Break-up fees and bargaining power in sequential contracting

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\textbf{A B S T R A C T}

When a buyer negotiates in sequence with two potential sellers of a good, the outcome of each negotiation depends on all three players’ bargaining powers. Assuming all parties are symmetrically informed, we find that the first seller’s payoff is increasing in his own and the second seller’s bargaining power. On the other hand, the second seller’s payoff is decreasing in the first seller’s bargaining power and, in some cases, also in his own bargaining power. We characterize when contracts will contain break-up fees. All results extend to the case of a seller negotiating in sequence with two buyers.

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\begin{enumerate}
    \item 1. Introduction

Most studies of bargaining focus on the classic framework in which two players must divide a fixed amount of surplus. In this setting, the role of bargaining power is straightforward—a player with more bargaining power secures a greater proportion of the surplus. In many instances, however, surplus is divided among multiple players, some of whom may negotiate before others. In these latter settings, the role of bargaining power is less straightforward and, as we show in this paper, a player may not always prefer to have more bargaining power.

When negotiations among players occur sequentially, the outcome of each bilateral negotiation will in general depend on all players’ bargaining powers. The outcome of a negotiation between a buyer and one seller, for example, may depend on what the buyer expects to obtain if and when it negotiates with a second seller, and similarly the outcome of the second negotiation may depend on what the buyer did or did not negotiate with the first seller. In these settings, bargaining power plays a dual role—it is important not only in determining how the players’ surplus is divided but also in determining the amount to be divided.

In this paper, we investigate this dual role of bargaining power by studying a sequential-contracting model similar to that of Aghion and Bolton (1987)—but extended to allow for bargaining—in which a buyer with unit demand negotiates in sequence with two potential sellers, labeled seller 1 and seller 2. We posit a simple non-cooperative bargaining game in which within each bilateral negotiation, one player makes a take-it-or-leave-it offer to the other. To capture the role of bargaining power, we assume that each player gets to make the offer with some probability. Thus, in the first negotiation, seller 1 makes a take-it-or-leave-it offer to the buyer with probability $\lambda_1$, and the buyer makes the offer with probability $1 - \lambda_1$, and in the second negotiation, seller 2 makes a take-it-or-leave-it offer to the buyer with probability $\lambda_2$, and the buyer makes the offer with probability $1 - \lambda_2$.

We assume that when negotiating in stage 1, the buyer and seller 1 do not know which player will get to make the offer in stage 2 (unless $\lambda_2$ equals zero or one), but they do know the relevant probabilities.

We show that in this setting, when all parties are symmetrically informed and below-cost pricing is infeasible, the sellers’ payoffs may depend on their bargaining powers in counterintuitive ways.\footnote{In contrast, if it is feasible for the buyer and first seller to engage in below-cost pricing, then the buyer and first seller can extract all surplus from the second seller when all parties are symmetrically informed.} For example, we find that whereas the first seller always prefers that the second seller have more bargaining power, the second seller always prefers that the first seller have less bargaining power. We also find that, in some cases, the surplus extracted from the second seller increases with the second seller’s bargaining power, implying that, in these cases, the second seller’s payoff may be \textit{decreasing} in his own
bargaining power. This follows because the second seller’s bargaining power affects both the size of the surplus that remains undivided after the first negotiation and how much of that surplus the second seller can capture. Since the size of the surplus remaining from the first negotiation is decreasing in the second seller’s bargaining power, an increase in the second seller’s bargaining power gives it a larger share of a smaller surplus, which in some cases can mean a smaller overall payoff. In contrast, the first seller’s payoff is always increasing in its own bargaining power since this gives him a larger share of a larger surplus. Thus, when contracts are negotiated sequentially, the last seller to negotiate with the buyer may actually benefit from an increase in buyer power because when the buyer has more bargaining power, she will be tougher in her earlier negotiations, which in turn leaves more surplus to be divided in the last negotiation.

These results contrast with those in Rubinstein–Ståhl type of bargaining models in which the players typically negotiate to maximize their joint surplus and then split it according to each player’s bargaining power. In these environments, each player’s payoff is increasing in its own bargaining power and decreasing in the bargaining power of its rival. In our model, however, subgame-perfect equilibria exist in which the players’ overall joint surplus is maximized, but the bargaining outcomes of the earlier negotiations affect the bargaining outcomes of the later negotiations, and the outcome of each negotiation depends on the distribution of bargaining powers among all players, not just those of the pair participating in an individual negotiation. As a result, a seller’s payoff can be increasing or decreasing in his own bargaining power, and increasing or decreasing in the rival seller’s bargaining power.

Our results have implications for the ongoing policy discussion in the U.S. and Europe on the welfare effects of increasing buyer power. Policy makers routinely express concern that an increase in buyer power may harm sellers by reducing their incentives to innovate. But, as noted by Inderst and Woy (2007a,b), the effect of increasing buyer power on a seller’s investment incentives depends on how it affects the latter’s marginal profits, not total profit. As they show, it is possible for an increase in buyer power to increase–not decrease–suppliers’ incentives. This paper adds to the policy discussion by noting in addition that a seller’s overall profit need not decrease as he may not be worse off when buyer power increases.

Our results also have implications for the literature on rent shifting. In Aghion and Bolton’s (1987) model with one buyer, two sellers, and complete information, the buyer and first seller can extract all the surplus from the second seller by agreeing to a contract in which the buyer pays a break-up fee to the first seller if she buys from the second seller. However, Aghion and Bolton’s model fixes all bargaining power in the hands of the sellers. In contrast, we show that when bargaining power is more evenly distributed, equilibrium contracts may not always entail break-up fees, and when below-cost pricing is infeasible, full extraction from the second seller may not always occur. The reason is that when the buyer has bargaining power, she is no longer indifferent between contracts that penalize her for trading with the second seller and contracts in which she is rewarded with a low price for trading with the first seller. Although both a break-up fee and a low price increase the buyer’s opportunity cost of trading with the second seller, only the former represents an out-of-pocket cost to the buyer if she actually trades with the second seller. Thus, all else being equal, the buyer will prefer low prices to break-up fees. It follows that when the buyer has bargaining power and thus can make offers, break-up fees may not arise and full extraction may not be possible.

The paper proceeds as follows. In Section 2, we describe the model. In Section 3, we present our main results. In Section 4, we show that the model can be extended to the case of two buyers and a common seller, and we discuss applications. In Section 5, we conclude.

2. Model

We consider a model with perfect information in which there are two sellers, 1 and 2, and one buyer. The buyer receives utility from consuming at most one unit of one good. She receives utility $R_i$ if she purchases from seller 1, $R_j$ if she purchases from seller 2, and zero if she purchases nothing. Let $c_i$ denote seller $i$’s opportunity cost of selling his unit. We assume that $R_i > c_i$ for $i \in \{1,2\}$ for ease of exposition, and we let $\Pi_i = R_i - c_i$ denote the overall joint payoff of the three players when the buyer purchases from seller $i$. Thus, our assumptions imply that $\Pi_i > 0$ for $i \in \{1,2\}$. In what follows, we say that seller $i$ is more efficient than seller $j$ if and only if $\Pi_i > \Pi_j$. The sellers are equally efficient if and only if $\Pi_1 = \Pi_2$.

The game consists of three stages. In stage one, the buyer and seller 1 negotiate a contract for the purchase of one unit of good 1. The contract specifies a payment $T_{11}$ if the buyer purchases from seller 1 and a payment $T_{10}$ if the buyer does not purchase from seller 1. In stage two, the buyer and seller 2 negotiate a contract for the purchase of one unit of good 2, specifying payments $T_{22}$ and $T_{20}$. Let $T_i$ denote the buyer’s contract with seller $i$. In stage three, the buyer decides which (if any) good to purchase and makes the required payments.

We assume the buyer cannot purchase from a seller with whom she has no contract. Thus, if a seller has no contract with the buyer, the seller’s payoff is zero. If seller $i$ has a contract with the buyer, the seller’s payoff is $T_{ij} - c_i$ if the buyer purchases from him, and $T_{ij}$ otherwise. The buyer’s payoff is $R_i - T_{ij} - T_{0j}$ if she purchases from seller $i \neq j$, where $T_{0j} = 0$ if no contract with seller $j$ has been signed. If the buyer does not purchase from either seller, her payoff is $-T_{10} - T_{20}$, where $T_{10} = 0$ if there is no contract with seller $i$.

We use as our bargaining protocol a simple non-cooperative bargaining game in which in each negotiation one player makes a take-it-or-leave-it offer to the other. In this environment, we equate a player’s bargaining power with the probability with which it gets to make the offer; the greater the probability of making the offer, the greater is the player’s bargaining power. This approach of allowing there to be some probability with which each player has the power to
make a take-it-or-leave-it offer in its respective negotiation is made for convenience and allows us to avoid mixing cooperative and non-cooperative solution concepts. It also allows us to capture the possibility that there is uncertainty about the future state of the world and thus uncertainty about the determinants of future bargaining power. In the case of a downstream firm and two suppliers, when the former negotiates with the first supplier, it may not know various economic factors that will affect what the second supplier’s other options will be, whether there will be good substitutes for the supplier’s product, or how risk averse that supplier will be. Thus, when the downstream firm and first supplier negotiate, they may not know which player will be making the offer in the future negotiation.

We assume that with probability $\lambda_1 \in [0,1]$, seller 1 makes a take-it-or-leave-it offer to the buyer in stage one, and with probability $1 - \lambda_1$, the buyer makes a take-it-or-leave-it offer to seller 1 in stage one. Similarly, with probability $\lambda_2 \in [0,1]$, seller 2 makes a take-it-or-leave-it offer to the buyer in stage two, and with probability $1 - \lambda_2$, the buyer makes a take-it-or-leave-it offer to seller 2 in stage two. Parameters $\lambda_1$ and $\lambda_2$ measure the bargaining powers of sellers 1 and 2, respectively, in the sense that a larger value of $\lambda_1$ implies that seller i has more bargaining power. In the special case of $\lambda_1 = 1$, seller i has all the bargaining power (with respect to the buyer), in the case of $\lambda_1 = 0$, the buyer has all the bargaining power (with respect to seller i), and in the case of $\lambda_1 = \frac{1}{2}$, the buyer and seller i have equal bargaining power. The timing of the game is such that when the buyer and seller 1 negotiate their contract in stage one, they do not know which player will make the offer in stage two.

### 3. Results

We consider first the equilibrium of the stage-two negotiation taking contract $T_{11}$ as given. If the buyer makes the offer in stage two, then clearly it is an equilibrium for the buyer to offer seller 2 a contract that just covers seller 2’s cost if the buyer purchases from seller 2, and pays zero to seller 2 otherwise. In this case, whether or not the buyer purchases from seller 2 (and thus not from seller 1) in stage three depends on whether her payoff from doing so, $\Pi_{12} - T_{11}$, is greater than or less than her payoff from purchasing from seller 1, $R_1 - T_{11}$.

**Lemma 1.** Given $T_{11}$ from stage one, if the buyer makes the offer in stage two, then there is an equilibrium of the continuation game in which the buyer offers $T_{22}$ defined by

$$ T_{22}^b \equiv c_2 + T_{20}^b = 0. $$

Furthermore, if $\Pi_{12} - T_{10} < R_1 - T_{11}$, then the buyer purchases from seller 1 in stage three and pays $T_{11}$ to seller 1 and zero to seller 2; and if $\Pi_{12} - T_{10} > R_1 - T_{11}$, then the buyer purchases from seller 2 in stage three and pays $T_{10}$ to seller 1 and $c_2$ to seller 2.

**Proof.** See Appendix A.

If seller 2 makes the offer in stage two, then seller 2 will offer a contract that extracts all the buyer’s rent from negotiating with him, taking into account the buyer’s alternative of purchasing from seller 1 and receiving $R_1 - T_{11}$ or purchasing nothing and receiving $-T_{10}$.

**Lemma 2.** Given $T_{11}$ from stage one, if seller 2 makes the offer in stage two, then there is an equilibrium of the continuation game in which seller 2 offers $T_{22}^s(T_{11})$ defined by

$$ T_{22}^s(T_{11}) \equiv \max\{c_2, R_2 - T_{10} - \max\{R_1 - T_{11}, -T_{10}\}\} \text{ and } T_{20}^s \equiv 0. $$

Furthermore, if $\Pi_{12} - T_{10} < R_1 - T_{11}$, then the buyer purchases from seller 1 in stage three and pays $T_{11}$ to seller 1 and zero to seller 2, and if $\Pi_{12} - T_{10} > R_1 - T_{11}$, then the buyer purchases from seller 2 in stage three and pays $T_{10}$ to seller 1 and $T_{22}^s(T_{11})$ to seller 2.

**Proof.** See Appendix A.

Once again, we find that whether the buyer purchases from seller 2 in stage three depends on whether the buyer and seller 2’s joint payoff when the buyer purchases from seller 2 is greater than or less than the joint payoff of the buyer and seller 2 when the buyer purchases from seller 1. Lemmas 1 and 2 thus imply that regardless of who makes the offer in stage two, the buyer will purchase from seller 1 if $R_1 - T_{11} > \Pi_{12} - T_{10}$ and from seller 2 if the opposite inequality holds.

It follows that the buyer will only purchase from an efficient seller in equilibrium. To see this, suppose contracts $T_{11}$ and $T_{22}$ are such that the buyer purchases from seller 2 in stage three. Then, seller 1 earns payoff $T_{10}$, and the buyer earns payoff $R_2 - T_{22} - T_{11}$. But if seller 2 is inefficient, then the buyer and seller 1 could have earned strictly higher payoff by negotiating

$$ T_{11} = R_1 - \Pi_{12} + T_{10} - \varepsilon, $$

provided that $\varepsilon$ is positive and sufficiently small. Given this $T_{11}$, and the equilibrium contract $T_{22}$ in stage two, it is a strict best response for the buyer to purchase from seller 1 in stage three, giving seller 1 a payoff of $T_{11} - c_1$, seller 2 a payoff of zero, and the buyer a payoff of $R_1 - T_{11}$. Substituting $T_{11}$ into these payoffs, it follows that for $\varepsilon$ positive and sufficiently small, both the buyer and seller 1 are strictly better off. Using similar reasoning, it is straightforward to show that trade will not occur with seller 1 if instead seller 1 is inefficient.

**Proposition 1.** Subgame-perfect equilibria (SPE) exist, and in all equilibria the buyer only purchases from an efficient seller.

**Proof.** See Appendix A.

**Proposition 1** extends Aghion and Bolton (1987)’s model with perfect information by showing that a more even distribution of bargaining power does not affect the efficiency properties of the equilibrium outcome. The offers in stage one maximize overall joint payoff and surplus is extracted from seller 2 either by using break-up fees in which the buyer pays seller 1 if it purchases from seller 2 (i.e., by choosing $T_{10} > 0$) or by setting $T_{11}$ appropriately.

As we show in the next subsection, however, the distribution of bargaining power does affect the degree to which the buyer and seller 1 can extract surplus from seller 2, and as we show in the remainder of this subsection, it also affects whether the buyer and seller 1 will resort to the use of break-up fees as a means of extracting some or all of seller 2’s surplus.

When seller 2 is more efficient than seller 1, a key feature of the equilibrium contracts is the specification of payments to seller 1 in the event the buyer subsequently chooses to purchase from seller 2. This can happen, for example, when seller 1 makes the offer in stage one, but only if seller 2 has some bargaining power, because only then is seller 1 valuable to the buyer as an outside option. In the case where seller 2 is the efficient seller and has no bargaining power, the buyer has no incentive to contract with seller 1, much less consent to a break-up fee. Similarly, break-up fees play no role if seller 2 is less
efficient than seller 1. For in that case, Proposition 1 implies that the buyer will always purchase from seller 1.

We now characterize the use of break-up fees in equilibrium.

Proposition 2. In all SPE the buyer pays a break-up fee to seller 1 if and only if seller 1 is inefficient, seller 1 makes the offer in stage one, and $\lambda_2 > 0$. When a break-up fee is paid in equilibrium, the amount that is paid is increasing in seller 2’s bargaining power.

Proof. See Appendix A.

Proposition 2 implies that break-up fees will only be observed when both sellers have some bargaining power. It also implies that break-up fees will always be observed when seller 1 has all the bargaining power in stage one, seller 2 has some bargaining power in stage two, and the buyer purchases from seller 2. Break-up fees will not be observed, however, when seller 1 is efficient, seller 2 has no bargaining power, or when the buyer makes the offer in stage one. The intuition is that when the buyer has all the bargaining power, her preferred method of surplus extraction is to have a lower price in place with the first seller for the seller’s unit. This is because although both a break-up fee and a lower unit price increase the buyer’s opportunity cost of trading with the second seller, only the former represents an out-of-pocket cost to the buyer if she actually trades with the second seller. Thus, the buyer has no incentive to offer a break-up fee to seller 1 when she makes the offer in stage one, and she has no incentive to accept a break-up fee from seller 1 when seller 1 makes the offer but $\lambda_2 = 0$ (i.e., when the buyer has all the bargaining power with respect to seller 2). Hence, in these cases, and when the buyer does not purchase from seller 2, break-up fees do not arise in equilibrium. In all other cases, break-up fees do arise and are increasing in seller 2’s bargaining power, as then the buyer’s outside option vis-à-vis the first seller is decreasing.

3.1. Full extraction and below-cost pricing

We now turn our attention to the $T_{11}$ term in the buyer and seller 1’s contract and consider how it and $T_{10}$ interact to allow surplus extraction from seller 2 when seller 2 is efficient. In particular, we begin by considering when full extraction from seller 2 is and is not possible.\(^{11}\)

It should be clear that seller 2’s payoff is zero if the buyer makes the offer in stage two. It should also be clear that seller 2’s payoff is zero if the buyer purchases from seller 1. Thus, it remains only to consider cases in which the buyer purchases from seller 2 and there is some chance that seller 2 makes the offer. In these cases, as shown in Lemma 2, seller 2 earns zero payoff if and only if\(^ {12}\)

$$c_2 = R_2 - T_{10} - R_1 + T_{11},$$

or, equivalently, if and only if

$$c_1 + \Pi_1 - \Pi_2 = T_{11} - T_{10}. \quad (3)$$

In the absence of restrictions on $T_{11}$ and $T_{10}$, condition (3) will be satisfied in any SPE in which the buyer purchases from seller 2 and $\lambda_2 > 0$, regardless of whether the buyer or seller 1 makes the offer in stage one. To see this, note that in these cases, the buyer’s expected payoff in the continuation game after stage one if a contract is in place with seller 1 is

$$\lambda_2 (R_1 - T_{11}) + (1 - \lambda_2) (\Pi_2 - T_{10}). \quad (4)$$

where $R_1 - T_{11}$ is the buyer’s continuation payoff if seller 2 makes the offer in stage two and $\Pi_2 - T_{10}$ is the buyer’s continuation payoff if the buyer makes the offer in stage two. Proceeding back to the first stage, if the buyer makes the offer in stage one, she maximizes her payoff in (4) subject to seller 1 earning non-negative payoff by choosing $T_{10} = 0$ and $T_{11} = c_1 + \Pi_1 - \Pi_2$, thus satisfying condition (3) and earning payoff $\Pi_2$. If instead seller 1 makes the offer in stage one, then seller 1 maximizes his payoff, $\Pi_{10}$, subject to the buyer earning her outside option, $(1 - \lambda_2) \Pi_2$, by choosing $T_{10}$ and $T_{11}$ to satisfy condition (3) and

$$\lambda_2 (R_2 - T_{11}) + (1 - \lambda_2) (\Pi_2 - T_{10}) = (1 - \lambda_2) \Pi_2. \quad (5)$$

The unique solution entails seller 1 choosing $T_{11} = c_1 + \Pi_1 - (1 - \lambda_2) \Pi_2$, and $T_{10} = \lambda_2 \Pi_2$.\(^{13}\)

This shows that full extraction is achieved in any SPE in which the buyer purchases from seller 2 and $\lambda_2 > 0$. But notice from condition (3), however, that if $T_{10} < \Pi_2 - \Pi_1$, as it must be in these cases if the buyer makes the offer in stage one or her outside option with seller 1 in stage one is sufficiently large, seller 1 would have to be willing to sell his unit at a loss if full extraction from seller 2 is to be achieved. Thus, for example, if seller 1 is inefficient, so that $\Pi_2 > \Pi_1$, and the buyer makes the offer in stage one, then seller 1 must agree to sell at

$$T_{11} = c_1 + \Pi_1 - \Pi_2 < c_1,$$

if full extraction is to be achieved, and if seller 1 makes the offer in stage one, it must set

$$T_{11} = c_1 + \Pi_1 - (1 - \lambda_2) \Pi_2,$$

if full extraction is to be achieved, where $T_{11}$ is less than $c_1$ if and only if $(1 - \lambda_2) \Pi_2 > \Pi_1$.\(^{14}\)

Although an offer to sell at a loss may be feasible in principle, in practice, such offers may violate antitrust laws. In the U.S., there are laws against predatory pricing that hold firms liable for treble damages if they sell their products at below-cost prices. This implies that a contract between the buyer and seller 1 that involves below-cost pricing may not be effective in extracting surplus from seller 2. To see why this may be so, suppose that after contracts are negotiated in stages one and two, and after the buyer makes her purchase in stage three, seller 2 has the option of taking seller 1 to court and claiming that seller 1 has engaged in predatory pricing, thereby causing it to be excluded from the market. For this option to have value for seller 2, seller 2 would have to prove two things in court. First, he would have to show that seller 1’s price to the buyer was indeed below some appropriate measure of cost (in this case, he would have to show that seller 1’s price was below seller 1’s cost of producing one unit), and second, he would have to show that he was excluded from the market (in this case, he would have to show that the buyer purchased from seller 1). Assuming both things were true and could be verified by the courts, seller 2 would be entitled to receive treble damages. If all parties expect these damages to be equal to what seller 2 would have received if seller 1 had not engaged in the illegal activity, then it is

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\(^{11}\) We will focus here on the case where seller 2 is efficient (otherwise, full extraction from seller 2 trivially holds). One can think of the order of negotiations as being exogenously given, with seller 1 being inefficient, or, one can think of the buyer as having chosen to negotiate first with the inefficient seller. Such a choice turns out to be weakly optimal, as it is straightforward to show that the buyer’s payoff is independent of the order of negotiations when below-cost pricing is infeasible, whereas it weakly prefers to negotiate first with the inefficient seller when below-cost pricing is feasible. See also the discussion in Marx and Shaffer (2007).

\(^{12}\) If $c_2 < R_2 - T_{10} - R_1 + T_{11}$, then the buyer purchases from seller 1, and if $c_2 < R_2 - T_{10} - R_1 + T_{11}$, so that the buyer purchases from seller 2, then Lemma 2 implies $T_{11} = c_2$ and seller 2 earns positive payoff.

\(^{13}\) The buyer’s outside option, $(1 - \lambda_2) \Pi_2$, is what she could expect to earn if she rejected seller 1’s offer.

\(^{14}\) In the case of the buyer making the offer, $T_{11}$ is found by setting $T_{10} = 0$ and solving condition (3). In the case of seller 1 making the offer, $T_{11}$ is found by choosing $T_{10}$ and $T_{11}$ to solve conditions (3) and (5).
straightforward to show that there is no equilibrium in which the stage-one contract exhibits below-cost pricing.\footnote{See Appendix A for full details of the modified game and a proof of the result that below-cost pricing does not arise. Intuitively, if the stage-one contract were to exhibit below-cost pricing, seller 2 would be better off making an offer in stage two that would cause the buyer to purchase from seller 1. Seller 2 could then sue and claim—correctly—that seller 1 had engaged in predatory pricing. With the trebling of damages, seller 2 would be better off than if it had secured the buyer’s patronage, but seller 1 would be worse off.}

One might argue that full extraction could be achieved without violating antitrust laws if upfront payments were feasible. And, indeed, they would allow for full extraction without having to set $T_{11} < c_1$. To see this, suppose, for example, that seller 1 makes the offer in stage one and $(1 - \lambda_2)\Pi_2 > \Pi_1$, implying that seller 2 is efficient and full extraction would otherwise require setting $T_{11} < c_1$. Then, in the absence of anti-predation laws, seller 1 could achieve full extraction by offering the buyer an upfront payment of $(1 - \lambda_2)\Pi_2 - \Pi_1$ in exchange for the buyer signing a contract with $T_{11} = c_1$ and $T_{10} = \Pi_2 - \Pi_1$. The buyer would accept this offer and seller 2’s surplus would be fully extracted for the reasons discussed above. However, once again, laws against predatory pricing may make this solution problematic. Seller 2 could adopt the strategy above and take seller 1 to court, claiming that it had been illegally foreclosed and that the buyer’s net cost of purchasing from seller 1 was in fact below seller 1’s marginal cost of production (i.e., $c_1 + \Pi_1 - (1 - \lambda_2)\Pi_2 < c_1$).

Contracts involving below-cost pricing may also be problematic in settings other than intermediate-goods markets. In labor markets, for example, where the players are employers and employees, an employee (seller) can in many cases legally break his contract without compensating the employer (buyer) by quitting, so an employee’s contractual agreement to supply labor for the employer at less than his opportunity cost of time if called upon to do so, may not provide a credible threat for the employer when, for example, she is negotiating a wage contract with a second employee. If the second employee were to make the offer in stage two, for example, the employee could effectively ignore the employer’s contract with the first employee, knowing that the first employee would quit rather than honor his agreement.\footnote{Here the possibility of upfront payments might suffice to mitigate ex-post incentives to quit, but these payments would require potentially deep pockets on the part of the employer, which may not be realistic.}

Thus, for these reasons, it is useful in the next proposition to summarize our findings above for the case in which below-cost pricing is feasible and for the case in which it is not.\footnote{The interested reader may wonder whether it is still the case that all equilibria will be efficient if below-cost pricing is infeasible. The answer is no because SPE exist in which the buyer purchases from the inefficient seller if and only if seller 2 is the efficient seller, $\lambda_1 < 1$, and $\lambda_2 = 1$. For example, if $\lambda_1 = 0$, $\lambda_2 = 1$, and $\Pi_1 < \Pi_2$, then there is an equilibrium in which the buyer offers seller 1 a contract with $T_{11} = c_1$, and $T_{10} = \Pi_2 - \Pi_1$, and does not contract with seller 2 (in the continuation game, seller 2 is indifferent between offering a contract that is accepted by the buyer and not). However, in these cases equilibria in which the buyer purchases from the efficient seller also exist, and the inefficient equilibria are always Pareto-dominated.}

Proposition 3. If below-cost pricing is feasible, seller 2 is inefficient, or $\lambda_2 = 0$, then seller 2 earns zero payoff in all SPE. If below-cost pricing is not feasible, seller 1 is inefficient, and $\lambda_2 > 0$, then seller 2 earns positive expected payoff in all SPE if and only if either the buyer makes the offer in stage one and $\lambda_2 < 1$, or seller 1 makes the offer and $\Pi_1 < (1 - \lambda_2)\Pi_2$.

Proof. See Appendix A.

Proposition 3 implies that even though there is perfect information, the second seller’s surplus may not be fully extracted if the second seller is efficient and below-cost pricing is infeasible. This result contrasts with that of Aghion and Bolton (1987), where full extraction always occurs when there is perfect information (this is because in Aghion and Bolton, both sellers make the offers and thus below-cost pricing is not a feature of equilibrium contracts).

The inability of the buyer and seller 1 to fully extract seller 2’s surplus in all cases when below-cost pricing is infeasible can be understood intuitively by noting that the buyer and seller 1 can extract surplus from seller 2 either by decreasing $T_{11}$ or increasing $T_{10}$. Extraction that occurs through a reduction in $T_{11}$ increases the buyer’s expected payoff, while extraction that occurs through an increase in $T_{10}$ decreases the buyer’s expected payoff. Thus, if the buyer has all the bargaining power in stage one, she will prefer to extract seller 2’s surplus by reducing $T_{11}$ without increasing $T_{10}$. In fact, if $\lambda_2 < 1$ it will never be profitable for the buyer to offer seller 1 a contract with $T_{10} > 0$. But if $T_{11}$ is bounded below by $c_1$, then from condition (3), full extraction requires that $T_{11} \geq \Pi_2 - \Pi_1$, and thus it follows that seller 2 will have positive expected payoff if there is any chance of the buyer making the offer in stage one. If seller 1 has all the bargaining power in stage one, then whether full extraction is possible depends on what the buyer could earn if she rejected seller 1’s contract. If the buyer’s outside option is such that $(1 - \lambda_2)\Pi_2 > \Pi_1$, then the buyer will reject any offer from seller 1 with $T_{10} \geq \Pi_2 - \Pi_1$, which ensures that seller 2 will have positive expected payoff.

3.2. Illustrative examples

It may be useful to illustrate these results with some numerical examples. Suppose the buyer values each seller’s unit at 1, the cost of seller 1’s unit is 1/2, and the cost of seller 2’s unit is zero (so that $\Pi_1 = 1/2$ and $\Pi_2 = 1$). Consider two values of $\lambda_2$, say $\lambda_2 = 1/3$ and $\lambda_2 = 2/3$.

In both cases, if below-cost pricing is feasible and the buyer makes the offer in stage one, it is optimal for the buyer to offer seller 1 the contract $T_{11} = 0$ and $T_{10} = 0$. Given this contract, which seller 1 will accept, seller 2 can do no better than to offer his unit at cost $c_2 = 0$ to the buyer, implying that regardless of whether seller 2 or the buyer makes the offer in stage two, the buyer will earn payoff $\Pi_2$, seller 2 will earn zero, and seller 1 will earn zero.

If below-cost pricing is feasible and seller 1 makes the offer in stage one, it is optimal for seller 1 to offer the buyer the contract $T_{11} = \Pi_1 = 1/3$ when $\lambda_2 = 1/3$ and $T_{11} = \Pi_2 = 1/3$ when $\lambda_2 = 2/3$. In both cases, the buyer’s payoff if she rejects seller 1’s offer would be $(1 - \lambda_2)\Pi_2$, which is what she would earn if she accepts seller 1’s contract given that seller 2’s surplus would then be fully extracted (because condition (3) is satisfied). It is thus optimal for the buyer to accept seller 1’s contract, resulting in a payoff to seller 1 of $T_{10}$ in the continuation game, a payoff to the buyer of $(1 - \lambda_2)\Pi_2$, and a payoff to seller 2 of zero.

These examples show that when there are no restrictions on below-cost pricing, the buyer and seller 1 can always extract all the surplus of the more efficient second seller. The intuition is the following. If the buyer makes the offer in stage one, she will offer seller 1 a contract with price $T_{11} = c_2$ (i.e., below seller 1’s unit cost). Because of this, if seller 2 wants to sell to the buyer in stage two, he will have to offer a price of $T_{22} = c_2$, thereby transferring all the surplus $\Pi_2$ to the buyer. If, instead, seller 1 makes the offer in stage one, he will offer a contract with both a price and a break-up fee. The price is chosen to elicit the buyer’s acceptance: it is fixed in such a way that the buyer would achieve her outside option utility if she bought at that price—i.e., the utility $(1 - \lambda_2)\Pi_2$ expected if she rejected the offer and decided to negotiate only with seller 2. The break-up fee is chosen to extract the additional surplus $\lambda_2\Pi_2$ from seller 2; even if seller 2 has all the bargaining power at stage two, he will have to offer a price of $T_{22} = c_2$ if he is to induce the buyer to pay the break-up fee and purchase from him. Note that seller 1’s contract also involves below-cost pricing if the buyer’s outside option is large enough, i.e., if the second seller’s bargaining power is sufficiently low.

3.2.1. No below-cost pricing

If below-cost pricing is infeasible and the buyer makes the offer in stage one, then the best the buyer can do is to offer seller 1 the contract $T_{11} = 1/2$ and $T_{10} = 0$. Given this contract, which seller 1 will
accept, seller 2 will earn payoff \( \lambda_2/2 \) in the continuation game (seller 2’s continuation payoff is given by his cost advantage \( c_1 - c_2 \) times the probability with which he makes the offer in stage two), the buyer will earn \( \Pi_1 - \lambda_2/2 \), and seller 1 will earn zero.

In contrast, if below-cost pricing is infeasible and seller 1 makes the offer in stage one, whether seller 2 earns positive payoff in the continuation game will depend on whether his bargaining power is above or below the critical cut-off level. If \( \lambda_2 = 2/3 \), then seller 1’s optimal contract in stage one is the same as it was before (\( T_{11} = T_{10} = 2/3 \)) and the restriction on below-cost pricing has no effect. Seller 2 will earn zero. But if \( \lambda_2 = 1/3 \), then the best seller 1 can do is to offer the buyer the contract \( T_{11} = 1/2 \) and \( T_{10} = 1/4 \). Given this contract, seller 2 will earn payoff \( \lambda_2/4 \) in the continuation game (seller 2’s continuation payoff in this case is equal to his cost advantage \( c_1 - c_2 \) minus the break-up fee that must be paid to seller 1 times the probability with which he makes the offer in stage two), the buyer will earn \( (1 - \lambda_2)(\Pi_2 - 1/4) + \lambda_2(1/2 - 1/4 - 1/4) = (1 - \lambda_2)\Pi_2 \), and seller 1 will earn 1/4.

As these examples show, the payoff of each seller may depend in a non-obvious way on his own and the other seller’s bargaining power. First, they suggest that seller 1 may be better off the stronger is seller 2 (the higher is \( \lambda_2 \)). Indeed, the more likely it is that seller 2 makes the offer in stage two, the lower will be the buyer’s outside option. This makes it more likely that full surplus extraction will be possible even without the use of below-cost pricing, and even when full extraction is not possible, the lower is the buyer’s outside option, the higher is the break-up fee that seller 1 can charge and still elicit the buyer’s acceptance of the initial contract (i.e., the higher is the rent and thus the payoff that seller 1 can earn).

Second, seller 2 may benefit from being a weaker bargainer (having a lower \( \lambda_2 \)). This follows immediately from observing that when \( \lambda_2 = 1/3 \) and seller 1 makes the offer in stage one, seller 2 earns positive payoff when below-cost pricing is infeasible, but when \( \lambda_2 = 2/3 \), seller 2 earns zero payoff under the same circumstances. As we will also show (see the comparative statics subsection below), in the region where full extraction from seller 2 is not possible, the lower is \( \lambda_2 \), the higher is the buyer’s outside option and thus the lower is the break-up fee that seller 1 can charge and still elicit buyer acceptance. It follows that the joint surplus of the buyer and seller 2 at stage two will be higher. Hence, as \( \lambda_2 \) decreases, seller 2 will appropriate a larger share of a larger pie. The latter effect may dominate if \( \lambda_2 \) is not too low, so that seller 2’s expected payoff will increase as his bargaining power decreases.

### 3.3. Comparative statics

A restriction on below-cost pricing has some surprising implications for the effects of bargaining power on each player’s payoff. For example, we have seen that when seller 1 makes the offer in stage one and seller 2 is efficient, seller 2’s payoff is zero if below-cost pricing is feasible or \( \lambda_2 \) is such that \( \Pi_1 > (1 - \lambda_2)\Pi_2 \). But if below-cost pricing is infeasible and his bargaining power is sufficiently low but non-zero, then, surprisingly, seller 2 may earn positive expected payoff. This implies that non-local increases in seller 2’s bargaining power may actually make seller 2 worse off. We summarize this result in the following proposition.

**Proposition 4.** If \( \Pi_2 > \Pi_1 \) and below-cost pricing is infeasible, seller 2 may earn higher expected payoff with a small amount of bargaining power than with all the bargaining power.

The result in **Proposition 4** turns on the relation between \( \Pi_1 \) and \( (1 - \lambda_2)\Pi_2 \). If the latter is greater and below-cost pricing is infeasible, then we have seen that the buyer strictly gains from purchasing from seller 2 and so seller 2 earns positive expected payoff if \( \lambda_2 > 0 \). In contrast, if \( \Pi_1 > (1 - \lambda_2)\Pi_2 \) then seller 1’s optimal contract if he makes the offer in stage one is \( T_{11} = c_1 + \Pi_1 - (1 - \lambda_2)\Pi_2 \) and \( T_{10} = \lambda_2\Pi_2 \), giving seller 2 zero payoff.\(^\text{18}\) Intuitively, when seller 1 makes the offer in stage one, seller 2 must rely on the buyer to reject any offer that extracts all of seller 2’s surplus. But the buyer will reject such offers only if her probability of making the offer in stage two is sufficiently large (any small) that she prefers to take a chance on being able to extract seller 2’s surplus for herself (rather than giving it to seller 1).

### 3.3.1. The effects of local changes in bargaining power

**Proposition 4** is concerned with the effects of non-local changes in seller 2’s bargaining power. We now consider how local changes in each player’s bargaining power affect the distribution of surplus among all three players. We first solve for the expected equilibrium payoffs and then conduct comparative statics with respect to each player’s bargaining power.

To simplify, we focus on the case in which seller 2 is efficient and below-cost pricing is infeasible. In this case, if the buyer makes the offer in stage one, then in any efficient SPE, we have seen that the buyer will offer \( T_{11} = c_1 \) and \( T_{10} = 0 \), giving seller 1 a payoff of zero, the buyer an expected payoff of \( \lambda_2\Pi_1 + (1 - \lambda_2)\Pi_2 \) (where we have substituted \( T_{11} \) and \( T_{10} \) into condition (4)), and seller 2 an expected payoff of \( \Pi_2 - (\lambda_2\Pi_1 + (1 - \lambda_2)\Pi_2) = \lambda_2(\Pi_2 - \Pi_1) \).

If seller 1 makes the offer in stage one and \( (1 - \lambda_2)\Pi_2 < \Pi_1 \), so that full extraction is possible, then in any efficient SPE, we have seen that seller 2 earns zero, the buyer earns \( (1 - \lambda_2)\Pi_2 \), and seller 1 earns \( \lambda_2\Pi_2 \). On the other hand, if \( (1 - \lambda_2)\Pi_2 > \Pi_1 \) and seller 1 makes the offer, then seller 1 maximizes his payoff, \( T_{10} \), subject to \( T_{11} \geq c_1 \) and condition (5) by choosing \( T_{11} = c_1 \) and \( T_{10} = \lambda_2\Pi_1/\Pi_2 \). Given seller 1 an expected payoff in this case of \( \lambda_2\Pi_2 - \lambda_2\Pi_1/\Pi_2 \), the buyer an expected payoff of \( (1 - \lambda_2)\Pi_2 \) and seller 2 an expected payoff of \( \Pi_2 - \lambda_2\Pi_1/\Pi_2 \).

Summing the expected payoffs in the various cases for each player when seller 2 is efficient and below-cost pricing is infeasible, and taking into account the probability that seller 1 makes the offer in stage one, yields the equilibrium expected payoffs given in Table 1.\(^\text{19}\)

Consistent with **Proposition 4**, Table 1 shows that seller 2 does not always earn higher payoff with more bargaining power. In particular, if \( \Pi_2 > \Pi_1 \), \( \lambda_2 = 1 \), and \( \lambda_2 > 0 \), then all surplus is extracted from seller 2 if and only if \( \lambda_2 \geq \lambda_2^* \), where \( \lambda_2^* = (1 - \lambda_2)(1 - \lambda_2) \Pi_2 \). This implies that when seller 2’s surplus is not fully extracted, non-local increases in \( \lambda_2 \) to a value above \( \lambda_2^* \) cause seller 2’s payoff to decrease from something positive to zero. The comparative static for local increases in \( \lambda_2 \) for all \( \lambda_2 < \lambda_2^* \) is given in the following proposition (the proof follows by differentiating the expected payoff expressions in Table 1 with respect to \( \lambda_2 \)).

\[ \frac{\Pi_1}{\Pi_2} < \lambda_1 + (1 - \lambda_2)^2 \lambda_2 \]  

*In contrast, the buyer’s equilibrium expected payoff is always decreasing in the bargaining power of seller 2.*

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\(^{18}\) To see this, note that under this contract, the buyer’s expected payoff is \( (1 - \lambda_2)\Pi_2 \) if seller 2 gets to make the offer in stage two (if seller 2 does not leave the buyer with surplus at least \( (1 - \lambda_2)\Pi_2 \), the buyer declines seller 2’s offer and purchases from seller 1) and is \( \Pi_2 = T_{10} = (1 - \lambda_2)\Pi_2 \) if she gets to make the offer in stage two. Thus, the buyer earns \( (1 - \lambda_2)\Pi_2 \). Because the proposed contract \( T_{10} \) maximizes seller 1’s payoff of \( T_{10} \) subject to the constraint of meeting the buyer’s outside option, it is an optimal contract offer.

\(^{19}\) For details on the derivation of the payoffs in Table 1, see Appendix A.

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### Table 1: Equilibrium expected payoffs.

<table>
<thead>
<tr>
<th>Condition</th>
<th>( \Pi_1 &lt; (1 - \lambda_2)\Pi_2 )</th>
<th>( (1 - \lambda_2)\Pi_2 \leq \Pi_1 &lt; \Pi_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buyer</td>
<td>( (1 - \lambda_2)\Pi_1 + \lambda_2(1 - \lambda_1)\Pi_1 )</td>
<td>( (1 - \lambda_2)\Pi_2 + \lambda_2(1 - \lambda_1)\Pi_1 )</td>
</tr>
<tr>
<td>Seller 1</td>
<td>( \lambda_2\Pi_2 )</td>
<td>( \lambda_2\Pi_2 )</td>
</tr>
<tr>
<td>Seller 2</td>
<td>( \lambda_2\Pi_2 - (\lambda_2\Pi_1 + (1 - \lambda_2)\Pi_2) = \lambda_2(\Pi_2 - \Pi_1) )</td>
<td>( \lambda_2(1 - \lambda_1)(\Pi_2 - \Pi_1) )</td>
</tr>
</tbody>
</table>
his own bargaining power. There exist parameters such that seller 2’s expected payoff is decreasing in his bargaining power. Thus, the relative gain from an increase in seller 2’s share of the surplus is more likely to lead to a decrease in seller 2’s payoff when seller 1’s bargaining power is large than small.

To better understand this result, assume \( (1-\lambda_2)\Pi_2 > \Pi_1 \), so that full extraction from seller 2 is not possible, and notice that the additional surplus available for the buyer and seller 2 to divide in stage two is \( \Pi_2 - T_{10} \), which is equal to \( \Pi_2 \) if the buyer made the offer in stage one and \( \Pi_2 - \frac{\lambda_1 R_1}{1-\lambda_1} \Pi_1 \) if seller 1 made the offer in stage one. Thus, the expected surplus available to be divided in stage two is

\[
(1-\lambda_1)\Pi_2 + \lambda_1 \left( \Pi_2 - \frac{\lambda_2 R_1}{1-\lambda_2} \Pi_1 \right) = \Pi_2 - \frac{\lambda_1 \lambda_2}{1-\lambda_2} \Pi_1.
\]

The higher is seller 2’s bargaining power, the larger is his expected share of this surplus. But, the expected surplus is decreasing in seller 2’s bargaining power. So even though more bargaining power gives seller 2 a larger share of the surplus, it decreases the surplus available for himself and the buyer to divide in stage two. As Proposition 5 shows, seller 2 may be worse off depending on which effect is larger, and this depends on the parameter values.20

The second result is more intuitive. The buyer is always worse off with an increase in seller 2’s bargaining power because both effects described above operate on her equilibrium expected payoff in the same direction: the buyer receives a smaller share of a smaller surplus.

The next proposition considers the effect of an increase in seller i’s bargaining power on seller j’s expected payoff, \( j \neq i \). The surprising result in this case is that the sellers’ preferences are not symmetric. Although seller 1 weakly prefers that seller 2 have more bargaining power, seller 2 weakly prefers that seller 1 have less bargaining power.

**Proposition 6.** Seller 1’s expected payoff is weakly increasing (strictly if \( \lambda_1 > 0 \)) in seller 2’s bargaining power. In contrast, when below-cost pricing is infeasible, seller 2’s expected payoff is weakly decreasing (strictly if \( \lambda_2 > 0 \) and \( \Pi_2 > \Pi_1 \)) in seller 1’s bargaining power.

Seller 1 prefers that seller 2 have more bargaining power (and thus that the buyer have less bargaining power) in the stage-two negotiation because the buyer’s disagreement payoff with seller 1 is \( (1-\lambda_2)\Pi_2 \), which is smaller when seller 2 has more bargaining power. In contrast, an increase in seller 1’s bargaining power increases the likelihood that the buyer and seller 1 can jointly extract all of seller 2’s surplus (depending on parameters, extraction may be full when \( \lambda_1 = 1 \), but not when \( \lambda_1 < 1 \)) thereby decreasing seller 2’s expected payoff.

Since the expected amount of rent extraction is increasing in the first seller’s bargaining power, it remains to be seen whether the buyer and first seller both gain when \( \lambda_1 \) increases, or whether the gains accrue only to one player. The next proposition implies that the latter holds because the two players differ in whether or not they prefer that seller 1’s bargaining power increase. Seller 1 prefers that it increase, but the buyer prefers that it decrease.

**Proposition 7.** When below-cost pricing is infeasible and \( \Pi_2 > \Pi_1 \), seller 1’s expected payoff is weakly increasing (strictly if \( \lambda_2 > 0 \)) in his own bargaining power, whereas the buyer’s expected payoff is weakly decreasing (strictly if \( \lambda_2 > 0 \)) in seller 1’s bargaining power.

Seller 1 gains from an increase in his bargaining power because this allows him to capture a larger share of a larger joint payoff with the buyer. On the other hand, the buyer’s expected payoff is weakly decreasing in seller 1’s bargaining power. To understand this, note that although surplus extraction is increasing in \( \lambda_1 \) when below-cost pricing is infeasible, all of the additional gains accrue to seller 1 (when seller 2 is efficient, all equilibrium contracts have \( T_{11} = c_1 \), and so increases in surplus extraction arise only through increases in \( T_{10} \), which accrue solely to seller 1). Thus, the buyer is left with a smaller share of a fixed payoff.

4. Applications and extensions

Although we have focused on the case of discrete quantities in which the buyer purchases at most one unit of one seller’s good, our main results (efficiency of equilibria, incentives for below-cost pricing off the equilibrium path, countervailing comparative statics with respect to bargaining power, and the role of break-up fees) extend to the case of a buyer wanting to purchase multiple units, potentially from multiple suppliers. It also extends to general cost functions and any degree of substitution and complementarity between the sellers’ products.

Specifically, consider the extension of our model to allow the buyer to purchase quantity \( x_1 \) from seller 1 and quantity \( x_2 \) from seller 2. Let seller 1 and 2’s opportunity costs be \( c_1(x_1) \) and \( c_2(x_2) \), respectively, and let \( R(x_1, x_2) \) denote the buyer’s maximized payoff gross of acquisition costs from purchases of \( (x_1, x_2) \).21 Furthermore, let \( T(x_1, x_2) \) be the contract between the buyer and seller 2 as a function of the quantities purchased from each seller.

In this more general model, it is still the case, as in Proposition 1, that equilibria are efficient and that, as in Proposition 2, equilibrium contracts may involve break-up fees. In addition, similar to Proposition 3, when below-cost pricing is permitted, there is full extraction from seller 2. However, a prohibition on below-cost pricing limits the ability of the buyer and seller 1 to extract surplus from seller 2. If the sellers’ products are perfect complements, the buyer must purchase both products to realize positive surplus, which makes it more difficult to extract surplus from seller 2 (unless \( \lambda_1 = 1 \)) than it would be, for example, if the sellers’ products were perfect substitutes. And if the products are perfect substitutes, the first-best with full extraction can be obtained over a larger range of parameter values.

The counterintuitive comparative statics of Propositions 4 and 5 also hold in the more general model. When surplus extraction is

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20 Seller 2’s expected payoff is decreasing in his own bargaining power for a larger range of parameter values the larger is seller 1’s bargaining power. This follows because the buyer’s expected payoff is decreasing in \( \lambda_1 \) and \( \lambda_2 \), and the cross derivative is negative. Thus, the relative gain from an increase in seller 2’s share of the rent is decreasing in seller 1’s bargaining power, and therefore capturing a larger share of a smaller rent is more likely to lead to a decrease in seller 2’s payoff when seller 1’s bargaining power is large than small.

21 Assume \( c_1(x_1) \) and \( c_2(x_2) \) are strictly increasing, continuous, and unbounded, with \( c_1(0) = c_2(0) = 0 \), and assume \( R(\cdot, \cdot) \) is continuous, bounded, and satisfies \( R(0, 0) = 0 \). These assumptions allow for the possibility that the sellers’ products are substitutes, complements, or independent in demand.
incomplete, seller 2’s payoff is decreasing in his own bargaining power for certain parameter values, typically when \( \lambda_1 \) and \( \lambda_2 \) are large. Moreover, as in Proposition 6, seller 2’s payoff is weakly decreasing in seller 1’s bargaining power but seller 1’s payoff is weakly increasing in seller 2’s bargaining power. A decrease in the latter’s bargaining power can push the buyer and seller 1 into the region of parameter space where full extraction is not possible and leave the buyer and seller 1 worse off.

Thus, the basic insight that the distribution of bargaining power affects multilateral negotiations between buyers and sellers in different ways than bilateral negotiations is robust.

### 4.1. Multiple buyers, single seller

We have thus far considered the case of a single buyer negotiating in sequence with two potential sellers, a set-up we chose in order to facilitate comparison with Aghion and Bolton’s (1987) seminal work on rent extraction. In this subsection, we show that our results are also robust to the case of a single seller who negotiates in sequence with two potential buyers.

To see that this case is isomorphic, label the buyers as buyer 1 and buyer 2 and assume that each buyer has unit demand and the seller has at most one unit to sell. We let \( \Pi_i = R_i - c_i \) denote the overall joint payoff of the three players if the seller sells to buyer \( i \), where \( R_i \) is the utility received by buyer \( i \), zero is received by buyer \( j \), and \( c_i \) is the seller’s cost.

The game consists of three stages. In stage one, the seller and buyer 1 negotiate contract \( \tilde{T}_1 \). The contract specifies a payment \( T_{11} \) from buyer 1 to the seller if the buyer purchases the seller’s unit and a payment \( T_{10} \) from buyer 1 to the seller if the buyer does not purchase from the seller. In stage two, the seller and buyer 2 negotiate contract \( \tilde{T}_2 \). The contract specifies payments \( T_{22} \) and \( T_{20} \). In stage three, the seller sells his unit to at most one buyer.

The seller cannot sell to a buyer with whom he has no contract. If a buyer has no contract with the seller, her payoff is zero. If buyer \( i \) has a contract with the seller, her payoff is \( R_i - \tilde{T}_{ij} \) if the seller sells to her, and \( -\tilde{T}_{ij} \) otherwise. The seller’s payoff is \( \tilde{T}_{ij} + \tilde{T}_{ij} - c_i \) if he sells to buyer \( i \neq j \), where \( \tilde{T}_{ij} = 0 \) if the seller has no contract with buyer \( j \). The seller’s payoff if he does not sell to a buyer is \( \tilde{T}_{10} + \tilde{T}_{20} \), where \( \tilde{T}_{10} = 0 \) if the seller has no contract with buyer \( i \).

As in the case with one buyer, we assume a simple non-cooperative bargaining game in which in each negotiation one player makes a take-it-or-leave-it offer to the other, and we equate a player’s bargaining power with the probability with which it gets to make the offer.

Given this set-up, our results hold by replacing \( \Pi_i \) with \( -c_i, c_i \) with \( -R_i, T_{ij} \) with \( -T_{ij} \), and \( T_{ij} \) with \( -T_{ij} \), where appropriate, and replacing ‘seller 1’ with ‘buyer 1’, ‘seller 2’ with ‘buyer 2’, ‘the buyer’ with ‘the seller’; and so forth. Thus, for example, the seller sells to the efficient buyer in all SPE when below-cost pricing is feasible, the contract between the seller and first buyer may sometimes contain break-up fees, and when below-cost pricing is infeasible, the second buyer’s payoff may sometimes be decreasing in her bargaining power.

### 4.2. Applications

We now turn our attention to some applications of the model. There are many real-world situations in which buyers and sellers with interdependent payoffs negotiate sequentially. Examples include mergers and acquisitions in which the takeover target negotiates first with one possible acquirer and then another, labor markets in which an employee must decide whether to leave her current job for another, goods markets in which a buyer negotiates in sequence with two potential suppliers of an input, and sports markets in which a coach who is under contract with one team negotiates for possible employment with a second team, or a team that is located in one city negotiates with a new city for possible relocation.

We have shown that the common player to both negotiations can sign a contract in the first negotiation that allows it and the first player to extract surplus from the second player. For example, in mergers and acquisitions, when a firm negotiates with one potential acquirer, it might agree to pay a break-up fee if it later rejects that offer in favor of an acquisition offer from another firm. These break-up fees reduce the surplus available to the second acquirer because if it does succeed in acquiring the firm, it also acquires the obligation to pay the break-up fee to the first potential acquirer. In other examples, the contractual features that may allow surplus extraction include non-compete clauses, liquidated damages, long-term contracts, pre-nuptial agreements, and non-refundable security deposits or downpayments.

In the rest of this section, we apply our results to the above-mentioned examples.

#### 4.2.1. Mergers and acquisitions

It is common in mergers and acquisitions for firms to negotiate a break-up fee to be paid by the acquisition target to the acquiring firm should the target receive and accept a competing offer. Most commonly, these break-up fees are payable only if the target is acquired by another firm, but in some cases they are payable whenever the acquisition fails to occur. For example, the pharmaceutical company Pharmacia & Upjohn Inc. agreed to pay Monsanto Co. a $575 million break-up fee if their $27 billion merger agreement was canceled or if Pharmacia & Upjohn accepted a “superior offer.” And in negotiations between investment firms Jostens Inc. and Investcorp SA, Jostens agreed to pay Investcorp a $19 million break-up fee if it were to accept a third-party takeover bid (Federal Filings Newswires, 4/10/2000).

Sometimes these break-up fees are actually paid. For example, insurer American General paid $600 million to Prudential when American General rejected Prudential’s takeover bid and agreed instead to merge with AIG, the world’s largest insurer (The Wall Street Journal, 5/29/2001, C2). However, sometimes no break-up fees are negotiated. In the oil exploration and production company Royal

22 Our assumption that the common player trades with only one of the other two players, although it may have contracts with both, is natural in these settings: a takeover target is acquired by one firm, an employee has one full-time job, a person has one spouse, a coach coaches one team, and a team bears one city’s name.


24 In goods markets, a buyer may have to pay damages to a seller if the relationship ends. In real-estate markets, non-refundable security deposits may be observed depending on whether the market favors buyers or sellers. In sports markets, although a team may gain some leverage in trade talks with another team when it must compensate players who are traded, the team would prefer to gain leverage by paying low salaries. Nevertheless, players who have enough bargaining power are routinely able to negotiate ‘trade-kicker’ clauses.

25 These contractual provisions found in takeovers are also known as target-termination fees. Officer (2003) shows that, in recent years, approximately 60% of acquisition contests involve the use of target-termination fees, which are on average at least 5% of the market value of the target firm’s equity. Reverse break-up fees, in which penalties are paid by buyers who do not consummate a deal with a given seller (e.g., because there is a better match with another seller) are also becoming common (www.sourcemedia.com 4/2/2007).

Dutch/Shell Group’s attempt to takeover Barrett Resources, Royal Dutch agreed to a binding merger agreement but still permitted Barrett to seek better offers for a period of time without a break-up fee (The New York Times, 3/29/2001, C4).

Our results imply that we should see break-up fees negotiated whenever the first potential acquirer has bargaining power with respect to the target firm, and that these fees will be paid whenever the second potential acquirer turns out to be a better match in the sense of creating greater value through acquisition than would the first potential acquirer. Our results also imply that the first potential acquirer will be better off the more bargaining power it has, and the more bargaining power the second potential acquirer is perceived to have, while the second acquirer will prefer that the first acquirer have less bargaining power. The second acquirer may even prefer that its own bargaining power be less, e.g., the less bargaining power AIG is perceived to have, the greater incentive American General has to reject an offer from Prudential that involves a break-up fee (because its perceived ability to negotiate a good deal with AIG is higher), thus increasing the value to AIG of acquiring it.

4.2.2. Labor markets

Labor market contracts often contain non-compete clauses that preclude employees from taking jobs at competing firms for a period of time after leaving their current job. Sometimes these firms compensate their rival to obtain the employee’s release. For example, although there was not an explicit non-compete agreement, chip manufacturer Motorola Inc. extracted a settlement from Intel Corp. when Motorola executive Mark McDermott and fifteen other Motorola employees left Motorola to take jobs at Intel (Wall Street Journal, 5/3/1999, B6).

Our results imply that we should see non-compete clauses in labor contracts when an employer can make take-it-or-leave-it offers with respect to its employees. They also imply that we should see employees leaving when their employment is more valuable elsewhere, with the non-compete clauses imposing costs on the new employers. Because a non-compete clause effectively extracts surplus from the new employer, our results also imply that the original employer will prefer that other potential employers have all the bargaining power with respect to the employee because then the employee’s outside options are poor and so the employee is more willing to accept a contract that includes a lengthy non-compete provision.

4.2.3. Sports and celebrities markets

There are many examples in which sports teams offer “guaranteed contracts” to their head coaches. Once in place, the coach may still be able to still switch teams, but in order to sign on with another team, the new team must buy the coach’s way out of the old contract. For example, when the Kansas City Chiefs hired football coach Dick Vermeil, who was still under contract with the St. Louis Rams, the Chiefs had to forfeit two draft picks and $500,000 in exchange for Vermeil’s release from his contract (Associated Press Newswires, 1/13/2001). Similarly, the Tampa Bay Buccaneers had to forfeit four draft picks and $8 million to hire football coach Jon Gruden away from the Raiders (USA Today, 2/19/2002), and the University of Michigan paid West Virginia $4 million to let Rich Rodriguez walk from his contract and coach the Wolverines (Associated Press Newswires, 12/16/2007).

In the examples above, the original team can be thought of as the first player and the coach can be thought of as the common player. On the other hand, athletes often have “trade-kicker” clauses in their contracts which compensate them in the form of a lump-sum payment if they are traded to a new team (for example, Chris Webber, a basketball player for the Sacramento Kings, had a 15% trade-kicker clause in his contract (Associated Press Newswires, 7/20/2001)). In these examples, the athlete can be thought of as the first player and the athlete’s original team can be thought of as the common player.

Our results have some interesting implications for the effect of guaranteed contracts on an athlete’s incentive to perform prior to becoming a free agent. Suppose a baseball team currently has a shortstop, but knows that a better shortstop will soon become available. The team might try to arrange its roster in such a way that it would be able to accommodate the new player even though cutting the current shortstop from the team would require that it forfeit the guaranteed portion of the current shortstop’s compensation. During the period when teams are making adjustments so that they would be able to compete for the free agent, the future free agent might be better off not having a star season, if having an exceptional season causes some teams to invest more in their current players, thinking that the free agent will be too expensive for their roster. The trade-off facing the free agent is that having a star season may allow him to command a higher salary among the teams which he negotiates, but the number of teams in the market for his services may be fewer as a result of his successes. That is, the free agent coming off a star season may command a larger share of the available economic surplus, but the economic surplus itself (which includes nonpecuniary factors such as having the option of playing for any team) may be smaller.

4.2.4. Goods markets

It is not uncommon for a buyer to negotiate an exclusive-dealing contract with one of her suppliers. For example, a hardware store might carry only one line of kitchen cabinets, an electronics store might carry only one brand of amplifiers, or a bike shop might carry only one line of bicycles. A computer manufacturer might use exclusively Intel’s processor or exclusively Microsoft’s operating system. Breach of such contracts often involves the payment of liquidated damages or the invocation of an explicit penalty clause in the contract. For example, prior to 1995, Microsoft negotiated “per-processor licensing” provisions in contracts with PC manufacturers requiring them to pay for the Windows operating system on all their machines even if some were sold without it (The Wall Street Journal, 6/24/1999, B16).

In input markets, bargaining power may depend on such things as the suppliers’ options for other retail outlets in a geographic area, the importance of an individual supplier’s product for attracting customers to the retail location, the supplier’s capital structure, whether the supplier has excess capacity, discount rates, and risk aversion. Our results suggest that a supplier will want to manipulate these factors to

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27 Since the most likely takeover targets are typically in some type of financial distress, it is not surprising that one tends to observe break-up fees in acquisition contests. In general, we would expect a firm facing a financial crisis to be less patient to finalize a merger deal than one that remains a viable entity on its own.

28 As pointed out by a referee, however, if break-up fees are infeasible, then non-compete clauses can actually prevent efficient job changes, contrary to our efficiency result in Proposition 1.

29 Other similar examples include movie stars and their studios and musicians and their record labels.

30 Similar examples can be found in other sports, and sometimes active players are involved in the compensation for the coach. For example, when the Tampa Bay Devil Rays hired baseball coach Lou Pinella, Pinella was still under contract with the Seattle Mariners, and so the Devil Rays had to give up all-star center fielder Randy Winn to obtain Pinella’s release from his contract (Sarasota Herald-Tribune Co, 10/29/2002).

31 This is also similar to the penalty clauses that sports figures and celebrities negotiate if their employers ‘change’ their mind. For example, NBC must pay Conan O’Brien a $40 million penalty if it fails to install O’Brien as the Tonight Show Host (Associated Press Newswires, 5/12/2008), and similarly, Florida State University must pay Jimbo Fisher a $2.5 million penalty if it fails to let him take over as Florida State’s new head coach when the current coach, Bobby Bowden, retires (Associated Press Newswires, 12/10/2007).
its advantage, and that the way it will want to manipulate them may depend on the order in which it negotiates with the retailer.

5. Conclusion

This paper shows that intuitions about surplus extraction and the role of bargaining power can be misleading in cases of sequential contracting because the economic rent in the negotiations between the buyer and each seller is not fixed. If the economic rent were fixed, a player would always be better off with more bargaining power. Instead, in our model, a seller’s bargaining power affects the outcome of the negotiation between the buyer and other seller, which in turn affects how much surplus is available for the seller to capture in his own negotiation. Thus, the two components that determine how much a seller can earn, the extent of his bargaining power and the buyer’s joint payoff with him, are not independent.

We obtain a number of results that contrast with those typically obtained in Rubinstein–Stahl models of bargaining and in models in which one player in each bilateral negotiation has all the bargaining power. For example, in our model the buyer and first seller may not be able to extract all the surplus from the second seller even when there is perfect information, and the second seller’s expected payoff can be decreasing in his own bargaining power. Furthermore, we show that each seller’s bargaining power may affect the expected payoff of the other seller even though the sellers do not negotiate directly with one another. The seller negotiating first will prefer that the second seller have more bargaining power, but the seller negotiating second will prefer that the first seller have less bargaining power.

These results have immediate implications for ongoing policy considerations. Since the first seller is unambiguously worse off when his own bargaining power decreases, and unambiguously worse off when the bargaining power of the second seller decreases, it follows that an exogenous increase in the buyer’s power will unambiguously harm the first seller. Note, however, that the second seller actually gains when the buyer’s bargaining power increases vis a vis the first seller, and in some environments also gains when his own bargaining power decreases. This implies, of course, that the second seller need not always fear an increase in buyer power; in some cases he gains. This has policy relevance because it is often asserted that buyer power can be harmful in that when facing powerful buyers, suppliers may “reduce investment in new products or product improvements, advertising and brand building,” to the detriment of consumers (European Commission, 1999, p.4). Of course, if suppliers do not necessarily lose from an increase in buyer power, as our results suggest, then the presumptions that underlie the assertion need not hold, and the opposite effect could occur.

We have also shown that our results extend to the isomorphic case of a single seller negotiating in sequence with two potential buyers. Among other things, this suggests that we should sometimes observe break-up fees in contracts between buyers and sellers if the seller trades with another buyer. Such fees are commonly found in mergers and acquisitions, where firms often negotiate a break-up fee to be paid by the acquisition target to the acquiring firm should the target receive and accept a competing offer, and in labor market contracts, break-up fees can be found implicitly in non-competitive clauses that preclude employees from taking jobs at competing firms within some period of time of leaving their current job.

Our result that the second seller’s expected payoff can be decreasing in his own bargaining power raises the question of whether the second seller might attempt ex-ante to reduce his bargaining power. For this to work, the action of the second seller must be costly to reverse because ex-post, at the time of the second negotiation, the second seller would always prefer to have more bargaining power rather than less. Concerns about the credibility of the second seller’s commitment to lower bargaining power may thus prevent this type of manipulation of bargaining power from being effective. One way to think about our result is that there are circumstances in which the second seller wants to commit to share his negotiation surplus with the buyer. Credibly reducing his bargaining power is one way, but there may be other means or conventions that can achieve the same thing, e.g., our model suggests that a seller might want to develop a reputation for sharing some of the joint surplus with the buyer.

Our result that the payoff of the first seller is increasing in the bargaining power of the second seller raises the question of whether the first seller might be able to do something, possibly at a cost to himself, that would increase the second seller’s bargaining power. For example, a seller might be able to contribute to an industry organization or share information that increases the bargaining power of the other seller. Our results suggest that an inefficient seller would offer to support an efficient seller in an industry if such support could increase the efficient seller’s bargaining power, but that efficient sellers (and buyers) would not offer such support, preferring instead to reduce the bargaining power of an inefficient seller.

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Appendix A

Proof of Lemma 1. Seller 2 is clearly indifferent between accepting \( T_2^1 \) and not. Thus, it is a best reply for seller 2 to accept contract \( T_2^1 \). Given this, one can show that it is a best reply for the buyer to offer \( T_2^1 \).

If \( T_1 \) satisfies \( \max(\Pi_1 - T_{10} - T_{21} - T_{11}) < R_1 - T_{11} \), then the buyer’s maximum payoff from purchasing from seller 2 is less than her payoff from purchasing from seller 1, and the buyer’s payoff from not purchasing is less than her payoff from purchasing from seller 1. It follows that in any equilibrium the buyer purchases from seller 1 and pays nothing to seller 2.

Now assume \( T_1 \) satisfies

\[
\max(R_1 - T_{11} - T_{10}) < \Pi_2 - T_{10},
\]

and let \( \epsilon \equiv (0, \Pi_2 - T_{10} - \max(R_1 - T_{11}, -T_{10})) \). Note that if the buyer offers the contract \( T_2^1 \) defined by \( T_2^1 \equiv \epsilon + \epsilon \) and \( T_{20} = 0 \), then the buyer strictly prefers to purchase from seller 2 because her payoff by doing so is \( \Pi_2 - T_{10} - \epsilon > \max(R_1 - T_{11}, -T_{10}) \), and seller 2 strictly prefers to accept the contract because he receives payoff \( \epsilon > 0 \). Letting \( \epsilon \) approach zero, in every equilibrium of the continuation game the buyer must receive payoff at least \( T_{20} - T_{10} \). If the buyer does not purchase from seller 2, she gets at most \( \max(R_1 - T_{11} - T_{10}) \), which is less than \( T_{20} - T_{12} \) by (A1). Thus, in any equilibrium of the continuation game, seller 2 accepts the buyer’s contract, the buyer purchases from seller 2, and the buyer pays seller 2 an amount \( c_2 = T_{20} \).

Proof of Lemma 2. If \( T_1 \) satisfies \( \max(\Pi_2 - T_{10} - T_{11}) < R_1 - T_{11} \), then the buyer’s maximum payoff from purchasing from seller 2 is less than her payoff from purchasing from seller 1, and the buyer’s payoff from not purchasing is less than her payoff from purchasing from

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32 For example, Adelphia Communications Corp. agreed to pay Time Warner and Comcast a combined $440 million in break-up fees if the sale of its cable systems did not go through (David Elman, “Adelphia gets OK on revised fee,” Daily Deal/The Deal, June 20, 2006), and Ripplewood Holdings offered to purchase Maytag Corp., but received a break-up fee of $40 million when Maytag was instead purchased by Whirlpool Corp. (Brenon Daly, “Maytag deal: Up to you, Whirlpool,” Daily Deal/The Deal, August 23, 2005).
seller 1. It follows that in any equilibrium the buyer purchases from seller 1 and pays nothing to seller 2. Nevertheless, it remains a best reply for seller 2 to offer contract $T_2^p$.

If $\max(R_1 - T_{11} - T_{10}, R_2 - T_{20}) = R_2 - T_{20}$, then the buyer is indifferent between accepting $T_2^p$ and purchasing from seller 2 and not because in either case the buyer has payoff $\max(R_1 - T_{11} - T_{10})$. Thus, it is a best reply for the buyer to accept contract $T_2^p$ and to purchase from seller 2. Given this, it is straightforward to show that it is a best reply for seller 2 to offer contract $T_2^p$.

Finally, assume $\max(R_1 - T_{11} - T_{10}) < R_2 - T_{10}$. Then $T_2^p(T_1^0) > c_2$ and we can let $\epsilon = (0, T_2^p(T_1^0) - c_2)$. Note that if seller 2 offers the contract $T_2^p$ defined by $T_2^p(T_1^0) = T_2^p(T_1^0) - \epsilon$ and $T_2^p = 0$, then the buyer strictly prefers to accept the contract and purchase from seller 2 because her payoff by doing so is $\max(R_1 - T_{11} - T_{10}) + \epsilon$, which is strictly larger than her payoff from rejecting seller 2's contract or accepting it and not purchasing from seller 2. Thus, if seller 2 offers contract $T_2^p$, her payoff is $T_2^p(T_1^0) - c_2$. Letting $\epsilon$ approach zero, in every equilibrium of the continuation game seller 2 must receive payoff at least $T_2^p(T_1^0) - c_2$ and, by the assumption that $T_2^p(T_1^0) > c_2$ and the arguments above, this can only be achieved in an equilibrium of the continuation game if the buyer accepts seller 2's contract, purchases from seller 2, and pays seller 2 an amount $T_2^p(T_1^0)$.

**Proof of Proposition 1.** To establish the existence of an equilibrium, first consider the case in which the buyer makes the offer in stage 1. Note that the buyer’s maximum equilibrium payoff is $\max(\Pi_1, \Pi_2)$. If $\Pi_1 \geq \Pi_2$, then the buyer achieves her maximum payoff with an offer of $T_{11} = c_1$ and $T_{10} = 0$ in stage 1, followed by the continuation equilibrium given in 1 and Lemmas 2. If $\Pi_1 < \Pi_2$, then the buyer achieves her maximum payoff with an offer of $T_{11} = R_1 - \Pi_2$ and $T_{10} = 0$ in stage 1, followed by the continuation equilibrium given in Lemmas 1 and 2 and the specification that the buyer purchases from seller 2 when she is indifferent between purchasing from seller 1 and seller 2. In both cases, it is a best reply for seller 1 to accept the buyer’s offer—he expects zero payoff in either case. This establishes the existence of equilibrium when the buyer makes the offer in stage 1.

Now consider the case in which seller 1 makes the offer in stage 1. Note that seller 1’s maximum equilibrium payoff is $\max(\Pi_1, \Pi_2) - (1 - \lambda_2)\Pi_2$ because the buyer will reject seller 1’s offer if it results in a payoff for the buyer of less than $(1 - \lambda_2)\Pi_2$. Suppose seller 1 offers the contract $T_1 = R_1 - (1 - \lambda_2)\Pi_2$ and $T_{10} = \lambda_2\Pi_2$. It is a best reply for the buyer to accept this offer because, using the continuation equilibrium given in Lemmas 1 and 2, the offer gives the buyer payoff $\lambda_2\Pi_2$, regardless of whether she buys from seller 1 or seller 2. Furthermore, it is an equilibrium for the buyer to buy from seller 1 if and only if $\Pi_1 \geq \Pi_2$ and from seller 2 otherwise. If $\Pi_1 \geq \Pi_2$, seller 1’s payoff is $\Pi_1 - (1 - \lambda_2)\Pi_2$ and if $\Pi_1 \leq \Pi_2$, seller 1’s payoff is $\lambda_2\Pi_2$, so seller 1 achieves his maximum payoff. This establishes the existence of equilibrium when seller 1 makes the offer in stage 1.

To show that there are no equilibria in which the buyer purchases from an inefficient seller, assume $\Pi_1 \neq \Pi_2$ so that one seller is inefficient. Using the arguments above, if the buyer makes the offer in stage 1, she can guarantee herself a payoff (arbitrarily close to) $\max(\Pi_1, \Pi_2)$ (she can guarantee that seller 1 will accept her offer by offering $T_{11} = c_1 + \epsilon$ and $T_{10} = \epsilon$ for small, positive $\epsilon$). In an inefficient equilibrium, the buyer’s payoff is bounded above by $\min(\Pi_1, \Pi_2)$, which is less than $\max(\Pi_1, \Pi_2)$, so this cannot be an equilibrium. Similarly, using the arguments above, if seller 1 makes the offer in stage 1, he can guarantee himself a payoff (arbitrarily close to) $\max(\Pi_1, \Pi_2) - (1 - \lambda_2)\Pi_2$. In an inefficient equilibrium, seller 1’s payoff is bounded above by $\min(\Pi_1, \Pi_2) - (1 - \lambda_2)\Pi_2$, which is less, so this cannot be an equilibrium.

**Proof of Proposition 2.** Assume $\Pi_2 > \Pi_1$. By Proposition 1, the buyer purchases from seller 2. As shown in the Proof of Proposition 1, if the buyer makes the offer in stage one she has payoff $\Pi_2$, which implies that she pays zero to seller 1. Also from the Proof of Proposition 1, if seller 1 makes the offer in stage one, he has payoff $\lambda_2\Pi_2$, which implies that the buyer pays a break-up fee of $\lambda_2\Pi_2$ to seller 2.

**Proof of Proposition 3.** The proof of Proposition 1 implies that if below-cost pricing is feasible, seller 2 earns zero payoff in all SPE. To see this, note that if the buyer makes the offer in stage 1, the buyer’s payoff is $\max(\Pi_1, \Pi_2)$, and if seller 1 makes the offer in stage 1, seller 1’s payoff is $\min(\Pi_1, \Pi_2) - (1 - \lambda_2)\Pi_2$ and the buyer’s payoff is $(1 - \lambda_2)\Pi_2$. In either case, zero surplus remains for seller 2. Clearly, seller 2 earns zero payoff in all SPE if $\lambda_2 = 0$ or if seller 2 is inefficient, in which case the buyer does not purchase from seller 2.

In the remainder of the proof, assume below-cost pricing is not possible, $\Pi_2 > \Pi_1$, and $\lambda_2 > 0$.

Suppose the buyer makes the offer in stage one and $\lambda_2 < 1$. If the buyer offers $T_{11} = c_1$ and $T_{10} = 0$ and seller 1 accepts, then using Lemmas 1 and 2, the buyer has expected payoff of $(1 - \lambda_2)\Pi_2 + \lambda_2\Pi_2 > \Pi_1$, which implies that the buyer can achieve an expected payoff of $(1 - \lambda_2)\Pi_2 + \lambda_2\Pi_2$ in equilibrium only if the buyer purchases from seller 2 and pays nothing to seller 1. This implies $T_{10} = 0$, and the restriction on below-cost pricing implies $T_{11} \geq c_1$, so using Lemma 2, when seller 2 makes the offer in stage two, his payoff is at least $\Pi_2 - \Pi_1 > 0$. Thus, seller 2’s expected payoff is positive.

Now suppose instead that $\Pi_1 < (1 - \lambda_2)\Pi_2$. If the buyer makes the offer in stage one, then as above, seller 2’s payoff is positive (note that the condition $\Pi_1 < (1 - \lambda_2)\Pi_2$ implies $\lambda_2 < 1$). Suppose seller 1 makes the offer in stage and offers $T_{11} = c_1$ and $T_{10} = \frac{\lambda_2}{1 - \lambda_2}\Pi_1$ and the buyer accepts. Using Lemmas 1 and 2, seller 1 has payoff of $\frac{\lambda_2}{1 - \lambda_2}\Pi_1$. It is straightforward to show that the buyer accepts seller 1’s offer in any continuation equilibrium. Because $\lambda_2 > 0$, seller 1’s payoff is positive, which implies that the buyer must purchase from one of the sellers in any continuation equilibrium. Because the buyer rejects any stage one contract offer that gives her expected payoff less than $(1 - \lambda_2)\Pi_2$, if the buyer purchases from seller 1, then seller 1’s payoff is bounded above by $\Pi_1 - (1 - \lambda_2)\Pi_2 < 0$, a contradiction. Thus, the buyer purchases from seller 2 and pays $\frac{\lambda_2}{1 - \lambda_2}\Pi_1$ to seller 1. This implies $T_{10} = \frac{\lambda_2}{1 - \lambda_2}\Pi_1$, and the restriction on below-cost pricing implies $T_{11} \geq c_1$, so using Lemma 2, when seller 2 makes the offer in stage two, his payoff is at least $\Pi_2 - \frac{1}{1 - \lambda_2}\Pi_1 > 0$. Thus, seller 2’s expected payoff is positive.

Finally, we must complete the “only if” part of the proof. To see that seller 2’s expected payoff is zero in at least some SPE if either the buyer makes the offer in stage one and $\lambda_2 = 1$, or $\Pi_1 \geq (1 - \lambda_2)\Pi_2$, see footnote 17 and the payoffs in Table A1 below.

**Derivation of the payoffs in Table 1:** The payoffs in Table 1 follow from Lemmas 1 and 2, which are given in the text, and Lemmas A1 and A2, which are given below. Lemma A1 considers the case in which the buyer makes the offer in stage one, and Lemma A2 considers the case in which seller 1 makes the offer in stage one. The proofs of Lemmas A1 and A2 follow from arguments similar to those given elsewhere in the paper and are available from the authors on request.

**Lemma A1.** For Lemma A1, define $T_1^p$ by $T_1^p \equiv c_1$ and $T_{10}^p \equiv 0$. If the buyer makes the offer in stage one, there is an equilibrium of the continuation game in which the buyer offers $T_1^p$ and seller 1 accepts. If $\Pi_1 = \Pi_2$ then in any equilibrium, the buyer’s payoff is $\Pi_1$. If $\Pi_1 > \Pi_2$ then in any equilibrium, the buyer purchases from seller 1 and pays $T_1^p$ to seller 1 and zero to seller 2. If $\Pi_1 > \Pi_2$ and $\lambda_2 < 1$, then in any equilibrium, the buyer purchases from seller 2, pays $T_2^p$ to seller 1, and pays either $c_2$ or $R_2 - \Pi_1$ to seller 2, depending on whether the
buyer or seller 2, respectively, makes the offer in stage two. If $\Pi_2 > \Pi_1$, $\lambda_2 = 1$, and the buyer purchases from seller 2, then the buyer pays $T_1^{T_2}$ to seller 1, and pays either $c_2$ or $R_2 - T_1 - \Pi_2$ to seller 2 as before.

**Lemma A2.** For Lemma A2, define contract $T_1^*$ by $T_1^* = \Pi_2 - (1 - \lambda_2)T_1$, and $T_2 = (1 - \lambda_2)T_1 + \Pi_2$, and define the contract $T_2^*$ by $T_2^* = \Pi_1$ and $T_1^* = \frac{\lambda_1}{1 - \lambda_2}T_1$. Combining these two, define

$$T_1^* = \begin{cases} 
T_1^* & \text{if } \Pi_1 \geq (1 - \lambda_2)\Pi_2 \\
T_2^* & \text{otherwise.}
\end{cases}$$

If seller 1 makes the offer in stage one, then there is an equilibrium of the continuation game in which seller 1 offers $T_1^*$ and the buyer accepts. If $\Pi_1 = \Pi_2$, then in any equilibrium, the buyer’s payoff is $(1 - \lambda_2)\Pi_2$. If $\Pi_1 > \Pi_2$, then in any equilibrium, the buyer purchases from seller 1, pays $T_1^*$ to seller 1, and pays zero to seller 2. If $\Pi_2 > \Pi_1$, then in any equilibrium, the buyer purchases from seller 2, pays $T_2$ to seller 2, and pays either $c_2$ (if the buyer makes the offer in stage two) or $(1 - \lambda_2)\Pi_2$ or $R_2 - (1 - \lambda_2)\Pi_2$ to seller 2 (if seller 2 makes the offer in stage two and $\Pi_2 < (1 - \lambda_2)\Pi_2$).

**Lemmas 1, 2, A1, and A2** imply a SPE of the game as is follows: In stage one, if seller 1 makes the offer, he offers $T_1^*$, and if the buyer makes the offer, she offers $T_2^*$; in both cases, the other player accepts. In stage two, if seller 2 makes the offer, he offers $T_2^* + T_1^*$ depending on whether the stage-one contract is $T_1^*$ or $T_1^*$, respectively, and if the buyer makes the offer, she offers $T_2^*$. In all cases, the other player accepts. In stage three, the buyer purchases from seller 1 if $\Pi_1 > \Pi_2$ and seller 2 otherwise. Furthermore, these lemmas imply that the equilibrium payoffs are unique in any efficient SPE. We can calculate the equilibrium payoffs for the players as a function of which player makes the offer in each period. The calculations for the case with $\Pi_1 > \Pi_2$ are straightforward. For $\Pi_2 \geq \Pi_1$, these payoffs are easily calculated using the equilibrium strategies and are given in Table A1.

Then one can use the probabilities with which the different players make the offers in each stage to calculate the expected payoffs given in Table 1.

**Proof that below-cost pricing does not arise in the modified game:** Define the modified game to be the game of our paper modified so that if (i) $T_1^* < c_1$ and contract $T_1^*$ is accepted, (ii) seller 2 makes a contract offer $T_2^*$ in stage two that would have been accepted by the buyer had $T_1^* < c_1$ and $T_1^* = 0$, and (iii) the buyer does not purchase from seller 2, then seller 2 can sue seller 1 for predatory pricing and receive treble damages equal to $3(T_2 - c_2)$.

**Proposition A1.** In the modified game, if $\lambda_2 = 1$, there is no equilibrium in which $T_1^* < c_1$.

**Sketch of Proof.** Below-cost pricing is only an issue if seller 2 is efficient, so assume $\Pi_2 > \Pi_1$. Suppose there exists an equilibrium in which $T_1^* < c_1$. Then seller 2 can sue and win if his offer is rejected and $R_1 - c_1 \leq R_2 - T_2$, which we can write as

$$T_2 \leq R_2 - R_1 + c_1.$$  \hspace{1cm} (A2)

If the buyer purchases from seller 1, her payoff is $R_1 - T_1$, and if she purchases from seller 2 her payoff is $R_2 - T_1 - T_2$. Assuming the buyer purchases from seller 2 when she is indifferent, the buyer purchases from seller 2 if and only if

$$T_2 \leq R_2 - R_1 - T_1 + T_1.$$  

Note that by our assumption of below-cost pricing,

$$R_2 - R_1 - T_1 + T_1 < R_2 - R_1 + c_1.$$  

This implies that there are three cases to consider depending on where $T_2$ falls.

**Case 1.** $R_2 - R_1 - T_1 + T_1 < R_2 - R_1 + c_1$: The buyer does not purchase from seller 2 and seller 2 sues. With $T_2 = R_2 - R_1 + c_1$, seller 2’s payoff is

$$3(R_2 - R_1 + c_1 - c_2) = 3(T_2 - T_2).$$

**Case 2.** $T_2 \leq R_2 - R_1 - T_1 + T_1 < R_2 - R_1 + c_1$: The buyer purchases from seller 2. With $T_2 = R_2 - R_1 - T_1 + T_1$, seller 2’s payoff is

$$R_2 - R_1 - T_1 + T_1 - c_2 < R_2 - R_1 - T_1 + c_1 - c_2 = \Pi_2 - T_1 + T_1.$$  

**Case 3.** $R_2 - R_1 - T_1 + T_1 < R_2 - R_1 + c_1 < T_2$: The buyer does not purchase from seller 2 and seller 2 does not have standing to sue, so seller 2’s payoff is zero.

Because $\Pi_2 > \Pi_1$, seller 2 prefers Case 1 and so offers $T_2 = R_2 - R_1 + c_1$ to the buyer in stage two. This offer is rejected by the buyer in stage three, and seller 2 then sues seller 1 claiming predatory pricing. Seller 1’s payoff is this case is $T_1^* - c_1 - 3(T_2 - T_2) < 0$, which cannot hold in equilibrium. Thus, there can be no equilibrium involving below-cost pricing.

**References**


