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Renegotiation Facilitates Contractual Incompleteness

by

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Abstract

Attempts to economize on bargaining costs imply that two parties may write a contract which is incomplete in the sense that each party tacitly cedes some decision rights to the other. If decision-makers can be disciplined by the threat of ex post renegotiation of decisions initially delegated to them, contracts may be even more incomplete. In the limit, the parties may leave all non-price decisions out of the contract. By thus arguing that the threat of renegotiation facilitates contractual incompleteness, the paper reverses the direction of causality stressed by the literature.

I. INTRODUCTION

It is widely agreed that bilateral contracts tend to be grossly incomplete. The issue is not so much that the parties agree to terms later, but that many terms never are agreed upon. In particular, a lot of decisions made during the life of a contract are absent from it and instead tacitly delegated to one of the parties. We propose to explain this based on the desire to economize on bargaining costs. By ceding the right to have influence on items about which they care little, players save bargaining costs for themselves and their opponent. We show that the threat of renegotiation (ex post bargaining about a decision at first tacitly delegated to one of the parties) can facilitate incompleteness by restraining the selfishness of decision-makers. In the limit, we get a very strong result: If there is no private information and renegotiation costs are the same as bargaining costs, the players may leave all non-price clauses out of the contract. In contrast to the direction of causality emphasized by the literature, this result then implies that a stronger threat of renegotiation can support less complete contracts.

To sketch the argument we first need to explain what we mean by a contract being more or less complete. We think of two parties and a set of decisions in which both are interested. If all decisions are made jointly, we will say that the set is covered by a complete contract. The contract is incomplete to the extent that some of the decisions are made unilaterally by either party. Consider therefore a specific decision and ask if it should be made jointly or unilaterally by one of the parties. The parties have different preferences in the sense that each wants the decision to be close to his or her objective, and each assigns a different importance to this. In addition, the two parties may have different information about the mapping between alternatives and objectives. In this setting, the direct effect of bargaining costs is simple: Joint decision making allows the preferences and the information of both parties to be taken into account, but unilateral decision making saves both of them the costs of bargaining. If the objectives are not too dissimilar, but one party cares more and has better information, it may be more efficient to let him or her make the decision unilaterally.[1]

Suppose next that a unilaterally made decision can be renegotiated before being irreversibly implemented. We assume that renegotiation is similar to ex ante negotiation in the sense that it pulls the initially uninvolved party into the decision making process and changes the decision to whatever alternative would have chosen if both parties had participated in the first place. So the temptation to ask for renegotiation depends on the relative magnitudes of the player's bargaining cost and the increased preference for the new decision. The original decision-maker can therefore prevent renegotiation by shading the decision just enough to persuade the other party to leave it alone. So the threat of renegotiation disciplines the party making a unilateral decision and thus reduces the cost of contractual incompleteness. In the extreme case where the (ex post) renegotiation cost is identical to the (ex ante) bargaining cost, the uninvolved party gets the same payoff as if he or she had participated in the decision. The party making a unilateral decision does better - partly because of the saved bargaining costs, but also because the decision is shaded in the direction he or she prefers. As long as bargaining costs are worth saving, the parties can avoid all joint decisions – write very incomplete contracts - by relying on the threat of renegotiation. Of course, in less extreme cases where renegotiation is more expensive than participation in (ex ante) bargaining, the leverage is smaller.

Specific investments and hold-up threats are tangential to the argument made here, but since they have played a large role in the literature on contractual incompleteness, we consider them in an extension of the main model. Under appropriate parameter conditions a variation of the original result holds: Decision makers counter hold-up threats by shading decisions in the direction preferred by their opponents, but the existence of renegotiation costs limits the amount of shading required. Because the parties share the costs savings resulting from tacit delegation, the shading may be worthwhile, and incompleteness will be efficient as long as investment distortions are not too large.

Bargaining costs, the existence of which is a critical premise for our argument, fall in an amorphous category of delays, disutilities, and inefficient outcomes affecting even simple conflict resolution mechanisms[2]. Most economists will agree that bargaining is costly, but these costs have not played a large role in formal models, with the possible exception of certain attempts to explain the existence of firms (Bajari and Tadelis, 2001; Bolton and Rajan, 2001; Hart and Moore, 2006; Tadelis, 2002; Wernerfelt, 1997). While we admit that many specific bargains appear cheap to strike, most activities governed by contracts involve a very large number of details. As long as it involves a non-infinitesimal amount of cost to agree on each, a great number of very small effects can add up to a substantial economic force. Arguments of this type are routinely used in other fields: airplanes glide on a large number of atmospheric molecules, and people die from infections caused by lots of individually very small viruses. The literature on learning-curves may be the best example in economics. It is difficult to think of a single “large” example of firm-specific learning, but we know that aggregate learning effects are very important, often accounting for a 25 percent drop in unit-costs for every doubling of cumulative firm output (Lieberman, 1984).

Examples

To illustrate the multitude of decisions involved in actual contracts, we briefly look at a few examples.

(a) Many readers of this paper will work for institutions (universities) that sell educational services. The typical contract explicitly gives the buyer the right to attend classes and use libraries, as well as other facilities, for an academic year. It is understood that the buyer can select the classes and decide on the time and way in which facilities are used. In turn, the university can decide which courses are offered, when and where they are offered, and who teaches them. It also decides on the contents of the libraries, the temperature of the pool, etc., etc.

(b) Think next about a custom-built house. The contract typically includes a large set of architectural drawings specifying particular production methods and materials. However, a tremendous number of decisions are still left out. The customer can make decisions on colors, fixtures, and a number of other decorative items. Conversely, the builder can decide on the brands or suppliers of several materials, as well as the exact location of many nails, joints, and boards.[3]

(c) While the two above examples represent very complicated services and products, there is also substantial incompleteness in contracts for much simpler services. Consider for example a case in which you go into a restaurant and order a dish off the menu. The contract gives you the right to receive one serving of the dish and eat it at your table. It is tacitly understood that you can decide how fast you eat, how loud you talk, and how big a mess you leave behind, while the restaurant can decide on how and from which ingredients the dish is prepared, how soon it is served, when you get your drinks, which napkins you are given, who sits at the other tables, and so on.

(d) Another simple example is a haircut. Both the customer and the beautician explicitly agree to the posted price, but the former gets to specify “how she wants it to look”, and the latter gets to decide on the instruments and how they are used.

While it is absurd to suggest that the above agreements should be governed by complete contracts, this would be the logical implication of truly costless contracting. [4]

We do not mean to claim that all trades are governed by incomplete contracts. If you go into a shoe store and buy a pair of sneakers off the rack, there is no incompleteness in the sense we are interested in here. There is an exchange of money for a specific pair of shoes, no more and no less. It is the passage of time between the agreement and the completion of the service/product that opens the door for interim decisions and creates demand for a contract. We will here focus on contracts in which a transfer of money can compensate for decision rights. However, we believe that the analysis applies to a wider set of contracts, such as for example marriage.

Literature

It is widely asserted that most contracts are incomplete, a large literature is built on an exogenous “incomplete contracting” assumption (Grossman and Hart, 1986). The typical paper in this literature observes that renegotiation is possible because contracts are incomplete and that this may cause ex ante inefficiencies. In marked contrast, the possibility of renegotiation allows incompleteness and enhances efficiency in the present paper.[5]

The literature explaining incompleteness can be classified into two gross categories, one focussing on strategic reasons for incompleteness, and the other on the effects of complexity. In the strategic category, it has been argued that incompleteness allows implicit contracting (Baker, Gibbons, and Murphy, 1994; MacLeod and Malcomson, 1989), signaling (Spier, 1992), information exchange (Wernerfelt, 2006), and flexibility (Hart and Moore, 2004; 2006). The point most closely related to ours is made by Bernheim and Whinston (1998) in the context of a situation in which one player has to make a non-contractible decision. Their argument is that this player's opportunism can be restrained by a threat of out-of-equilibrium punishments if some decisions of the opponent are left out of the contract. Our model does not depend on any decisions being non-contractible, and the discipline comes from renegotiation of the original decision, rather than punishment through another, possibly unrelated, decision. Finally, and in a slightly different context, Aghion and Tirole (1997) have identified a different effect of tentative delegation. If players invest in decision-relevant information, they show that the threat of intervention gives an agent weaker investment incentives. A central difference between their model and ours is we allow the agent to avoid intervention by making a less selfish decision. An advantage of tentative delegation is therefore that the threat of intervention disciplines the decision-maker. On the other hand, we do not consider the incentives to collect information. While both effects seem reasonable, it might be possible to evaluate their relative importance in an empirical setting.

The complexity category contains fewer papers (Arrow, 1974, p.35; Crocker and Reynolds, 1993; Dye, 1985; Schwartz and Watson, 2004; Segal, 1999) and very little agreement on how best to model the issues. Nevertheless; two common assumptions are that it is costly to write more detailed contracts and that the number of contingencies is very large. We also rely on these.

The argument presented here straddles the two categories in the sense that we derive a strategic force based on a premise that by itself could be put in the complexity category. Our model differs from the literature on strategic effects by postulating that unilateral decision making, rather than ex post bargaining, is the alternative to contracting. It differs from the literature in the complexity category by looking at contracting costs as the difference between one and two-person decision-making. We are not focussing on the fact that it takes time to write an agreement between two players, but on the fact that both of them need to get involved in a decision before it can be included in the contract.

From a formal perspective, parts of the paper parallel Shavell’s (2006) analysis of the judicial appeals process. He asks whether the legislature should give sentencing discretion to better informed judges or impose mandatory sentencing rules. Shavell’s argument is that the possibility of appeal will reign in biased judges and thus make it less costly to use their information. While the threat of appeal also limits selfishness in the present paper, the implications are quite different because delegation here leads to a loss of information, while enabling the parties to save on bargaining costs.

In Section II, we present a simple model of a supplier-buyer relationship, looking first at a case in which decisions cannot be renegotiated, then at one in which renegotiation is allowed, and finally at the possibility of hold-up. In the concluding Section III we discuss the extent to which the model can throw light on the theory of the firm and the function of management.

II. MODEL

We look at a situation in which a seller and a buyer trade a product characterized by D dimensions $(a_1, a_2, ...a_D)$. In principle, D could be 1, but we will carry the larger notation through the paper to emphasize the point that the decisions, although individually "small", are very numerous and thus of aggregate importance. The players disagree on the optimal product design and we use superscripts indicate specific choices made such that the buyer's ideal is $(a_1^b, a_2^b, ...a_D^b)$, while that of the seller is $(a_1^s, a_2^s, ...a_D^s)$. The product is traded at the price p, and the buyer values her ideal design at v, while it costs the seller c to produce his ideal design.

We use J to indicate the set of decisions made jointly by the buyer and the seller, while B and S are the sets of decisions made unilaterally by the former and the latter, respectively. It costs a player k to take part in (ex ante) negotiation over a decision, and we assume that players experience quadratic losses if decisions differ from those they ideally want. For an attribute d, the buyer's ideal is $a_d^b = x_d - \theta_{db}$, where θ_b is her individual bias and x_d is a common random shock. Similarly, the seller's ideal is $a_d^s = x_d + \theta_{ds}$, where θ_s is his individual bias and x_d is the common shock. To fix ideas, we will think of the biases θ_{db} and θ_{ds} as positive, such that the buyer wants smaller a^0's, while the seller wants larger a^0's. Since there is no disagreements about biases going in the same direction, we normalize the sum of the biases to zero such that $\theta_{db} = \theta_{ds} = \theta_d$. Squared deviations from ideal decisions are multiplied by importance weights, β_{db} for the buyer and β_{ds} for the seller. For economy of presentation, we use L_b denote the buyer's combined losses from non-ideal decisions and negotiation costs, while L_s is the same quantity for the seller. With this notation, the buyer values a trade for $(a_1^0, a_2^0, \ldots a_D^0)$ at

$$v - p - L_b \equiv v - p - \Sigma_D \beta_{db}(a_d^0 - x_d + \theta_{db})^2 - |J|k, \tag{1}$$

while the seller values it at

$$p - c - L_s \equiv p - c - \Sigma_D \beta_{ds}(a_d^0 - x_d - \theta_{ds})^2 - |J|k. \tag{2}$$

The random variables x_d, $d \in \{1, 2 \ldots D\}$, are drawn iid from a normal distribution with mean 0 and precision h_x, and represent the resolution of ex ante uncertainty about the first best trade. To describe a player's information about x_d, we imagine that both players have received two signals about it. The public signal, which is known by both, is denoted z_d and is distributed according to a normal distribution with mean x_d and precision h_z. The seller's private signal is denoted by y_{ds} and is distributed according to a normal distribution with mean x_d and precision h_{ds}, while the buyer's private signal is denoted by y_{db} and is distributed according to a normal distribution with mean x_d and precision h_{db}.[6] So the players may have informational advantages on different problems and everything except the private signals is common knowledge.

If two players are involved in a single bargain with two-sided asymmetric information, one would expect some informational distortions, including the possibility of no-trade (Myerson and Satterthwaite, 1983). To focus on the novel aspects of the paper, we will assume that these costs are summarized in the bargaining costs k and abstract from informational distortions. Specifically, we will assume that the bargaining process perfectly reveals the private information of both players. The extent to which this assumption is violated will favor delegation even more, so it is in some sense conservative. If the buyer and the seller bargain over the decision d, it implies that they will use the vector of signals known to them, (z_d, y_{ds}, y_{db}), to construct a posterior distribution of x_d. This distribution is normal with mean

$$\mu_d(z_d, y_{ds}, y_{db}) \equiv (h_z z_d + h_{ds} y_{ds} + h_{db} y_{db})/(h_x + h_z + h_{ds} + h_{db}), \tag{3}$$

and precision

$$h_d(sb) \equiv h_x + h_z + h_{ds} + h_{db}. \tag{4}$$

If only the seller is involved in the decision, his posterior will also be normal, but with mean

$$\mu_d(z_d, y_{ds}) \equiv (h_z z_d + h_{ds} y_{ds})/(h_x + h_z + h_{ds}) \tag{5}$$

and precision

$$h_d(s) \equiv h_x + h_z + h_{ds}. \tag{6}$$

If only the buyer is involved, we get the corresponding results and can define $h_d(b)$ like $h_d(s)$ with h_{db} substituted for h_{ds}.

In the most general model, the sequence of events is as follows: The players (i) allocate decision rights over attributes into three groups: those to be decided jointly for inclusion in a contract and those tacitly delegated to each party, (ii) negotiate joint decisions, (iii) negotiate the price, (iv) make unilateral decisions, (v) may renegotiate unilateral decisions, and (vi) produce and trade. For a given *D*, we will take the number of items negotiated in (ii) as our measure of the completeness of the contract, or equivalently take the number of decisions left for (iv) as our measure of incompleteness. To make the intuition as clear as possible, we will first analyze the model without renegotiation, in effect dropping stage (v), and then proceed to look at the full sequence with varying levels of renegotiation costs.

Renegotiation is impossible

There are at least two ways of thinking about this case. It could be that unilateral decision rights are contractually guaranteed, or it could be that unilateral decisions are irreversible once made (implemented before being observed).

In stage (iv), the players make unilateral decisions on the attributes left to their discretion. Given that the decisions can not be renegotiated, they will be made in a straightforward way. Starting with the seller, he will set a dimension unilaterally chosen by him at $a_d^{su} = \mu_d(z_d, y_{ds}) + \theta_d$, implying that it contributes $L^S_{ds} = \beta_{ds}/h_d(s)$ to his expected loss, and $L^S_{db} = \beta_{db}[1/h_d(s) + 4\theta_d^2]$ to the buyer's expected loss. If the buyer makes a unilateral decision, she will set $a_d^{bu} = \mu_d(z_d, y_{db}) - \theta_d$, contributing $L^B_{db} = \beta_{db}/h_d(b)$ to her own expected loss, and $L^B_{ds} = \beta_{ds}[1/h_d(b) + 4\theta_d^2]$ to s's expected loss.

The price p is negotiated in stage (iii), after joint decisions are made, and in anticipation of the unilateral decisions in stage (iv). Assuming that the bargaining outcome is that which equalizes the expected payoffs, p will be given by

$$2p = v + c + \Sigma_J L^J_{ds} + \Sigma_B \beta_{ds}[1/h_d(b) + 4\theta_d^2] + \Sigma_S \beta_{ns}/h_d(s)$$

$$- \Sigma_J L^J_{db} - \Sigma_B \beta_{db}/h_d(b) - \Sigma_S \beta_{db}[1/h_d(s) + 4\theta_d^2], \tag{7}$$

where L^J_{ds} and L^J_{db} are the seller's and the buyer's losses from the jointly made decision d.

In stage (ii) where the joint decisions are made, we assume that the agreed upon (negotiated) attribute level maximizes joint payoff and thus is

$$a_d^* = \mu_d(z_d, y_s, y_b) + \theta_d(\beta_{ds} - \beta_{db})/(\beta_{ds} + \beta_{db}). \tag{8}$$

This is consistent with our assumption that the bargaining process reveals all private information and implies that the seller's expected loss from this decision is

$$L^J_{ds,} \equiv k + \beta_{ds}[1/h_d(sb) + 4\beta_{db}^{\ 2}\theta_d^{\ 2}/(\beta_{ds} + \beta_{db})^2], \tag{9}$$

while the buyer's expected loss is

$$L^J_{db} \equiv k + \beta_{db}[1/h_d(sb) + 4\beta_{ds}^{\ 2}\theta_d^{\ 2}/(\beta_{ds} + \beta_{db})^2]. \tag{10}$$

Looking now at stage (i) where the decision-rights are allocated, the players need to take into account the fact that the price changes when decision rights change. Keeping all other decision rights constant, let us ask if the buyer should allow the seller to make the decision *e*. After plugging *(9)* and *(10)* into *(7),* we can find the change in price if the buyer cedes the decision *e* to the seller as

$$\{v + c + \Sigma_{J/e}L^J_{ds} + \Sigma_B L^B_{ds} + \Sigma_S L^S_{ds} + L^S_{es} - L^S_{eb} - \Sigma_{J/e}L^J_{db} - \Sigma_B L^B_{db} - \Sigma_S L^S_{db}\}/2$$

$$-\{v + c + \Sigma_{J/e}L^J_{ds} + \Sigma_B L^B_{ds} + \Sigma_S L^S_{ds} + L^J_{es} - L^J_{eb} - \Sigma_{J/e}L^J_{db} - - \Sigma_B L^B_{db} - \Sigma_S L^S_{db}\}/2$$

$$= [L^J_{eb} - L^S_{eb} - L^J_{es} + L^S_{es}]/2 =$$

$$[(\beta_{es} - \beta_{eb})h_{eb} /\{h_e(s)h_e(sb)\} - 4\theta_e^{\ 2}\beta_{eb}^{\ 2}(\beta_{eb} + 3\beta_{es})/(\beta_{es} + \beta_{eb})^2]/2 \equiv \Delta p_e(js). \tag{11}$$

The first term compensates the player who cares the most for the loss of the buyer's information, and the second compensates the buyer for the fact that the seller will make a self-interested decision.

With this notation, the buyer will allow the seller to make a decision *e* if

$$\beta_{eb}[1/h_e(s) + 4\theta_e^{\ 2}] + \Delta p_e(js) \leq k + \beta_{eb}[1/h_e(sb) + 4\beta_{es}^{\ 2}\theta_e^{\ 2}/(\beta_{es} + \beta_{eb})^2]. \tag{12}$$

Using *(11), (12)* reduces to

$$4\theta_e^{\ 2}\beta_{eb}^{\ 2}/(\beta_{es} + \beta_{eb}) \leq 2k - (\beta_{eb} + \beta_{es})h_{eb}/\{h_e(s)h_e(sb)\}\ . \tag{13}$$

The left side of *(13)* measures the net cost of the seller's selfish decision-making, while the right side reflects the cost saved by the buyer not being involved in the decision (*w*) less the joint value of the loss of the buyer's information (h_{eb}). Since the players share the gains from incompleteness, the condition under which the seller will agree to make the decision without the buyer reduce to *(13)* as well, and the conditions under which the players agree to have the buyer make a unilateral decision are symmetric. To see that *(13)* is non-trivial, note that it reduces to $\theta^2 + 1/12 \leq k$ if $\beta_{eb} = \beta_{es} = h_{eb} = h_{es} = h_x = h_z = 1$.

While *(13)* appears complicated, its interpretation is intuitive.

Proposition 1: *When renegotiation is impossible, players are more likely to cede decision-rights to an attribute if it is relatively less important to them (β_{eb}), if they have less information about it (h_{eb}), if there is less difference of opinion about it (θ_e), and if negotiation is more costly (k). Similarly, players are more likely to get unilateral decision rights to an attribute if they have better information about it (h_{es}). (The effect of β_{es} is ambiguous and depends on the relative importance of information and bias.)*

If the players somehow can agree to not make selfish decisions, the term $4\theta_e^2\beta_{eb}^2/(\beta_{es} + \beta_{eb})$ will drop out of *(13)* and the outcome is first best. We will now allow renegotiation and see how it can help the players go part of the way by limiting the extent of selfishness in equilibrium.

<u>Renegotiation is possible</u>

We assume that it costs the players $k + r$ each to renegotiate a decision d, and since renegotiation should not cost less than ex ante negotiation, we assume that $r \geq 0$. This assumption is consistent with the allocation of decision rights in stage (i) being tacit. For any decision not included in the contract, the players have a tacit agreement about who will make it, but nothing is written about this and since both have formal rights to be involved, renegotiation is possible.[7]

When renegotiation is impossible, we saw that the cost of incompleteness is that the preferences and the private information of the uninvolved player are ignored. We now show that renegotiation can reduce the former cost by forcing unilateral decisions to be made in light of the preferences of the uninvolved player.

To make the argument sharply, we first focus on the case in which neither player has any private information, implying that $h_{ds} = h_{db} = 0$, $h_d(sb) = h_d(b) = h_d(s) = h_x + h_z$, and $\mu_d(z_d, y_{ds}, y_{db}) = \mu_d(z_d, y_{db}) = \mu_d(z_d, y_{ds}) = \mu_d(z_d)$. So informational concerns do not play a role and the allocation of unilateral decision rights depends on preferences only. With no loss of generality, we again look at an example in which $\beta_{ds} > \beta_{db}$, and ask if the buyer will give the seller the right to decide on a_d.

We assume that the renegotiation process results in a decision identical to what the players would have agreed upon if the decision had been included in the original contract. That is, if decision *d* is renegotiated, the players agree on

$$a_d^* = \mu_d(z_d) + \theta_d(\beta_{ds} - \beta_{db})/(\beta_{ds} + \beta_{db}). \tag{14}$$

Since price always is part of the formal contract, we do not consider the possibility of renegotiating that.

Starting at stage (v), suppose that the seller has made the unilateral decision which deviates from the posterior mean by ϕ_d^s.

$$a_d^{su} \equiv \mu_d(z_d) + \phi_d^s. \tag{15}$$

This decision gives him an expected loss of

$$L^J_{ds} = \beta_{ds}[1/(h_x + h_z,) + (\phi_d^s - \theta_d)^2], \tag{16}$$

while the buyer's expected loss from this decision is

$$L^J{}_{db} = \beta_{nb}[1/(h_x + h_{z,}) + (\phi_d^s + \theta_d)^2]. \tag{17}$$

By spending $k + r,$ the buyer can renegotiate the decision to a_d*. This would give her an expected loss of

$$L^J{}_{db} = k + r + \beta_{db}[1/(h_x + h_{z,}) + 4\beta_{ds}^2\theta_d^2/(\beta_{ds} + \beta_{db})^2], \tag{18}$$

and she will therefore renegotiate iff

$$\beta_{db}(\phi_d^s + \theta_d)^2 > \ k + r + \beta_{db}4\beta_{ds}^2\theta_d^2/(\beta_{ds} + \beta_{db})^2. \tag{19}$$

More to the point, she will not renegotiate if ϕ_d^s is below the critical value ϕ_d^s given by

$$\phi_d^{sr} \equiv [(k + r)/\beta_{db} + 4\beta_{ds}^2\theta_d^2/(\beta_{ds} + \beta_{db})^2]^{1/2} - \theta_d. \tag{20}$$

(Since we have assumed that $\beta_{ds} > \beta_{db}$, this is positive.)

To avoid renegotiation, the seller may therefore exercise restraint in stage (iv) and set ϕ_d^s = Min $\{\phi_d^{sr}, \theta_d\}$, where the first argument is chosen if and only if

$$k + r \leq 4\beta_{db}^2\theta_d^2(2\beta_{ds} + \beta_{db})/(\beta_{ds} + \beta_{db})^2. \tag{21}$$

When the players allocate decision rights in stage (i) they take into account the fact that the price reflects the decision rights. If *(21)* holds, we can use *(19)* and *(20)* to find the change in price if the buyer cedes the decision *d* to the seller as

$\Delta p_d(js)$ =

$$[(k+r)(\beta_{ds}-\beta_{db})/\beta_{db} + 8\theta_d^2\beta_{ds}^2/(\beta_{ds}+\beta_{db}) - 4\theta_d\beta_{ds}\{(k+r)/\beta_{db} + 4\beta_{ds}^2\theta_d^2/(\beta_{ds}+\beta_{db})^2\}^{1/2}]/2. \tag{24}$$

This implies that the buyer will agree to cede *d* if

$$k + r + \beta_{db}4\beta_{ds}^2\theta_d^2/(\beta_{ds} + \beta_{db})^2 + \Delta p_d(js) \leq k + \beta_{db}4\beta_{ds}^2\theta_d^2/(\beta_{ds} + \beta_{db})^2, \tag{22}$$

which immediately reduces to $\Delta p_d(js) \leq - r$, or

$$k(\beta_{ds} - \beta_{db})/\beta_{db} + r(\beta_{ds} + \beta_{db})/\beta_{db} + 8\beta_{ds}^2\theta_d^2/(\beta_{ds} + \beta_{db})$$
$$\leq 4\theta_d\beta_{ds}\{(n + r)/\beta_{db} + 4\beta_{ds}^2\theta_d^2/(\beta_{ds} + \beta_{db})^2\}^{1/2}. \tag{23}$$

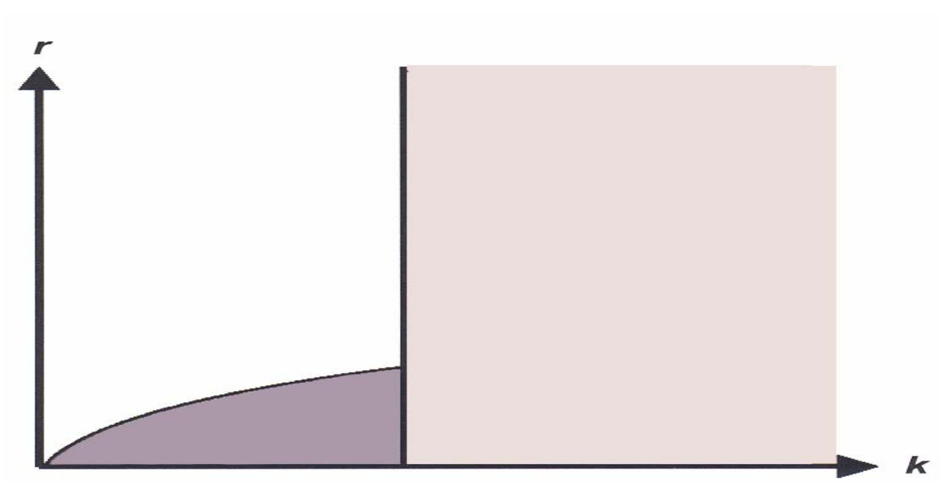
Since the parties share the gains from the arrangement, *(23)* also guarantees that the seller will want to make the decision. So the restraint induced by the threat of renegotiation implies that the buyer will cede the decision to the seller if *(21)* and *(23)* both hold. In addition, we know from *(13)* in the previous Section that the buyer will cede if

$$k \geq 2\theta_d^2 \beta_{db}^2/(\beta_{ds} + \beta_{db}). \qquad (24)$$

Since *(21), (23),* and *(24)* intersect in one point, that at which renegotiation becomes irrelevant, the buyer will cede decision *d* to the seller whenever *(23)* or *(24)* holds. This is illustrated in Figure 1 below, in which the curve is *(23)* and the vertical line is *(24)*.

Figure 1

{*k, r* | The buyer will cede decision *d* to the seller}



To interpret the result, assume first that $r = 0$. In this case *(23)* is an equality at $k = 0$, but the right side initially grows faster with *k*. So all decisions are ceded if renegotiation cost equals bargaining costs.

Proposition 2: *If renegotiation is as cheap as bargaining and players have no private information, the threat of renegotiation allows maximally incomplete contracts.*

The implication of $r = 0$ is, in effect, to make the ceded decisions ex post contractible. Since it costs the same to negotiate ex post as ex ante, a player might as well wait. Decisions outside the contract are made in a different way than those in the contract $(a_d^{su} \neq a_d^*)$, but in the end, the uninvolved player gets the same utility outcome. The players are jointly better off because the decision-maker saves bargaining costs and can tilt the decision a bit in the direction he or she prefers.

Not all decisions are ceded for higher values of r, but the $r(k)$ defined by *(23)* is increasing in k. This implies that more decisions are ceded for lower values of r and higher values of k.

Proposition 3: *When renegotiation is possible, players are more likely to cede decision rights to an attribute if the difference between renegotiation costs and bargaining costs is low, and if bargaining costs are high.*

The net advantage of ceding is the saved bargaining costs less the biased decision. The former grows with k and the latter with r. Intuitively, the threat of renegotiation imposes more restraint if r is lower, and the parties are willing to swallow more distortions if k is higher.

The advantages of renegotiation imply that the players will prefer a regime in which it is possible to one in which it is not. If we interpret this as a choice between tacit and contractual allocation of decision rights, they will weakly prefer the former.

Proposition 4: *The players will weakly prefer the ceding of decision rights to be tacit, rather than contractual.*

This advantage of renegotiation is larger if the biases are uncertain. Consider a decision d and suppose that while both players know that the buyer's bias is $-\theta_d$, the seller's bias is uncertain. The latter knows his true bias, but from the perspective of the buyer, this bias is θ_d^+ with probability π, and θ_d^- with probability $1-\pi$, where $\pi\theta_d^+ + (1-\pi)\theta_d^- = \theta_d$. In this case renegotiation results in the decisions $\mu_d(z_d, y_{ds}) + (\beta_{ds}\theta_d^+ - \beta_{db}\theta_d)/(\beta_{ds} + \beta_{db})$ if the seller's bias is θ_d^+, and $\mu_d(z_d, y_{ds})+(\beta_{ds}\theta_d^- - \beta_{db}\theta_d)/(\beta_{ds} + \beta_{db})$ if it is θ_d^-. Suppose now that that *(23)* is violated, meaning that the buyer would not want to cede a decision for which the seller's bias is known to be θ_d. In this case, we can find values of θ_d^+, θ_d^-, and π, such that the buyer prefers to cede the decision with uncertain θ_d, because she can threaten renegotiation only in the case where the seller turns out to have a large bias and thus pay a smaller price for the privilege.

On the other hand, the advantage of renegotiation may be smaller if the decision-maker has private information. To see this, suppose that the decision-maker (the seller) has positive bias and at the same time possesses private information suggesting that the first best level of a_d be large. Norms of equilibrium may then dictate that the ceding player (the buyer), occasionally react to a high a_d^{su} by requesting to renegotiate. The cost of this may cause the seller to decide on a smaller a_d^{su}, ultimately hurting both players. (Wernerfelt, 2007, shows this formally in a related setting.)

Possible hold-up

Since the possibility of hold-up plays a central role in the literature on incomplete contracts, we will briefly investigate how this might influence our results. Suppose therefore that the seller and the buyer can make non-contractible relationship-specific investments ex interim, i_s and i_b, respectively. These investments do not influence decision and negotiation costs, but increase gains from trade gross of these. Specifically, the seller's cost of his ideal design, $c(i_s)$, is decreasing in i_s, while the buyer's valuation of her ideal, $v(i_b)$, is increasing in i_b.

In the case without renegotiation, the sequence of events is now: The players (i) allocate decision rights over attributes into three groups: those to be decided jointly for inclusion in a contract and those tacitly delegated to each party, (ii) negotiate joint decisions, (iii) negotiate the price, (iv) make specific investments, (v) make unilateral decisions, and (vi) produce and trade. The analysis proceeds exactly as before, except that the price is negotiated based on expected levels of investment. All conclusions regarding decision rights are unchanged, and investments are efficient as long as c is independent of i_b and v is independent of i_s.

In the case with renegotiation, the sequence of events becomes: The players (i) allocate decision rights over attributes into three groups: those to be decided jointly for inclusion in a contract and those tacitly delegated to each party, (ii) negotiate joint decisions, (iii) negotiate the price, (iv) make specific investments, (v) make unilateral decisions, (vi) may renegotiate unilateral decisions, and (vii) produce and trade. We have so far assumed that a renegotiation in stage (vi) is efficient in the sense that it results in a decision identical to what the players would have agreed upon if the decision had been included in the original contract. Since this is independent of v and c, the presence of specific investments once again does not change our conclusions about decision rights, and investments will be efficient.

To create a scenario with hold-up, we make the alternative assumption that renegotiation is *distributive* in the sense that it favors an under-investing player by equalizing payoffs to the extent possible. On the assumption that price can not be renegotiated, surplus is most efficiently transferred to a player by renegotiating decisions to his or her ideal level, except when $k + r$ are very low.[8] Suppose that renegotiation would transfer surplus to the buyer and that decision d is to be made unilaterally by the seller. He can then head off renegotiation by setting a_d equal to $a_d^{s\#}$ given by

$$\beta_{db}(a_d^{s\#} + \theta_d)^2 = k + r + \beta_{db}(a_d^b + \theta_d)^2, \qquad (25)$$

since in that case the buyer gains nothing by asking to renegotiate.

Holding specific investments constant, the seller prefers an incomplete contract with $a_d^s = a_d^{s\#}$ over ex ante contracting if

$$\beta_{ds}(a_d^{s\#} - \theta_d)^2 < k + \beta_{ds}(a_d^* - \theta_d)^2, \qquad (26)$$

while the buyer prefers it if

$$\beta_{db}(a_d^{s\#} + \theta_d)^2 < k + \beta_{db}(a_d^* + \theta_d)^2. \qquad (27)$$

The former constraint is tighter and since $a_d^{s\#}$ is increasing in r, we once again find that incomplete contracts ceteris paribus are more attractive when renegotiation is cheap.

If the seller has made specific investments beyond the level anticipated at the time of price negotiation, he pays for this by having to equalize payoffs by shading a sufficient number of his unilateral decisions from to $a_d^{su} = \mu_d + \theta_d$ to $a_d^{s\#}$.[9] So the hold-up problem is not solved. With incomplete contracting, players still expect to receive less than the full value of their specific investments, and will thus under-invest. On the other hand, incomplete contracting has the advantage of saving bargaining cost and the possibility of cheap renegotiation will amplify this effect.

III. DISCUSSION

Based on the premise that it is costly to bargain over clauses in a contract, we have argued that trading partners may cede decision rights to each other, and suggested that this be interpreted as incomplete contracting. We showed that the effect is stronger if the ceding is provisional in the sense that the uninvolved player can ask to renegotiate. In particular, even if bargaining costs are infinitesimal, contracts should exclude all decisions for which renegotiation is as cheap as bargaining. Under appropriate parameter restrictions, the endogenous incompleteness survives the introduction of specific investments and threats of hold-up.[10]

While the model depicts a contracting problem, the arguments apply more generally to the theory of delegation. This could be relevant for the literatures on principal-agent problems, the functions of management, and the optimality of different organizational structures.

The analysis is cast in the context of bargaining cost, but the critical condition is that the cost of decision-making is larger as soon as more than one player is involved.

This could also be due to decision-making or communication costs. The former have been mentioned at least by Barnard (1968) and Wernerfelt (2007). Similarly, there is a small literature based on the fact that communication is necessary as soon as more than one player is involved in a decision (Dessein, 2002; Dewatripont and Tirole, 2005; Segal, 2006). It must nevertheless be admitted that the costs driving the model, whether they are interpreted as bargaining delays, decision-making time, or communication-costs, have little resonance in the literature. In particular, they contrast sharply with the forces stressed in many modern theories about the relationship between contracts and firms. Their importance is, however, consistent with the views expressed by Arrow (1974, p. 68), and Hayek (1945). It is finally worth noting that the present argument has force even if these costs are very small (although the recent work of Zbaracki et al. (2004) suggests that they are quite significant).

Although the paper is concerned with incomplete contracting, the model has a limiting outcome, that in which all decisions are ceded to one player, which looks like an authority relationship (Wernerfelt, 1997). It is interesting to recall that this is most likely to happen when decision costs are large and when the party in question has good information (h), representative biases (θ), and strong preferences (β). This list of characteristics is consistent with the view that the boss has a big job, that he knows what should be done, that he will not abuse his authority, and that he cares about what is done.

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ENDNOTES

[1] So we argue that it may be worth saving bargaining costs even with commonly known and relatively similar preferences. In the limit, bargaining costs may reduce to the costs of two-way communication, but these will still be larger than those of one-way communication (Wernerfelt, 1997).

[2] An out-of-equilibrium example is provided by the recent experience of the small town of Belmont, Massachusetts which received several complaints over barking from a newly expanded kennel. Although the board of selectmen voted to terminate the kennel's license, a legal technicality forced the town to hold a referendum about the question, at a direct cost of $10,000, or about $4 per vote cast (Belmont Citizen-Herald, 8/7/2003a, p. 8; 8/14/2003b, p.1).

[3] Suggesting that these minutiae can add up, Muth and Wetzler (1976) find that commonly used, but inefficiently restrictive, building codes add about two percent to the cost of the average house.

[4] More precisely, the parties would contract on all details for which both parties derive positive benefits from the joint decision and neither party gains so much from a unilateral decision to that they could pay the opponent to cede the decision right.

[5] It is worth pointing out that the meaning of "renegotiation" differs a bit between the two arguments. In the "incomplete contracting" literature, it refers to a mutual agreement to change the terms of an explicit contract. In the present paper, it refers to one player requesting a change in a decision tacitly delegated to the other.

[6] The normality assumptions are not necessary for the main results, but give us to closed form solutions.

[7] In the house building example, this could be a situation in which the buyer sees the hole being dug and decides that he wants a deeper basement. Or it could be a case in which the buyer shows up with a very difficult-to-install set of lights.

[8] If $k + r$ is very small, it may be better to renegotiate more decisions and select some intermediate value between $a_d^{b'}$ and a_d^*.

[9] Once surplus is equalized, or almost so, there is no need to renegotiate more decisions.

[10] It is obviously important to subject this and other theories of endogenous incompleteness (Baker, Gibbons, and Murphy, 2006; Hart and Moore, 2006) to empirical and/or experimental testing. While it may be very difficult to find data that allows researchers to distinguish between alternative theories in the area, Gil (2006) has made a promising start with data from the Spanish movie industry.