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Abstract

Hart & Moore (1999) construct a model to show that contracts perform poorly in complex environments when the state of the world is unverifiable and renegotiation cannot be ruled out. They implicitly assume one player can extort payment from another by threatening to take an inefficient action which hurts both of them. We show that

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without this assumption a simple "buyer option" contract can implement the first- best even as complexity becomes severe.

JEL Codes: L14, K12

1 Introduction

In a recent paper, Hart and Moore(1999) argue that contractual incompleteness emerges naturally in complex trading environments. They show that in such environments, when the state of the world is unverifiable and renegotiation cannot be ruled out, then the value of writing long- term contracts declines with environmental complexity, even if information is not asymmetric between buyer and seller. They also argue that the inability to describe future contingencies can be a significant limitation on the power of contracts. In this note, we argue that the poor performance of contracts in the Hart-Moore model is due to the assumption that one of the contracting parties, the buyer, can commit to a disagreement point that neither wants implemented. If the buyer could not commit to carry out his threat to unilaterally take an action that hurts both himself and the seller once bargaining ends, the first best could be achieved with a simple "buyer option" contract.[1]

A number of other papers share our concern about the inconsistency of assuming that no further actions will be taken in this kind of game if an inefficient take-it-or-leave-it offer is refused.[2] Edlin and Reichelstein (1996, p. 494) point out that for a seller's take-it-or-leave-it offer to be credible:

> "[T]he parties must believe that the status quo outcome (q, p) would be the final outcome if the buyer refused the seller's offer. Since this outcome would, however, be inefficient, we believe the buyer will anticipate the possibility of further negotiation and a corresponding share of the realized gains...A buyer would accept an offer to trade

[1] Segal (1999) employs a similar structure in which the buyer demands a widget he does not want in order to extort a payment from the seller. To keep our exposition focused, however, we will limit our analysis to the Hart and Moore (1999) model.

[2] For example, Rubinstein and Wolinsky [1992] and Aghion, Dewatripont and Rey[1994] both raise this concern.

> the efficient quantity at the same profit as trading q at price p, only if the buyer places probability zero on profitable negotiation following a rejection."

Edlin and Reichelstein use this argument to motivate a model with fixed shares of the bargaining surplus. Our point is different. We will accept the simplifying assumption that one party has all the bargaining power, and so can make the last bargaining offer a take-it-or-leave-it one. We object, however, to treating unilateral actions (such as the exercise of an option in a contract) in the same way as actions that require mutual consent (such as renegotiating the terms of a contract). In particular, we reject the assumption that a player who is given an option in a contract cannot change his mind about his *own* choice before the other player takes action contingent on that choice. Once this assumption is removed, the first-best in the Hart and Moore model can be achieved with a simple "buyer option" contract.[3]

2 The Model

Hart & Moore (1999) is a model of a buyer and seller who are contracting for production and delivery of a "special" widget.[4] First, they sign a contract. Then, the seller invests σ in cost reduction. With probability $\pi(\sigma)$, the cost

[3]Our analysis of the power of changing a small assumption parallels the earlier paper of Noldeke and Schmidt (1995). They show that the underinvestment result in Hart and Moore (1988) is reversed with one small change in assumptions: namely, that the court can determine whether the seller failed to deliver or the buyer refused to accept delivery. (Hart and Moore assume that if trade fails the court cannot make this determination.) This simple change allows for the use of option contracts in which discretion is assigned to one of the parties and results in first-best investment.

[4]The appendix of their paper considers a more general case where both parties invest and both have some bargaining power. We discuss that case in section 6 below.

of the special widget is c_L, and otherwise it is the greater amount c_H. The buyer's value for the special widget is v, which is greater than c_H. There are also $N-1$ generic widgets that might be produced, which we will assume have positive but trivial value for the buyer (Hart and Moore are vague as to their value, but it does not really matter). Generic widget n has production cost $g_n = c_L + (n/N)(c_H - c_L)$, so the generic widget costs are spread evenly between c_L and c_H. Only after the seller has invested in cost reduction do the parties learn which widget is the special one; earlier, all they can do is (in one version of the model) identify specific widgets by color (in the other version they cannot even do that). Thus, the initial contract could say, "Deliver the red widget," but it could not say, "Deliver the special widget." In any bargaining game, we assume that the buyer will have all the bargaining power: the buyer can make the seller a take-it- or- leave- it offer.

The problem for buyer and seller is that, by assumption, the contract cannot specify either the seller's investment σ or that the widget delivered be the special widget. The two players can observe these things by the end of the game, but courts cannot. Moreover, it is assumed that the contract cannot prevent renegotiation if both parties want it. If the outcome specified by the contract would be inefficient, the two players will renegotiate to something efficient.

In the absence of a contract (the "null contract"), the seller would choose investment level $\sigma = 0$ and the two players would agree on a price of $p = c_L$ or $p = c_H$, depending on the cost of the special widget. The buyer would be allowed to choose which widget he wanted, or, equivalently, to refuse delivery if he did not like the widget the seller presented to him. He would choose the special widget. This would be the equilibrium because the seller gains nothing by deviating to positive investment. In the bargaining over the price, the buyer will pay him no more than cost anyway, so there is no point in the

seller trying to reduce the cost.

If, contrary to the assumptions, it were possible to include the seller's investment amount and the identity of the widget in the contract, the buyer and seller would agree to a price of c_L or c_H for the special widget, depending on the cost, with an upfront payment from buyer to seller of σ^*, the first-best investment level, and a requirement that the seller choose investment level σ^*.

Hart and Moore argue that a contract can accomplish little here. The best a contract can do is to specify in advance that one of the widgets (say, the red one) is to be delivered at a fixed price, say P. If in fact the red widget is the special widget, then the contract is performed as written. If not, the parties renegotiate so that the special widget is delivered. Because the buyer has all the bargaining power, the seller earns a zero share of the incremental surplus that is created by renegotiating from the undesired red widget to the special widget. Since he does not benefit from the cost of the special widget being low unless the red widget is the special widget, the seller has inefficiently low incentives to invest in cost reduction. He fails to capture the full benefits of his investment; indeed, he captures only a share $1/N$ of those benefits, so as N goes to infinity, his share goes to zero.

3 The Equilibrium

Hart and Moore's Proposition 1 says that as N approaches infinity, the seller's equilibrium investment σ approaches zero, regardless of the contract. Thus, the null contract is as good as any other contract. The players cannot do better by trying to construct a mechanism in the way that Maskin and Tirole (1999) suggest.

Hart and Moore discuss several contracts. One that they rightly reject

is what we will call "seller option". In this contract, the buyer pays the seller σ^* plus the price $p = \pi(\sigma^*)c_L + (1 - \pi(\sigma^*))c_H$ up front, and the seller gets to choose which widget is delivered. The problem with this contract is that Seller will always start to deliver the cheapest widget, which may happen to be the special widget but which often will not be. Buyer will stop Seller and they will renegotiate to the efficient outcome that the special widget is produced but the renegotiated price will just be an extra payment from Buyer to Seller to compensate for the higher cost of producing the special widget. Since the Seller will often end up just barely compensated for the cost of the special widget, he does not have sufficient incentive to invest to reduce that cost.

Another contract, which we think Hart and Moore *wrongly* reject, is what we will call "buyer option." In this contract, the buyer pays the seller σ^* plus the price $p = \pi(\sigma^*)c_L + (1 - \pi(\sigma^*))c_H$ up front, and the buyer gets to choose which widget is delivered. Except for a possible flaw that we will shortly discuss, the seller would accept this contract, which yields him an expected payoff of zero, and then would choose investment level σ^* voluntarily, because he knows the buyer will choose the special widget at the contract price and so the seller will keep any cost savings earned by the investment.

The flaw that Hart and Moore see in this contract (on page 122 of their paper) is as follows. The buyer will not, in fact, always select the special widget. Rather, if the special widget happens to have the low cost of c_L, the buyer will select the most- expensive-to-produce generic widget, which in the limit as N goes to infinity has cost c_H. The buyer does this not because he likes the generic widget—he actually prefers the special widget—but because he will use that as a starting point for renegotiation. He will extort a payment from the seller in exchange for allowing the seller *not* to deliver the expensive

generic widget. If the seller refuses to renegotiate, the seller expects to receive the price of $\pi(\sigma^*)c_L + (1-\pi(\sigma^*))c_H$ but is forced to pay the cost of c_H, which sums to the negative expected profit of $\pi(\sigma^*)(c_L - c_H)$.[5] In expectation, the renegotiated price p_r minus the actual production cost of the special widget would give the seller the same payoff (since the buyer is assumed to have all the bargaining power). Thus, the seller has lost his incentive to keep costs low, so he would choose $\sigma = 0$ before the renegotiation even starts.

It will help to attach numbers to the situation. Suppose that the buyer valuations are $v = 100$ for the special widget and 1 for the generic widget, that $c_L = 3$ and $c_H = 90$, and that $\sigma^* = 10$, $\pi(10) = .8$ and $\pi(0) = .2$. The buyer option contract is then

Buyer Option: "Buyer immediately pays Seller 10 to cover investment and a price of $p = .8(3) + .2(90) = 42$ for the widget. Buyer later chooses which widget is to be produced and delivered. If Buyer rejects Seller's delivery, Seller pays Buyer 90 in liquidated damages."

Suppose the number of possible widgets approaches infinity. The buyer extortion problem takes the form of the buyer choosing, if the cost of the special widget were to turn out to equal $c_L = 3$, to purchase the generic widget that costs 90 to produce.[6] The seller's payoff would come to 10 - 90+42 = -38. The buyer would then offer to release the seller from that contract and buy the special widget instead if the seller refunds him the original price of 42 plus 45 extra extortion money,leaving the seller a payoff of 10 -3-45 = -38.

Our objection is that this extortion threat is not a credible threat. It

[5]We are ignoring the fixed payment σ^* from buyer to seller here.

[6]The actual cost of the most expensive widget is $90 * (N-1)/N$, but as $N \to \infty$ this approaches 90.

is not subgame perfect in the game that should be specified here. This is a strange kind of extortion. Buyer's threat is "Seller, if you don't renegotiate, then I will buy the widget I value at 1 instead of the widget I value at 100 and you will have to pay more to produce this worthless widget." But what happens if Seller ignores the threat and refuses to renegotiate? In Hart and Moore, Seller produces the generic widget and that is the end, with both players losing out. But Buyer can avoid this unilaterally. He can tell Seller: "No—I was just kidding. Produce the special widget, the one that I wanted all the time."

Does it matter that Buyer take an affirmative action to retract his threat and order the efficient widget instead? No. Suppose Seller ignores Buyer's choice of the generic widget, and delivers the special widget anyway. The ball is now in Buyer's court. If Buyer wishes to carry out his threat, he must go to court and ask the court to require that Seller deliver the inferior generic widget to him, leaving himself with a lower payoff. That is not a credible threat.[7]

At first glance, it does seem to matter that Buyer cannot bind himself to require delivery of the generic widget instead of the special widget. On further consideration, however, even that does not matter. If he could so bind himself, he would not, because the only reason to bind himself would be as a starting point for renegotiation. If he could somehow bind himself to accept delivery only of the inferior widget and not the special widget he would be in too firm a bargaining position— he would have nothing to surrender to the other player.

The kind of commitment the Buyer needs is different: a commitment to

[7]Alternatively, suppose that Seller tells Buyer, "I need time to think about your proposal. Let me get back to you." Seller would then be happy to wait forever, since he has already gotten all the payments due him under the contract and he is not eager to produce either kind of widget—everything left in the contract for the seller to do is costly to him.

refuse to accept delivery if and only if the Seller refuses to accept a low price. It is hard to see how such a commitment would be made. One way would be the standard one whereby the Buyer promises to pay a large amount to a third party if he backs down from his threat. Recall, however, that we started by assuming that the two players could not agree not to renegotiate. If two players cannot bind themselves not to renegotiate out of inefficient situations, how could a single player bind himself to carry out an inefficient threat?

The only assumption we have changed from the Hart-Moore model is that instead of having to compel the seller to deliver an undesired widget, the buyer can propose another widget be traded instead. This seems an eminently reasonable assumption. Neither party has an interest in enforcing an inefficient trade. To us, it seems more reasonable that the negotiation process will continue than that the buyer will go to court to enforce an outcome he does not want.[8]

4 Explicitly Modelling the Renegotiation Subgame and Bargaining

Given the ease with which one may fall into confusion, it may be useful to set out the renegotiation game more formally. We first consider a slight modification of Hart and Moore's basic model that leaves all bargaining power in the hands of the buyer; later we turn to a variation in which bargaining via alternating offers allocates bargaining power symmetrically.

[8]It is interesting to note that in Grossman and Hart (1986), where a similar extortion could potentially be attempted, the authors assume (p. 701) that each party takes an action he is willing to stick to should renegotiation not ensue, thus avoiding our criticism of Hart and Moore (1999).

4.1 Bargaining When Buyer Has All the Power

In Hart and Moore, the subgame starting after a buyer- option contract has been agreed upon and the seller's investment decision has been made is implicitly like this:

1. Buyer tells Seller which widget to deliver.
2. Buyer offers Seller a new contract, specifying a widget to be delivered and a price.
3. Seller accepts or rejects the new contract.
4. Seller delivers a widget or breaches by not delivering anything. Buyer pays Seller according to the most recent contract, or breaches the contract by making a payment of the wrong amount.

We argue that the subgame should alter stage (3) subtly and add a stage (5), as below:

1. Buyer tells Seller which widget to deliver.
2. Buyer offers Seller a new contract, specifying a widget to be delivered and a price.
3. Seller accepts or rejects the new contract. *If Seller rejects the new contract, Buyer can change his specification of the widget to be delivered under the original contract.*
4. Seller delivers a widget or breaches by delivering the wrong widget or no widget at all. Buyer pays Seller according to the most recent contract, or breaches the contract by making a payment of the wrong amount.

5. The buyer and seller each decide whether to go to court, at zero cost, to enforce the verifiable terms of the most recent contract.

This "What happens after breach?" approach is in the spirit of the general criticism Ronald Coase (1970, p. 119) makes of theoretical models: that they tend to forget that desired actions must be implemented by institutions. (His particular context was natural monopoly pricing.) Note that Stage 5 of the subgame is implicitly present in Hart and Moore as well, though they do not discuss court enforcement explicitly. Thus, the only substantive change we have made in the subgame is that if Seller rejects Buyer's amended contract, then Buyer can rescind his original widget request unilaterally and replace it with a different one before Seller makes delivery.

We now present our main result, which follows from an analysis of our altered subgame.

Proposition *In our modified Hart-Moore game, the buyer option contract with all payments made* ex ante *supports first-best investment.*

Proof: At stage 5, there are two possible contracts we must consider: (a) the original contract including the buyer's choice of widget as made at Stage 1 (we suppose Buyer sends Seller written notification of his choice of widget, so this choice of widget is enforceable), (b) the revised contract offered by Buyer at stage 2. It is clear Buyer will never go to court to enforce (a), the original contract, if he requests one of the generic widgets, as this would leave him with an undesirable result; he would, however, enforce the original contract if he requests the special widget. He would also go to court to enforce the modified contract (b), since it delivers him the special widget plus all the renegotiation surplus. Seller would enforce the original contract (a) if Buyer requests the special widget. If Buyer requests the costly generic widget, however, then Seller has no interest in enforcing (a) unless his *ex post*

payment from doing so would more than offset the high cost of producing the most costly generic widget. That is, enforcing the contract will not be profitable for Seller unless $P > c_H - (c_H - c_L)/N$. Seller would go to court to enforce (b), however, if Buyer breached by making too small a payment at stage 4.

At stage 4, Seller must decide which widget to deliver, and both parties must make payments. Seller will be faced with one of two possibilities: either Buyer has specified the special widget (if its cost is c_H) or the most costly generic widget (which is possible if the cost of the special widget is c_L). Seller will deliver the special widget if it is specified by the Buyer, since Buyer can costlessly enforce the contract anyway. (This happens regardless of whether Buyer specifies the special widget at Stage 1 under the original contract or at Stage 2 under the renegotiated contract.) But what if Buyer specifies the most costly generic widget and Seller at stage 3 rejects the new contract? Seller is now stuck with the initial fixed price in the contract, and he can either deliver the costly generic widget or breach the contract and deliver the cheap special widget instead. As argued in the preceding paragraph, Seller knows Buyer will not go to court to enforce the delivery of the worthless costly generic widget, so he is better off to deliver the special widget.

Stage 4 also requires Buyer pay Seller any remaining remittance P not made *ex ante*. Seller can enforce the contract in court costlessly, so Buyer will simply pay the contracted amount if Seller has not breached the contract. What if Seller has breached the contract by delivering the special widget when Buyer had requested the costly generic one? Assuming $P < c_H - (c_H - c_L)/N$, then Seller will not go to court to enforce the contract, as shown above. Hence, Buyer will choose not to pay Seller anything at Stage 4 if Seller has breached by delivering the special widget. This is not an issue, however, when all payments are made *ex ante*.

At stage 3, Seller decides whether to accept Buyer's amended contract, if such a contract is offered. In the Hart and Moore model, of course, Buyer will have designed this in an attempt to make Seller just indifferent between the original contract (with delivery of the costly generic widget specified) and the new one (with delivery of the special widget but at a lower price). In our amended subgame, however, Seller does better to refuse the amended contract. If he does so, then Buyer has the chance to rescind his original widget request and replace it with another. If Seller refuses the amended contract, Buyer does indeed prefer to rescind the request for the worthless costly generic widget, and ask for the special widget instead.

At stage 2, Buyer can offer an amended contract, but the foregoing analysis shows that Seller will not accept the offer, so Buyer might just as well not bother.

At stage 1, Buyer can request the special widget or the costly generic widget. He will do the former, because requesting the costly generic widget would only make sense if Buyer planned to offer an amended contract; this, however, is pointless, as we have shown above. Hence Buyer requests the special widget. Seller can thus foresee early in the game that he will be producing the special widget (rather than face the high sanctions for breach), so he will choose the efficient investment in cost reduction. **Q.E.D.**

The point of our Proposition is simple: Buyer's extortionary request for the worthless costly generic widget constitutes a "threat" that is not credible. If Seller calls Buyer's bluff and refuses to renegotiate the original contract, Buyer has every incentive to rescind his extortionary request and opt for the special widget instead. Once this is recognized, the simple "buyer option" contract is first best.

4.2 Alternating Offer Bargaining

The modified subgame we examine above explicitly models bargaining, but in the arbitrary form of a take-it-or-leave-it offer. Another approach is to incorporate a more symmetric model of the bargaining process. Let us consider the familiar one proposed by Rubinstein (1982). Both players have small positive discount rates and we suppose that after Buyer specifies his choice of widget, the two players make alternating offers until they reach an equilibrium price. If Seller has received his fixed payment *ex ante*, then he has no interest in reaching agreement on delivery. Instead, he would prefer to keep haggling indefinitely in order to avoid incurring the production cost. Thus, the argument we made above will apply here just as strongly. Seller will keep rejecting Buyer's offer until Buyer finally offers to trade the special widget at the original price P.

If Seller does not receive his fixed payment *ex ante*, then he might be expected to have incentives to enforce the disagreement point rather than bargain on indefinitely. After all, he only gets paid once delivery actually occurs. In this case, the contract might fail to achieve the first best investment. But Seller's incentives depend on how the initial price P compares to his production cost at the disagreement point. If Buyer chooses the most expensive widget, enforcing the contract will not be profitable for Seller unless $P > c_H - (c_H - c_L)/N$. In order to achieve the first best, all the parties need do is have Buyer make most of the payment through an upfront payment, and ensure that the *ex post* portion of the payment is less than $c_H - (c_H - c_L)/N$.

An important part of this is that Buyer's threatened action is to do something that is bad for both parties, rather than to refrain from doing something that is good. Seller is quite happy to delay agreement indefinitely, because it postpones a negative utility flow for him. Typical bargaining models are very different. In them, continued disagreement postpones the

arrival of a positive utility flow—the surplus from agreement. Thus, both parties are eager to come to quick agreement. Here, Seller would just as soon never agree, so long as they keep negotiating and he never has to produce a widget.

5 The Suicide Bomber Game

The idea we criticize in Hart and Moore has broader implications. Consider two simpler games, "Split the Pie" and the "Suicide Bomber Game." "Split the Pie" is the archetypal bargaining game, so we begin with it.

Split the Pie. *Buyer and Seller are considering a deal that will yield $100,000 in surplus. Buyer makes a take-it-or-leave-it offer of $100,000 for himself and 0 for Seller by signing a contract to that effect and then vanishing onto the subway a few minutes before the 5 p.m. deadline for any possible deal.*

This is an example of what we normally think of as take-it-or-leave-it offers, where both players lose if the offer is rejected. Unless both sign, the deal is dead and both Buyer and Seller have lost surplus. The Buyer cannot take back his action, but it is the Seller who can unilaterally prevent surplus from vanishing.

The Hart-Moore model, however, is more like the Suicide Bomber Game:

The Suicide Bomber Game. *At the close of contract negotiations, Buyer pulls out a bomb, sets it on the table in front of him, and turns the switch from "No explosion" to "Explode in 5 minutes." Buyer then tells Seller, "Unless you give me an extra $10,000, I will let the bomb blow the two of us to smithereens. I know you value your life at exactly $10,000 (compared to*

the mere $9,000 value I place on my own life), and since I am a very good bargainer, I know you will pay me the full $10,000 to save your life. Pay up or die."

Is this a credible threat? No, not even if we say that Buyer has all the bargaining power, unless by "have all the bargaining power" we are imposing conditions on what moves are allowed in a game. The problem is that Buyer can unilaterally stop the bomb from exploding, by twisting back the lever to "No Explosion" even if Seller doesn't reply. If a player can unilaterally withdraw a threatened action, and has incentives to do so, then we should not expect the action to occur. This is the kind of situation we usually denote as a non- credible threat: if the threatened player refuses to be intimidated, the threatening player will bear a cost if he carries out his threat, and since carrying out the threat is entirely under his control, he won't do it. His bluff can be called.

6 Extensions of the Basic Model

In the appendix to their paper, Hart and Moore construct a more general model in which their central proposition continues to hold. They generalize in two directions: (1) both Buyer and Seller can undertake investment, and (2) Buyer does not have all the bargaining power; rather, any split of power is allowed. Does our criticism still hold in the general model?

For intuition, start by thinking about the Suicide Bomber Game. Suppose Buyer and Seller play a bargaining game in which they choose a price that splits the surplus. Buyer's threat to let the bomb explode is still not credible. His threat is now to blow up both players unless they split the $10,000 + $9,000 surplus from staying alive equally, so he will demand a

payment of $500 from Seller. But Seller should still be safe in rejecting the demand and calling Buyer's bluff.

In Hart and Moore's "Widget Game," suppose Buyer obtains share λ of the surplus in bargaining, while Seller obtains share $1 - \lambda$. Under the "Buyer Option" contract, Buyer specifies the widget that is to be traded. Suppose, as before, that he specifies the costliest one. The parties can then renegotiate to trade the special widget, splitting the renegotiation surplus. However, the seller can do better than to participate in this renegotiation. What happens if the seller refuses to renegotiate? Once again, Buyer would prefer not to trade the costly generic widget, and will eventually specify the special widget. Once he does so, however, the initial contract price becomes operative and cannot be renegotiated in a Pareto-improving way. Again the contract becomes a fixed-price contract, and the seller has first-best incentives to invest.

Let us look at this in more detail. Hart and Moore change the Widget Game in other small ways in their Appendix, but let us stay with their basic game. We will just add their two generalizations:

1. The Buyer invests β prior to the bargaining game and his value $v(\beta)$ for the special widget is increasing in β;[9]

2. In any bargaining game, with probability λ Buyer makes a take-it-or-leave-it offer to Seller, and with probability $1 - \lambda$ Seller makes a take-it-or-leave-it offer to Buyer.[10]

[9]Hart and Moore allow a general specification in which Buyer's valuation is $v(\beta, \sigma)$ and Seller's cost is $c(\beta, \sigma)$, but this does not change the point we are making.

[10]This is Hart and Moore's specification. A more conventional specification would be that in any bargaining game the surplus is split so Buyer gets fraction λ and Seller gets fraction $1 - \lambda$. The two specifications work out the same.

What difference will these changes make to buyer extortion? The reasoning we employed earlier still applies to the Widget Game. Buyer now makes a more moderate demand on Seller, but his threat is still not credible. After renegotiation failed, the buyer would still change his mind about the widget he selects. We will repeat the numerical example, modifying it somewhat:

Suppose the original buyer values are $v(0) = 15$ for the special widget and 90 for the generic widget, that $c_L = 3$ and $c_H = 90$, and that $\sigma^* = 10$, $\pi(10) = .8$ and $\pi(0) = .2$. The buyer can increase v by investing β, and the first-best investment level is $\beta^* = 5$, which yields $v(5) = 100$. In any bargaining game, with probability .3 Buyer makes a take- it- or- leave-it offer to Seller and with probability .7 Seller makes a take- it- or- leave-it offer to Buyer.

The "Buyer Option" contract is now "Buyer immediately pays Seller 10 to cover investment and a price of $p = .8(3) + .2(90) = 42$ for the widget. Buyer later chooses which widget is to be produced and delivered." If this works out as a first-best contract, Seller will invest 10 and Buyer will invest 5. Buyer will then ask Seller to deliver him the special widget.

The buyer extortion problem would take the form of Buyer choosing, if the cost of the special widget was 3, to purchase the generic widget that costs 90 to produce. Seller's payoff would come to $10 + 42 - 10 - 90 = -48$. Buyer would then offer to release Seller from the contract and buy the special widget instead. In bargaining over the price of releasing Seller from the contract, either party may have the opportunity to make the take-it-or-leave it offer. If Seller gets to make the offer, he will choose a price that makes Buyer just indifferent between accepting it and remaining with the original arrangement. Under Buyer's original proposal, Seller delivers the generic widget, and Buyer's payoff is $90 - 10 - 42 - 5 = 33$. Thus, in

renegotiation, Seller proposes that Buyer pay him an additional 10 for the special widget, in which case Buyer receives utility of $100-20-42-5=33$. Similarly, if Buyer gets to make the offer, he will propose a price that makes Seller just indifferent to accepting it. Under Buyer's original proposal, Seller receives $10+42-10-90=-48$. In renegotiation, Buyer will propose that Seller deliver the special widget, refund him the original price of 42 plus a payment of 45 extra extortion money, in which case Seller receives a payoff of $10+42-3-10-42-45=-48$. Foreseeing that with probability $1-\lambda=.7$ he will not get any benefit from his investment in cost reduction, Seller will invest less than σ^*, though still a positive amount.[11]

The point we wish to emphasize is that even in this extended model where both players invest and share the bargaining power, buyer extortion is not subgame perfect. Buyer extortion still requires Seller to believe that if a take-it-or-leave-it offer is rejected, then the game ends and the generic widget is delivered. In our numerical example, Buyer's payoff is then 33. However, if Buyer unilaterally rescinds his request for the generic widget, and requests the special widget instead, his payoff jumps to 43. Thus, Seller should expect that if he refuses Buyer's take-it-or-leave-it offer, Buyer will unilaterally change his mind and request that the special widget be delivered under the original terms of the contract. The "Buyer Option" contract then has the effect of creating a fixed price contract in which the special widget is sure to be delivered. Buyer has first-best incentives to invest, as does Seller.

[11] In Hart and Moore's model, for large N the value and cost of the best generic widget are equal and approach 100, the first-best value of the special widget. As a result, for large N Buyer is in a better and better bargaining position and seller investment approaches zero.

7 Distinguishing "Bargaining Power" from "Bargaining Position"

Bargaining power is a useful concept. Very often in models we want to simplify a surplus-splitting module because the result does not really matter to the overall conclusions. One way is to give one party all the bargaining power, meaning that he gets 100 percent of any surplus in bargaining. An easy way to specify this is that the strong party gets to make a take-it-or-leave-it offer.

One of the advantages of economic theory over looser thinking about bargaining, however, is that this definition of bargaining power has considerable analytic meaning because it distinguishes strong bargaining *power* from a strong bargaining *position*. Consider the following example:

Bargaining Power Game: *John is selling Mary a car. John values the car at $2,000, its market price. Mary, however, values the car at $22,000 because she promised her dying mother she would buy that particular car. On the other hand, Mary is a patient and skilled bargainer, and always takes 90 percent of the surplus in her bargains with John. Thus, here the price they agree upon is $4,000.*

In everyday language, people would have a hard time deciding whether to say Mary had weak or strong bargaining power. As conventionally used by economists, however, the situation can be simply described: Mary is in a weak bargaining *position*, but she has strong bargaining *power*. This is a distinction of great value. Despite Nash (1952) and Rubinstein (1982), we are still uncomfortable saying we know a unique solution to simple pie-splitting games. But we are much more comfortable in specifying the size of the pie, which is simply a function of tastes, technology, and past actions

of the players. Thus, we often make reduced-form assumptions on a player's bargaining power but we do not make them on a player's bargaining position in the same way. It is dangerous to move beyond assumptions on just splitting surplus—a zero-sum activity—to assumptions restricting real actions. Then, allowing a take-it-or- leave- it offer is perilously close to allowing any threat whatsoever to be credible.

8 Restoring the Foundations of Incomplete Contracts: Asymmetric Information About Buyer Preferences

We believe we have shown that in Hart & Moore (1999) a contract can be found that yields the first-best despite the unverifiability of investment and the indescribability of the product to be produced. The idea that contracts may be incomplete because of these things can be salvaged, however, by adding incomplete information to the model. The effect of incomplete information will not be directly to make contracts incomplete, but to destroy the viability of the option contract we proposed as a way to attain the first best.

The intuition is as follows. Because of the difficulty of describing the product to be produced while giving the seller the proper incentives for investment, it is desirable to use a buyer option contract, allowing the buyer to refuse delivery if he is dissatisfied with the product. Sometimes we do see such contracts in the real world, but a problem with them is that they may make the seller vulnerable to manipulation by the buyer. What if the buyer tells the seller, after the contract is signed, that he wants a product that is very expensive to produce? That does happen with some probability in the Hart and Moore model, because the special widget may turn out

to be expensive. Information is complete and symmetric, however, so the contract price is high enough that on average the seller can break even, and the buyer is willing to pay that high price because he knows he might end up wanting a widget that is expensive to produce. Suppose, however, that information was incomplete and asymmetric, so the buyer knew in advance whether he wanted an expensive widget, but the seller did not know what the buyer wanted. All buyers would pretend to have inexpensive tastes, the seller would charge a price high enough to cover the probability of having to deliver to both kinds of buyers, and buyers with inexpensive tastes would decide not to buy. This adverse selection could result in the market breaking down completely. The buyer-option contract has made this a "lemons market" of the kind introduced by Akerlof[2], even though adverse selection was not originally a problem. Thus, the buyer and seller would abandon buyer-option contracts and instead use some contract, such as the null contract, that did not leave the seller vulnerable to buyers with expensive tastes.

Formalization of this idea will make it clearer. Let us use the Hart-Moore model of Section 2, with the following additions. With probability θ, the buyer is "normal." His favorite widget is the special widget, with a value of v and a production cost of either c_L or c_H, as in Section 2. With probability $(1-\theta)$, however, the buyer is "finicky" and his favorite widget is a "superspecial" widget that he values at $\tilde{v} > v$ and which costs a known $\tilde{c}$ to produce. The buyer knows his type at the time of contracting, but the seller does not. As before, the buyer has all the bargaining power, in the sense that he can make take-it-or- leave-it offers in contract negotiations. We will allow either $\tilde{v} > \tilde{c}$, or the opposite, in which case no trade should take place unless the buyer is normal. More importantly, the superspecial widget's cost is very high relative to the value of the special widget:

$$v < \theta c_L + (1-\theta)\tilde{c}. \tag{1}$$

The null contract works much as before. The seller will choose zero investment in cost reduction. Once the cost of the special widget is known, the normal buyer will offer to buy the special widget at a price equal to its cost, either c_L or c_H. The finicky buyer will either offer to buy the special widget at its cost, if the cost is c_L and $(\tilde{v} - \tilde{c}) < v - c_L$ or the cost is c_H and $(\tilde{v} - \tilde{c}) < v - c_H$, or the superspecial widget at its cost of $\tilde{c}$ otherwise.

When information was complete, the buyer-option contract specified that the the buyer pay the seller σ^* plus the price $p = \pi(\sigma^*)c_L + (1 - \pi(\sigma^*))c_H$ up front, and the buyer chose which widget was to be delivered. Under that contract, the seller's profits would now be negative for large enough $\tilde{c}$, because with probability θ the buyer will be finicky and choose the superspecial widget, regardless of its cost. For the seller's expected profit to equal zero, a pooling contract, offered by both types of buyers, must have a price p such that

$$p \geq \theta c_L + (1 - \theta)\tilde{c}. \tag{2}$$

This, however, is impossible, by our assumption (1) on costs. A buyer- option contract must therefore contain a price so high that only finicky buyers choose it—a price of $p = \tilde{c}$. Even the finicky buyers will find this no better than the null contract, and possibly worse (depending on the parameters and the special widget's realized cost). Thus, the buyer-option contract now fails as a solution to the problem of unverifiable product quality.

The underlying problem is not adverse selection in this modified model. Under the null contract, the efficient product is produced and delivered, because the buyer observes the quality of the product before he agrees to buy it. The effect of the adverse selection is just to rule out the buyer-option contract as a solution to the hold-up problem facing a seller who invests in cost reduction. The null contract still is inefficient, because it results in higher production costs than necessary, but this is an example of insufficient

investment due to the hold-up problem, not of adverse selection.

9 Conclusion

We have shown that the contracting difficulties highlighted by Hart and Moore (1999) are readily resolved if a slight change is made in their assumptions about the renegotiation process. In their model, it is difficult to give the seller proper incentives for investment in a buyer option contract, because the buyer will choose a high-cost widget to establish a disagreement point that is favorable to him and unfavorable to the seller. Using this disagreement point as a threat allows the buyer to extract the full surplus *ex post*.

We alter this setup by recognizing that the buyer prefers not to enforce the disagreement point, since it yields him a low payoff. Instead, if the seller refuses a take-it-or-leave-it offer, the buyer would prefer to unilaterally shift the disagreement point, and request that the seller deliver the special widget. With this choice of disagreement point, however, there is no room for price renegotiation, and the seller receives the initially-stated contract price P. Under this effectively fixed- price contract, both buyer and seller will invest optimally.

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