$ , B receives the payoff  $V_k - p_k$  (gross of any contract design costs), and S receives  $p_k - C_k$ . If B and S do not trade, B receives  $b_k$  and S receives  $s_k$ .
6. *Litigation*: If B and S have renegotiated at stage 4 and  $t_k = t_c$  but  $p_k \neq p_c$ , the party who has lost from renegotiation may claim that  $p_k$  has been extracted under duress and ask a judge to reinstate  $p_c$ . The judge observes a vector  $\xi$  of characteristics of B, S, their contract, and the competitive environment in their industries, where  $\xi_i \in \mathbb{R}$  for any

element of  $\xi$ . After observing  $\xi$ , the judge chooses decision  $r \in \{0,1\}$ , where  $r = 1$  denotes that the judge reinstates the stage-1 price  $p_c$ .

At the “Positioning” stage, each party spends efforts to build up his bargaining power by acquiring a capacity that can potentially harm his partner at the later “Bargaining and Retaliation” stage. For example, an OEM can acquire proprietary information on its component supplier’s products, and later use this to negotiate for a better price for himself after the project value is realized. Alternatively, the party may simply collect evidence on his partner’s hidden competitive weaknesses ex ante, which would allow him to sue for damages or obtain favors from the latter’s competitors. Since the cost of ex ante positioning effort is sunk, ex post inefficiencies may arise when the potential benefits of retaliation are so high that the party actually prefers to carry out his threat. An important assumption, implicit in the model’s timing, is that parties cannot retaliate (perhaps out of spite) after the initial contract has been reinstated at stage 6. If that were possible, given that retaliation is costless ex post, the threat of suing redistributive contractual modifications would not be credible, so specifying the price ex ante would not help. We find this assumption reasonable, for two reasons. First, retaliation activities such as “working by the book” simply cannot be carried once the good has been produced. Second, there are retaliation activities whose effect may be severely diminished after a successful reinstatement lawsuit: for instance, it may be hard for an OEM to badmouth his supplier and be believed if the receivers of his messages know that the OEM just lost a lawsuit with the supplier on contractual matters, and even more so if the lawsuit was about reinstatement, which signals strong OEM’s opportunism.

The model rests on the following additional assumptions:

- 1) Trade is contractible at cost  $D$  ;
- 2)  $V_k - C_k \geq b_k + s_k$  for every  $k \in K$  ;
- 3) There is a subset of states  $K_T \subset K$  such that  $V_k - b_k < s_k + C_k + D$  for  $k \notin K_T$  ;
- 4)  $\sum_{k \in K} q_k (V_k - b_k) = E_{k \in K} [V_k - b_k] > E_{k \in K} [s_k + C_k + D] = \sum_{k \in K} q_k [s_k + C_k + D]$  ;
- 5) For any  $i \in \{B, S\}$  , there is a subset of states  $K_H \subset K_T$  such that  $\pi_{ik}(a_i) > 0$  for  $k \in K_H$  and  $a_i > 0$  , while  $\pi_{ik}(a_i) = 0$  for  $k \notin K_H$  ;
- 6) For any  $i, j$  and  $k$ :  $\pi_{ik}$  and  $\alpha_{ik}$  are increasing and concave,  $L_i$  is increasing and convex,  $\pi_{ik}(0) = \pi'_{ik}(0) = \alpha_{ik}(0) = \alpha'_{ik}(0) = 0$  , and  $\lim_{a_i \rightarrow \infty} \alpha_{jk}(a_i) = 1$  ;
- 7)  $\alpha_{jk}(a_i) \omega_j > \pi_{ik}(a_i)$  , for any  $k \in K$  and  $i, j \in \{B, S\}$  ;
- 8)  $a_i, h_{ik}, V_k, C_k, \pi_{ik}(a_i), \alpha_{ik}(a_i)$  and  $\omega_i$  are non-verifiable for any  $i \in \{B, S\}$  ;
- 9) The judge's utility from reinstating the original contract in state  $k$  is  $U_{jk} = \left(r - \frac{1}{2}\right)(2LI_k - 1)$ , where  $LI_k \in \{0, 1\}$  is an indicator for whether the judge deems it a bilateral monopoly in which  $B$  or  $S$  are locked into and therefore exposed to holdup. Specifically,  $LI_k = 1$  when  $V_k - C_k - b_k - s_k \geq LI^*$  , where  $LI^*$  is the judge's tolerance of holdup.
- 10)  $\frac{d \text{Prob}(LI_k = 1 | \xi)}{d\xi} > 0$

In line with the incomplete contracts literature, Assumption 1 implies that writing a contract that describes performance metrics, product specifications, and responsibilities is costly: business partners often spend significant efforts in drafting, communicating, interpreting, and recording their agreements. This is true not only for complex technological products, but also when contracts are in standardized format (e.g., Ben-Shahar and White 2005, in particular p.18). Assumptions 2 and 3 imply that, although trade always produces a net value (assumption 2), there are states where this value is not high enough to make the contract design costs worthwhile (assumption 3). Assumption 4 implies that in expectation trade is efficient. Assumption 5 implies that there are states where a party benefits directly from harming the other ( $\pi_{ik}(a_i) > 0$ ), and states where she benefits indirectly by threatening to harm in order to negotiate on better terms ( $\pi_{ik}(a_i) = 0$  but  $\alpha_{jk}(a_i) > 0$  for  $a_i > 0$ ).<sup>3</sup> For instance, a component supplier may leak his OEM's proprietary information to the latter's competitors to gain favors (e.g., Myers and Cheung 2008, p.69), or threaten to do so in order to extract more surplus from bargaining (e.g. Lyons et al. 1990, p.34). Assumption 6 implies that, when an opportunity to harm arises ex post, it can only be exploited if the parties have spent positioning effort ex ante, and that harm becomes more effective the greater such positioning effort. Assumption 7 implies that harm is ex post inefficient even in states where it produces private benefits. Assumption 8 implies that contracts are incomplete, in the sense that B and S cannot directly or indirectly

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<sup>3</sup> We assume that, once a capacity to harm has been acquired ex ante, inflicting harm is costless ex post. We would obtain similar results if we assumed that the cost of inflicting harm ex post is small relative to its benefit. In states that belong to  $K_H$ , the benefit of harm is given by  $\pi_{ik}(\cdot)$  whereas, in states that do not belong to  $K_H$ , this benefit may be given by the private satisfaction to retaliate against a party who refuses to negotiate.

agree not to engage in wasteful positioning and not to retaliate against each other ex post. Assumption 9 captures an important legal principle on contract modifications: when two parties are locked-in ex post, courts presume that purely redistributive modifications of their original contract have been extorted under economic duress, and are willing to reinstate the original contract on demand (Aivazian et al. 1984; Schwartz 1992; Schwartz and Scott 2003). Two features of the judge's utility function are noteworthy: first, it is symmetric, in the sense that the judge receives the same (dis)utility from making the right (wrong) decision. Second, the judge is only willing to reinstate the original contract if the degree of lock-in between B and S – and the consequent risk of holdup – exceeds a threshold. This threshold may be established by law, or it may reflect the judge's personal concern with redistributive consequences of holdup. Assumption 10 complements Assumption 9, implying that, while the judge does not observe whether B and S are locked-in, he observes *signals* of lock-in – for instance, the importance of *contractible* specific investments, geographic proximity, or simply temporal specificity, defined as the parties' ability to promptly find alternative partners in the spot market (Masten et al. 1991). As we will shortly see, the assumptions on judicial reinstatement are important because they insure that, despite contractual incompleteness, the parties can *indirectly* commit not to engage in wasteful renegotiations ex post by specifying their price terms ex ante.

### **3. The choice of contract form**

This section considers in turn the benefits and costs of writing a specific versus non-specific contract at stage 1.

### *Specific contract*

Consider the case where, at stage 1, B and S agree on a specific contract  $(t_c = 1, p_c)$ , incurring the design cost  $D$ . Without loss of generality, we assume  $D$  is paid by the buyer. To evaluate the joint surplus under this contract, we proceed by backward induction. Given that the design cost has already been sunk and that  $V_k > C_k$  in each state, B and S will always want to trade at stage 4. In addition, if  $a_i > 0$  and  $k \in K_H$ , party  $i$  will harm party  $j$ . If  $a_i > 0$  but  $k \notin K_H$ , party  $i$  may threaten to harm  $j$  in case  $j$  refuses to renegotiate the price to  $p_k \neq p_c$ . Suppose B and S have renegotiated the price at stage 4. Then, the party who loses from renegotiation can take his case to the court at stage 6 and ask the judge to reinstate the initial price  $p_c$ <sup>4</sup>. The judge will choose the reinstatement decision  $r$  to solve

$$\max_r E_k [U_{jk} | \xi] = \left(r - \frac{1}{2}\right) E_k [2LI_k - 1 | \xi] = \left(r - \frac{1}{2}\right) [2\text{Prob}(LI_k = 1 | \xi) - 1]. \quad (1)$$

Hence, the judge will set  $r = 1$  if, and only if  $\text{Prob}(LI_k = 1 | \xi) \geq \frac{1}{2}$ .

Assume, first, that  $\text{Prob}(LI_k = 1 | \xi) \geq \frac{1}{2}$ , so the judge reinstates the initial contract at stage 6. Then, B and S do not even bother to renegotiate the price at stage 4. Anticipating that, B and S will choose the positioning efforts at stage 2 to solve, respectively:

$$\max_{a_B} E_{k \in K_H} [V_k + \pi_{Bk}(a_B) - p_c + (1 - \alpha_{Bk}(a_S)) \omega_B] + E_{k \notin K_H} [V_k - p_c + \omega_B] \text{ and}$$

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<sup>4</sup> We implicitly assume that retaliation opportunities no longer exist after stage 5.

$$\max_{a_S} E_{k \in K_H} [p_c - C_k + \pi_{Sk}(a_S) + (1 - \alpha_{Sk}(a_B))\omega_S] + E_{k \notin K_H} [p_c - C_k + \omega_S].$$

The parties' effort, denoted as  $a_B^{SC}$  and  $a_S^{SC}$  are then given by the first-order conditions

$$\sum_{k \in K_H} q_k \pi'_{Bk}(a_B) = L'_B(a_B) \text{ and} \quad (2)$$

$$\sum_{k \in K_H} q_k \pi'_{Sk}(a_S) = L'_S(a_S). \quad (3)$$

Hence, at stage 1, the expected joint surplus under a specific contract is

$$JS^{SC} = E_{k \in K} \{V_k - C_k - D + \sum_i \omega_i\} - E_{k \in K_H} \left\{ \sum_i [\alpha_{ik}(a_i^{SC})\omega_i - \pi_{ik}(a_i^{SC})] \right\} - \sum_i L_i(a_i^{SC}).$$

Assume, instead, that  $\text{Prob}(LI_k = 1 | \xi) < \frac{1}{2}$ . Then, the judge will not reinstate the

original contract at stage 6, so the analysis of specific contracts coincides with that of non-specific contracts, to which we now turn.

### *Non-specific contract*

Consider the case where B and S wait to contract after state is realized. In this case, if B and S negotiate a contract  $(t_k, p_k)$  at stage 4, no party can seek judicial reinstatement at stage 6 because there is no previous contract to reinstate. When  $k \notin K_T$  that is, when contracting is inefficient, there will be no negotiation, no trade, and no retaliation; B and S's payoff will be  $b_k + \omega_B$  and  $s_k + \omega_S$  respectively. Conversely, when  $k \in K_T$ , negotiation will occur. Assume S has bargaining power  $\gamma$  and B has bargaining power  $(1 - \gamma)$ . Then, the price B and S negotiate,  $p_k$ , depends on whether  $k \in K_H$  or not. Suppose, first, that

$k \in K_H$ . Since party  $i$  obtains a private benefit  $\pi_{ik}(a_i) > 0$  and the decision to harm  $h_{ik}$  is non-contractible, both parties harm each other in equilibrium. B's payoff from bargaining is

$$(1 - \alpha_{Bk}(a_S))\omega_B + \pi_{Bk}(a_B) + V_k - p_k - D$$

and S's payoff is

$$(1 - \alpha_{Sk}(a_B))\omega_S + \pi_{Sk}(a_S) + p_k - C_k.$$

Assuming that B and S agree to the Nash Bargaining Solution, B's payoff must be equal to

$$b_k + (1 - \alpha_{Bk}(a_S))\omega_B + \pi_{Bk}(a_B) + (1 - \gamma)(V_k - C_k - D - b_k - s_k)$$

and S's payoff must be equal to

$$s_k + (1 - \alpha_{Sk}(a_B))\omega_S + \pi_{Sk}(a_S) + \gamma(V_k - C_k - D - b_k - s_k).$$

In words, each party receives his payoff under his outside option plus a share of the net bargaining surplus between trade and no trade. Solving from the above equations, we obtain the price

$$p_k^H = \gamma(V_k - D - b_k) + (1 - \gamma)(C_k + s_k). \quad (4)$$

Suppose, now, that  $k \in K_T$  but  $k \notin K_H$ . In this case, each party retaliates only if the other party refuses to negotiate, so the parties' pre-existing capabilities are not diluted in equilibrium. However, the threat of dilution serves as a bargaining chip. B's payoff from bargaining is

$$\omega_B + V_k - D - p_k,$$

and S's payoff is

$$\omega_S + p_k - C_k.$$

Under Nash Bargaining, B's payoff must also be equal to

$$b_k + (1 - \alpha_{Bk}(a_S))\omega_B + (1 - \gamma) \left[ \sum_{i \neq j} \alpha_{ik}(a_j)\omega_i + V_k - C_k - D - b_k - s_k \right],$$

and S's payoff must be equal to

$$s_k + (1 - \alpha_{Sk}(a_B))\omega_S + \gamma \left[ \sum_{i \neq j} \alpha_{ik}(a_j)\omega_i + V_k - C_k - D - b_k - s_k \right].$$

Solving from the above equations, we obtain the price

$$p_k^{NH}(a_B, a_S) = \gamma \left[ V_k - D - b_k + \alpha_{Bk}(a_S)\omega_B \right] + (1 - \gamma) \left[ C_k + s_k - \alpha_{Sk}(a_B)\omega_S \right]. \quad (5)$$

Anticipating this outcome, B chooses their positioning efforts at stage 2 to solve,

respectively,

$$\max_{a_B} E_{k \in K_H} \left[ V_k - D - p_k^H + \pi_{Bk}(a_B) + (1 - \alpha_{Bk}(a_S))\omega_B \right] + E_{\substack{k \in K_T \\ k \neq K_H}} \left[ V_k - D - p_k^{NH}(a_B, a_S) + \omega_B \right] + E_{k \in K_T} [b_k + \omega_k] - L_B(a_B)$$

and

$$\max_{a_S} E_{k \in K_H} \left[ p_k^H - C_k + \pi_{Sk}(a_S) + (1 - \alpha_{Sk}(a_B))\omega_S \right] + E_{\substack{k \in K_T \\ k \neq K_H}} \left[ p_k^{NH}(a_B, a_S) - C_k + \omega_S \right] + E_{k \in K_T} [s_k + \omega_S] - L_S(a_S).$$

The solutions, denoted as  $a_B^{NSC}$  and  $a_S^{NSC}$ , are given by the first-order conditions

$$\sum_{k \in K_H} q_k \pi'_{Bk}(a_B) + \sum_{\substack{k \in K_H \\ k \in K_T}} q_k (1 - \gamma) \alpha'_{Sk}(a_B)\omega_S = L'_B(a_B), \text{ and} \quad (6)$$

$$\sum_{k \in K_H} q_k \pi'_{Sk}(a_S) + \sum_{\substack{k \in K_H \\ k \in K_T}} q_k \gamma \alpha'_{Bk}(a_S)\omega_B = L'_S(a_S). \quad (7)$$

By comparison of (2) with (6) and of (3) with (7), it immediately follows that

**Proposition 1:**  $a_i^{\text{NSC}} > a_i^{\text{SC}}$  and  $\alpha_{jk}(a_i^{\text{NSC}})\omega_i - \pi_{ik}(a_i^{\text{NSC}}) > \alpha_{jk}(a_i^{\text{SC}})\omega_i - \pi_{ik}(a_i^{\text{SC}})$ , for any  $i$ .

Under both specific and non-specific contracts, ex ante positioning efforts generate returns in terms of the private benefits from opportunistic actions. Under non-specific contracts, positioning efforts have the additional advantage of increasing the parties' ability to retaliate ex post and, therefore, their bargaining power. This return on positioning does not arise under specific contracts, because the threat of judicial reinstatement prevents ex post bargaining. As a result, both positioning efforts and the resulting ex post inefficiencies can be reduced by fixing the price ex ante.

Moreover, the joint surplus under a non-specific contract is

$$JS^{\text{NSC}} = E_{k \in K_T} [V_k - C_k - D] - E_{k \in K_H} \left[ \sum_i (\alpha_{jk}(a_i^{\text{NSC}})\omega_i - \pi_{ik}(a_i^{\text{NSC}})) \right] + \sum_i \omega_i - \sum_i L_i(a_i^{\text{NSC}}).$$

### *Comparative analysis*

At stage 1, B and S compare their expected payoffs under a specific versus a non-specific contract. Because of symmetric information, they will agree on the option that yields the greatest expected joint surplus and on a price that splits the expected surplus according to the parties' bargaining power, defined by  $\gamma$ .

From the previous analysis, it follows that a specific contract is efficient if, and only if

$JS^{\text{SC}} > JS^{\text{NSC}}$ . After simplifying and rearranging, this boils down to

$$\begin{aligned}
& E_{k \in K_H} \left[ \sum_i \left( \left( \alpha_{ik} \left( a_j^{NSC} \right) - \alpha_{ik} \left( a_j^{SC} \right) \right) \omega_i - \left( \pi_{ik} \left( a_i^{NSC} \right) - \pi_{ik} \left( a_i^{SC} \right) \right) \right) \right] + \\
& + \sum_i \left[ L_i \left( a_i^{NSC} \right) - L_i \left( a_i^{SC} \right) \right] > E_{k \in K_T} \left[ D - \left( V_k - C_k \right) \right].
\end{aligned} \tag{8}$$

This can be summarized through the following proposition.

**Proposition 2:** A specific contract is efficient when the total cost of positioning activities (the term  $\sum_i \left[ L_i \left( a_i^{NSC} \right) - L_i \left( a_i^{SC} \right) \right]$ ) is large; when the expected ex post inefficiencies (the term  $E_{k \in K_H} \left[ \sum_i \left( \left( \alpha_{ik} \left( a_j^{NSC} \right) - \alpha_{ik} \left( a_j^{SC} \right) \right) \omega_i - \left( \pi_{ik} \left( a_i^{NSC} \right) - \pi_{ik} \left( a_i^{SC} \right) \right) \right]$ ) are large; and when the expected cost from excessive contract design (the term  $E_{k \in K_T} \left[ D - \left( V_k - C_k \right) \right]$ ) is small.

By inspection of (8), we obtain the following corollary of Proposition 2.

**Corollary:** A specific contract becomes more efficient as i) D decreases; ii) the set  $K_T$  increases; iii) the set  $K_H$  increases; and iv)  $\omega_i$  increases, for any i.

In words, the parties prefer a specific contract when describing the content of trade in advance is relatively simple (part i), there are few states where the cost of describing trade in advance is large relative to the value of trade (part ii), there are several states where parties have an opportunity to profit from retaliation (part iii), and the parties' pre-contractual capabilities are valuable (part iv). In terms of the TCE literature, we may view parts (i) and (ii) as predictions on product complexity, and part (iii) as a prediction on the extent of ex post opportunism. Part (iv) is a novelty from our model, as it states that, even if assets are *non-specific* at the beginning of the contractual relationship, parties will safeguard them through tighter price terms.

### *Asset specificity and lock-in*

While traditional TCE studies long-term contract as means to protect specific assets from holdup, it does not predict a relation between asset specificity and the precision of price terms. Our model does predict a positive relation between specific contracts and factors that lock B and S into a bilateral monopoly situation, such as asset specificity (Williamson 1979), and temporal specificity (Masten et al. 1991)<sup>5</sup>, as follows.

**Proposition 3:** Specific contracts are only observed when  $\xi$  is large. Moreover, an increase in  $\xi$  makes specific contracts more efficient, provided that  $D$  is small, or  $\text{Prob}(k \notin K_T)$  is small, or  $\text{Prob}(k \in K_H) = \sum_{k \in K_H} q_k$  is large, or  $\omega_i$  is large, for any  $i$ .

**Proof:** From (1) and from Proposition 1, we know that, when  $\text{Prob}(LI_k = 1|\xi) < \frac{1}{2}$ ,

$JS^{SC} < JS^{NSC} = JS^{SC} + E_{k \notin K_T} [D - (V_k - C_k)]$ . Hence, specific contracts will only be

observed when  $\text{Prob}(LI_k = 1|\xi) \geq \frac{1}{2}$ . Since  $\text{Prob}(LI_k = 1|\xi)$  increases in  $\xi$ , this is the same

as saying that specific contracts will only be observed when  $\xi$  is large. Assume that  $\xi$  is

large. Then, specific contracts will be observed if, and only if (8) holds – that is, if  $D$  is

small, or  $\text{Prob}(k \notin K_T)$  is small, or  $\text{Prob}(k \in K_H)$  is large, or  $\omega_i$  is large, for any  $i$ . QED.

The intuition behind proposition 3 is simple: specific contracts reduce ex ante wasteful positioning actions and the ex post dilution of general-purpose assets only when they

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<sup>5</sup> This seems an appealing feature of our model. Gibbons (2010) noted that, while most of the empirical TCE focuses on vertical integration and contracts as means to protect specific assets from holdup, theoretical TCE relies on the more general concept of bilateral lock-in, which could arise even in the absence of specific assets.

prevent renegotiation of the initial contract – that is, when they are backed by a credible threat of judicial reinstatement. In turn, courts refuse to enforce renegotiated contracts only when they believe that the parties are locked into a bilateral monopoly and, therefore, renegotiations are a product of holdup. Courts cannot observe the parties' degree of lock-in directly, but they can observe some signals of it, such as the size of the parties' contractible specific investments or the thickness of the market where they conduct their transactions. Hence, specific contracts help only when there are observable signals that the parties are locked-in; that is, when assets used in production are specific or, more generally, when it is difficult for the parties to promptly replace each other.

Note the difference between our argument and standard TCE. There, specific assets and lock-in are part of the problem: the more locked-in the parties are, the more they can threaten each other, and the greater the losses they suffer when the contractual relation fails. Here, lock-in is part of the solution. Parties acquire sensible information ex ante and use it as a bargaining chip ex post but, occasionally, the opportunistic use of such information becomes too tempting and the parties' reputation and brand-strength will get diluted. Dilution affects assets that are readily re-deployable outside the relation, so it does not depend, per se, on the degree of lock-in between the parties. However, when the parties are perceived by courts as being locked-in, they can use fixed-price contracts as credible non-renegotiation commitments and, by eliminating ex post negotiation, they can reduce their own ex ante incentives to engage in positioning activities that can later be used opportunistically.

One last point pertains to testability. At first sight, proposition 3 seems inconsistent with evidence from the TCE literature, which shows that asset specificity increases contract duration (Joskow 1987, Crocker and Masten 1988) and, in turn, contract duration increases uncertainty, calling for more flexible price terms (Crocker and Reynolds 1993).<sup>6</sup> However, the contradiction is only apparent, because proposition 3 holds contract duration as constant.<sup>7</sup> Indeed, by assuming that trade is perfectly contractible ex ante, we implicitly focus on an environment with moderate environmental uncertainty and, therefore, moderate contract duration. It would be interesting to see evidence on the relation between asset specificity, lock-in and the rigidity/flexibility of price terms, controlling for contract duration. We hope to pursue this goal in future work on this topic.

## 4. Evidence

Our model yields two main results. First, there is a tradeoff between fixing the price terms ex ante to prevent ex post *dilution of non-specific capabilities* and leaving the price terms open to save on ex ante contract-design costs. Second, specifying the price terms ex ante is useful when the parties are *perceived* to be locked into a bilateral monopoly, as a consequence of asset specificity *or other factors*. We emphasize that price terms in our model can be interpreted broadly as any contractual terms and conditions that define the division of trade surplus.

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<sup>6</sup> But see Joskow (1988), who finds that long-term coal supply contracts use price escalation formulae that link price adjustments to objective, exogenous market variables such as market prices and costs, rather than to the outcome of negotiations between the parties. This seems to be in the spirit of our model, which could be easily extended to the case where specific contracts set a price formula, rather than a fixed price.

<sup>7</sup> We are grateful to Scott Masten for pointing this out to us.

Our predictions are supported by both empirical studies and anecdotal evidence on vertical relationships such as aircraft engine procurement, construction contracts, and supplier-manufacturer contracts (including car manufacturing and co-branding agreements). We summarize these findings by first looking at the effect of pre-existing, non-specific capabilities on price and other contract terms, and then at the effect of ex post opportunism, and transaction uncertainty and complexity.

### ***Protection of non-specific capabilities***

Lo et al. (2011) find that in branded-component agreements, where a component is incorporated in and *co-branded* with the end-product, the stronger the brand strength of the component-supplier and the market strength of the OEM are, the more rigid the price format the parties use. The authors argue that these rigid price terms prevent rents created by the parties' pre-contractual, non-specific capabilities from being dissipated ex post.

To explain the observation that, while Japanese automobile manufacturers use long-term informal contracts with suppliers, their American counterparts mostly use arm's length formal contracts, Helper and Levin (1992) invoke the presence of large market power of US manufacturers in the 1910-29 period and in the 1950s – a measure of the value of auto-manufacturers' oligopoly rents (p.565-7) as the cause. Specifically, they argue that the non-verifiable nature of an auto-manufacturer's product-market rents would expose him to ex post appropriation by an opportunistic auto-part supplier *after* the two parties are transformed into a bilateral monopoly.

In the industrial-machine manufacturing sector, Ghosh and John (2005) find that, possibly due to opportunistic appropriation, less synergy (in terms of product enhancement) is created between the suppliers' inputs and the OEMs' final product when the OEM enjoys high reputation and premium pricing.

Interestingly, protecting pre-contractual, non-specific assets from ex post appropriation is also observed in marriage agreements. Mastron (1997, pp.891-892) observes that women bringing in high-value tangible assets and the parties who wish to protect their assets for their children from previous marriages are more likely to seek safeguards in the form of prenuptial agreements. Hamilton (1999, p.72) notes similar evidence in 19<sup>th</sup>-century Quebec where one in every six couples used prenuptial agreements. Using archival data, she finds that these "non-conventional" marriage agreements were more frequently used by men who had attractive outside options, e.g., the literate class and well-to-do merchants (p.89), and who married widows with children from their previous marriages.

### ***Ex post opportunism***

Our model predicts that the greater the risk of ex post opportunism through positioning and retaliation (formally, the greater the set  $K_H$ ), the more we should observe contracts that specify the price in advance. Consistent with this prediction, Crocker and Reynolds (1993) find that the price terms in air-force procurement contracts are more rigid when the engine manufacturer has a past record of judicial disputes and, therefore, is likely to be opportunistic. In contracts between information-technology suppliers and auto manufacturers, Ben-Shahar and White (2005, p.13 and p.35-6) find that the former

successfully negotiate more customized terms, including protective price terms, in order to safeguard their easy-to-abuse intellectual property.

In addition, the legal literature on relational contracts offers descriptions of opportunistic conducts such as threats of non-performance, lawsuits following minor faults, working to rules, and post-agreement jockeying that plague real-world contractual relations (see Goldberg 1985 and Masten 1988 for reviews). These activities are consistent with our rationale that parties would strategize in the course of the relationship to increase their ex post bargaining power, and that opportunistic actions sometimes occur in equilibrium as a result of such activities. Under these circumstances, contract terms will be more judiciously crafted ex ante in order to decrease the parties' incentives for strategizing.

### ***Product complexity***

Our prediction on the negative effect of complexity on the completeness of price and other contract terms has long been noted in the empirical literature on contracting. In the industrial-machinery sector, Ghosh and John (2005) find that the more difficult for the OEM to specify technical requirements ex ante, the more flexible the price terms and technical-specifications included in their contracts. Recently, Lo et al. (2011) find that, in branded-component contracts, the contracting parties opt for more open price terms and use ex post negotiation rather than fixing price ex ante when the component's technology is more unpredictable.

In sum, evidence in various types of vertical relationships supports the core predictions derived from our model.

## 5. Conclusion

In this paper, we develop a model investigating the choice of price terms in joint business ventures where the contracting parties bring in pre-existing, non-specific capabilities, and transactions might be uncertain and complex. To generate results on ex post inefficiency, we model a two-stage bargaining process in which the parties' efforts to build bargaining capacity before the realization of uncertainty can be used to harm their counterparts' valuable capabilities afterwards. We find that once the bargaining capacity is built, outright opportunism such as retaliation, rather than the mere threat of it, may become an equilibrium outcome.

Our main result is that a specific contract prevents wasteful activities (ex ante positioning and ex post retaliation) but may cause the parties to overspend in contract design. Specific contracts prevent opportunism because, under the grounds that the renegotiation was extorted under economic duress, the aggrieved party can ask a court to reinstate the original price terms when his counterpart attempts to force a redistributive renegotiation. The prospect of reinstatement discourages the ex ante building of bargaining capacity and thus the ex post retaliation actions enabled by such capacity. An important implication of our model is that when the parties bring valuable pre-existing capabilities to the relationship that are vulnerable to post-contractual expropriation, safeguard can be achieved through a specific contract. Our model therefore extends the TCE rationale for long-term price agreements to settings where the assets brought into production are non-specific.

While we focus on the tradeoff between specific and non-specific contracts, our model of bargaining costs may also be extended to derive a theory of firm boundary in the shadow of the law. Consistent with American legal practice, we assume that, in the presence of *redistributive* contract modifications, courts will reinstate the original contract. Matters become more complicated, however, when the transaction involves high uncertainty like rapidly evolving technologies, since the courts would then be unable to distinguish redistributive renegotiations from efficiency-enhancing ones. One way to insure reinstatement, and hence to fully discourage ex ante and ex post opportunism, is to bring the transaction within a unified firm, where disputes over transfer prices in redistributive renegotiations are resolved by hierarchies, not the court<sup>8</sup>.

Finally, while our contracting model is spot, long-term business partners may use relational contracts to prevent ex ante positioning and ex post opportunism. It would be interesting to see how contract design and the parties' behavior change once we allow for relational contracts sustained by repeated interactions. We leave the exploration of these topics for future research.

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<sup>8</sup> See Williamson (1991), Hansmann (2010), and Kornhauser and MacLeod (2010).

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