

# Exclusive Contracts Foster Relationship-Specific Investment

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## Abstract

Exclusive contracts prohibit one or both parties from trading with anyone else. Contrary to earlier findings, notably Segal and Whinston (2000), we show that investments that are specific to the contracted parties may be encouraged. Results depend on the nature of the investments and whether the bargaining is cooperative or non-cooperative. The major part of the analysis show that exclusive contracts designed to “assure” the supply of essential inputs promote investment. Infinite penalties for breach, even if *ex post* renegotiable, may result in excessive investment, in which case a finite penalty for breach achieves the first-best outcome.

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## Non-technical summary

Exclusive contractual agreements entail the acceptance by one or both parties to the contract of limitations on the freedom to individually deal with others for the duration of the contract. The present paper examines whether or not these exclusivity provisions serve the socially useful purpose of encouraging (unverifiable) relationship-specific investments within contexts characterised by partial contractual incompleteness, that is to say, in situations where the terms of future trade cannot be fully specified in a contract verifiable in courts of law.

Following the burgeoning Property Rights literature, we define a relationship-specific (or idiosyncratic) investment as one that is highly valuable inside a particular business partnership but that has extremely low or eventually no value whatsoever outside it. A mine-mouth (coal) plant built by an electric utility represents a good illustrative example. In effect these productive units locate adjacent to coal reserves from which the coal is mined for the plant, where electrical power is first generated and then transmitted through high voltage transmission systems to load centres. It is well known that mine-mouth plants involve substantial durable relationship-specific investments (e.g., in transmission capacity or in specialised productive machines) because they are conceived to purchase and burn the particular type of coal existing in the adjacent mine over the life of the plant. The use of coal that differs from the original design specifications leads to both important losses in thermal efficiency and sharp increases in power outages and plant maintenance costs. Since, once the plant is already in place, the operator's outside procurement opportunities are enormously constrained, the utility's investment is bound to be highly relationship specific.

At first sight it may seem rather evident that if a firm holds an enforceable exclusive-dealing contract that allows it to block trade between its business partner and others, then the exclusive-rightholder will in general be willing to undertake more relationship-specific investment. The underlying reasoning is that the exclusivity clause redistributes bargaining power between the parties to the contract, thereby affecting the future distribution of the gains from trade. Clearly the holder of the exclusive contract ends up receiving a bigger share of the total cake. However, whether the exclusive-rightholder's improved bargaining position is ultimately sensitive to its level of specific investment is by and large less obvious, and this is indeed one of the main lines of enquiry throughout the remainder of the paper.

The existing literature mostly explains exclusivity as a device to eliminate horizontal externalities that give rise to inefficient outcomes. In particular, it has been argued that exclusive dealing sometimes encourages specific investment because it curbs certain (intra- and inter-brand) free-riding problems that arise whenever a party's investment has - at least to an appreciable extent - positive spillovers on non-investing parties. For instance, a manufacturer may grant an exclusive dealership for a territory so as to restore incentives for the retailer to invest in surplus-enhancing services and/or local promotions that

would otherwise benefit other retailers located in the same geographical area and carrying the manufacturer's brand. The reason is that without exclusive dealing the services become a public good on which the retailers will free ride, thus triggering an underprovision result, whereas with an exclusivity agreement incentives are sharpened because the contracted retailer appropriates the whole benefit from its investment.

The aforementioned argument, although intuitively compelling, entails investments that are not entirely relationship specific. In effect the presence of so-called external effects implies that the manufacturer will benefit from the investment made by a particular retailer even when dealing with other retailers. In contrast, we fix attention on a vertical structure comprising a supplier of an indispensable good and two downstream customers in which one of the (risk-neutral) buyers faces a risky investment opportunity that only creates a surplus if he has access to the seller's product. Hence in our set up the buyer's investment exhibits no externality whatsoever on others. Significantly, it is precisely under these circumstances that earlier findings, most notably Segal and Whinston (2000), claim that contractually locking parties together is neutral with respect to investment in the partnership and that exclusive contracts are thus devoid of any substantive content. The major part of our theoretical analysis demonstrates, however, that an exclusivity provision designed to "assure" the supply of an essential input unambiguously promotes the buyer's investment. Indeed this seems to bring the theory much closer to the empirical evidence.

The above discrepancy in our respective predictions owes in part to the fact that Segal and Whinston assume initial "non-cooperative" investment decisions are followed by "cooperative" bargaining over the division of the total surplus. Such a mixed approach has many precedents in multi-stage bargaining models, but tractability aside, it is not always clear why different solution concepts apply at different stages of the game. Furthermore cooperative solution concepts leave the bargaining process unmodelled and are generally best justified as incorporating notions of justice or fairness. We allege that this is not obviously an appropriate basis for positive economics. For example, firms that fail to trade in the marketplace or job candidates that are finally turned down do not in reality normally receive compensatory payments from those that do, as it is actually implied by the cooperative models frequently used in the industrial economics literature. Interestingly enough, in this paper we contrive to provide a theoretical framework that is not marred by those unrealistic features.

The chief modelling problem is that exclusive-dealing contracts only make sense if at least three parties have an interest in the total outcome. Trilateral non-cooperative bargaining solutions are, however, notoriously delicate. This may explain the preference for using cooperative bargaining to determine the split of the surplus. In that connection, an extra contribution of this paper is to set forth a novel three-agent bargaining model which allows us to show that under plausible non-cooperative bargaining assumptions, exclusivity deals are beneficial for relationship-specific investment because they affect marginal as well as total payoffs. Thus, our conclusions support existing informal arguments that emphasize the link existing between an exclusionary provision and the

investment incentives of its recipient, thereby challenging Segal and Whinston's claims to the contrary. Furthermore we find that infinite penalties for breach of contract, even if ex post renegotiable, may in fact result in excessive investment from an efficiency point of view, in which case a finite penalty for breach achieves the first-best outcome.

# 1 Introduction

A burgeoning literature examines how to mitigate hold-up problems created by incomplete contracts. Less attention has been paid as to why firms sometimes deliberately expose themselves to the threat of hold-up. That after all is the consequence of exclusive-dealing contracts so frequently adopted when legal. Of course there is no real paradox. Exclusive contracts, by prohibiting trade with third parties, redistribute ex post bargaining power.<sup>1</sup> If one side of the transaction is more vulnerable to hold up, the other is less so. As a result, exclusive contracts may stimulate relationship-specific investment.

In contrast, Segal and Whinston (2000) find that contractually locking parties together is neutral with respect to investment in the relationship. This is in part because they assume initial “non-cooperative” investment decisions are followed by “cooperative” bargaining over the division of the surplus [see also Segal (2003)].<sup>2</sup> Such a “mixed” approach has many precedents in multi-stage bargaining models, but tractability aside, it is not clear why different solution concepts apply at different stages. Cooperative solution concepts leave the bargaining process unmodelled but are generally best justified as incorporating notions of justice or fairness. This is not obviously an appropriate basis for positive economics.<sup>3</sup> For example, firms that fail to trade in the market do not in reality normally receive compensatory payments from those that do, as is implied by most cooperative bargaining solutions (this is made explicit in Section 2).

The modelling problem is that exclusive-dealing contracts only make sense if at least three parties are involved. Trilateral non-cooperative bargaining solutions are, however, notoriously delicate. This may explain the preference for using cooperative bargaining to determine the split of the surplus. The contribution of this paper is to show that under plausible non-cooperative bargaining assumptions exclusivity does matter for investment incentives because it affects marginal as well as total payoffs. Thus, our results support existing informal arguments that emphasize the link existing between an exclusionary provision and the investment incentives of its recipient [e.g., Klein, Crawford and Alchian (1978), Klein (1988) and Frasco (1991)], thereby challenging Segal and Whinston’s claims to the contrary.

The existing literature mostly explains exclusivity as a device to eliminate horizontal externalities. For example, a manufacturer may grant an exclusive dealership for a territory so as to create incentives to invest in advertising and local promotions that would otherwise benefit non-investing retailers [e.g. Mathewson and Winter (1994)].<sup>4</sup> The key features are that investment is not rela-

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<sup>1</sup> A requirements contract prevents a buyer dealing with other than the stipulated seller whilst an output contract precludes a seller dealing with any but the specified buyer.

<sup>2</sup> An important exception is the recent analysis by Che and Sákovics (2003b). We comment on this paper later.

<sup>3</sup> Cooperative solutions can generally be replicated by some non-cooperative bargaining protocol. Segal and Whinston show that this applies to their case. However, those non-cooperative games often involve rather arbitrary assumptions that seem difficult to defend.

<sup>4</sup> Technological externalities and the attempt to curb free riding also underlie the exclusionary provisions analysed by Mathewson and Winter (1987), Marvel (1982), Besanko and Perry

relationship specific and not all those capable of benefiting from it sign the exclusive contract. In contrast it is assumed here that investment is only of value to two parties. It is then that Segal and Whinston claim that exclusive contracts are pointless.

To show that this need not be so consider an example similar to that of Segal and Whinston (p. 608). A buyer desires a unit of an input available in generic form from a competitive industry at price equal to production cost  $c$ . The buyer values the good at  $v > c$ . There is a seller able to tailor the good to the buyer's specific requirements. The modified product is no more costly for the seller to produce whilst the buyer's valuation increases to  $v + \Phi$ . For this benefit to be realised, both the buyer and seller must each make unverifiable investments of  $i$  before production takes place, where  $\Phi > 2i > 0$  (perfect complementarity is not necessary for the results or even double sided investment). Thus investment is efficient and does not exhibit external effects because it only affects the value derived from trade between the two of them. For the buyer, the investment costs may be informing the seller of what is needed to enhance value or of adapting plant to use the modified input or of promoting a superior natural good.

If both investments are undertaken but the good is not yet produced there is a surplus of  $v + \Phi - c$  to divide. At this point a binding price can be negotiated. The bargaining protocol is an infinite-horizon Rubinstein alternating offer game. We take the limit as the interval between rounds shrinks to zero. The buyer could purchase a generic good on the competitive market so has outside option  $v - c$ . For the seller the best alternative is to produce for the market, in which case their joint surplus is zero. As is standard, the buyer's outside option binds if  $v - c > 0.5(v + \Phi - c)$  or  $v - c > \Phi$ . If this condition holds the tailored good is sold for  $c + \Phi$  and the buyer's gross surplus is the same as when not investing. Hence investing cannot be an equilibrium.

Now consider the situation if there is an exclusive contract that prohibits the buyer acquiring the good from any but the contracted seller.<sup>5</sup> This eliminates the buyer's outside option so the surplus is split equally. Both buyer and seller investing is thus an equilibrium if  $0.5(v + \Phi - c) - i > 0.5(v - c) = 0.5\Phi > i$ . Exclusivity brings about investment if and only if investment is efficient.<sup>6</sup> The set up resembles a franchise where, as Klein and Saft (1985) document, it is common that the franchisee (the buyer) must obtain inputs from franchisor (the seller) rather than on the open market. The usual explanation for this practice is quality control but our analysis shows that investment incentives, especially for the franchisor, may be involved.

(1993) Masten and Snyder (1993) and Bernheim and Whinston (1998). See Motta (2004) for a recent discussion of these arguments.

<sup>5</sup> When the contract is signed any necessary transfer payments can be made.

<sup>6</sup> This does not preclude other ex ante contracts being helpful. Giving the buyer an option to buy at a prespecified price achieves efficiency as long as price is not negotiable ex post. Unlike an exclusive contract, with double-sided smooth investment such a scheme can achieve the first-best outcome. The assumption that the price can be committed to is a strong one. It requires that the seller can be compelled to deliver, but since quality is not verifiable offering a generic product and having it turned down would vitiate the contract and then allow free bargaining over the adapted good.

The outside-option example of Whinston and Segal involves a seller able to invest to lower its production cost. Absent the exclusive contract, the buyer has a binding outside option from the opportunity to acquire the good on the competitive market. Thus the seller, whose good is by assumption worthless in the competitive market, is residual claimant and captures the full marginal benefit to the relationship of their investment. Under exclusivity the split-the-surplus solution applies and so the seller's investment incentive is diminished at the margin.

What our version shows is that the conclusion that exclusivity is bad for investment depends on which parties invest. In the main part of their paper Segal and Whinston analyse much more general investment structures but combine this with a cooperative bargaining solution that precludes reasonable non-cooperative outcomes that reverse their result.

In the rest of our paper we do not invoke a competitive sector but provide an explicit three-agent model where all parties engage in non-cooperative bargaining. Whether or not the outside-option principle applies we show that exclusive contracts may be beneficial for relationship-specific investment. The setting is of a risk-neutral buyer with a risky investment opportunity only investing if the supplier of an essential input contracts not to sell it elsewhere.<sup>7</sup>

In modelling the bargaining over the intermediate input we assume that resale is feasible. This is not only realistic in many contexts but cuts through some of the modelling difficulties otherwise encountered in three-party bargaining. The proposed trading game is set forth in the companion paper by Selvaggi (2003). In this context it implies that exclusive dealing not only encourages investment but may give rise to overinvestment, though this can be controlled by suitable breach remedies.

The remainder of the Introduction provides an example to illustrate the gist of our main analysis.<sup>8</sup> A seller possesses a single unit of an indivisible good, which can be used productively by two potential customers. Perhaps the seller is an input monopolist and the potential customers are two downstream firms. Each downstream buyer seeks to buy at most one unit of the intermediate input and one can invest to enhance the value of obtaining the good though returns are stochastic.

First, the ex-post bargaining solution will be sketched.<sup>9</sup> Suppose buyer 1 obtains payoff  $\alpha$  from use of the good whereas buyer 2's use value is  $\beta$ . The

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<sup>7</sup> Using a rather different setting, McAfee and Schwartz (1994) conclude that in multilateral contexts exclusivity can protect customers from ex post opportunism. However, their result stems from the assumption that downstream firms produce (perfect or imperfect) substitute products, which in the absence of exclusive dealing generates negative externalities among the buyers. In this paper we assume instead that downstream firms do not compete on the product market.

<sup>8</sup> These examples use the subgame-perfect equilibrium outcomes of our three-party bargaining game when the interval between successive proposals becomes vanishingly small. Section 2 in this paper discusses further details of this model, whereas Selvaggi (2003) gives a thorough discussion of the underlying non-cooperative game.

<sup>9</sup> As usual in these kinds of non-cooperative bargaining settings, a coalition between the buyers (e.g. a legally binding collusive agreement) is ruled out by assumption.

seller's valuation is normalised to zero. A key ingredient in determining the price at which the good is sold is our assumption that if buyer 1 (the low-value customer) initially acquires the good, negotiations can instantly be opened up with buyer 2 to resell it. This second-stage price determination game is a two-party bargaining problem to which the Nash "split-the-difference" rule applies; that is, the price equals the owner's use value plus half of the surplus created by the transfer. The item is thus sold on to buyer 2 (the high-value customer) at price 7. The final allocation of the good is therefore Pareto efficient. The non-cooperative bargaining underlying the resale equilibrium is a standard alternating-offer game with random selection of proposer, in which there is no discounting but a vanishingly small exogenous chance of breakdown in each round that prevents further negotiations between the agents.<sup>10 11</sup> Crucially, that agents know that if buyer 1 obtains the good at the first stage it will be resold to buyer 2 at price 7 shapes willingness to pay when negotiating with the seller at the outset.

In the first stage of the game, as in Calvó-Armengo (1999), the seller is the central player and alternately meets each buyer. Which party is then proposer is decided at random. If the offer is rejected, the seller then moves to the other buyer. The procedure continues until there is agreement but there is again a small chance in each round that negotiations irretrievably break down, in which case the seller is left with the good.<sup>12</sup>

Although the two buyers differ in the use they can make of the good, the resale opportunity means that neither would pay more than 7 for the item at the first stage. Moreover, if a buyer's failure to reach agreement with the seller is followed by the other buyer agreeing next period, then neither buyer would reject a price of 7 or less. What is implied is that the good is instantly sold for 7.<sup>13</sup>

<sup>10</sup> See, e.g., Binmore et al. (1986), Osborne and Rubinstein (1990) and Muthoo (1999). For other recent applications of this bargaining solution, see Che and Sákovics (2003b) and Stole and Zwiebel (1996).

<sup>11</sup> As shown by Binmore (2003), the unique subgame-perfect equilibrium of this two-party bargaining converges to the Nash bargaining solution for the problem  $(X, b, b)$ , where the breakdown/deadlock point is  $b = (v^L, 0)$ . Since in our case the buyers' bargaining powers are identical, the equilibrium value of resale locates halfway between the valuations of the two buyers.

<sup>12</sup> A plausible cause for such a risk of breakdown is that the owner of the item may get fed up with negotiations, thereby walking away from the negotiating table and immediately consuming the good. This type of human behaviour is naturally random. Other interpretations may also be appropriate though. Consider, for example, a "telephone bargaining" model. Specifically, the owner of the good phones another player and they exchange offers over the phone. In this context a breakdown is due to the fact that the owner may randomly hang up at the end of each round and, possibly, then phone another party. Namely, at the first stage of the game the seller hangs up and subsequently phones the other buyer, whereupon the situation repeats itself. At the resale game, L hangs up and immediately consumes the good -for there is no other agent to phone. Both interpretations give rise to identical limiting outcomes.

<sup>13</sup> If the entire bargaining game has no risk of breakdown but there is instead time discounting, the outside-option principle applies. Then, as the interval between successive proposals becomes vanishingly small the resale price obtained by buyer 1 tends to 6, and this is the price at which the upstream firm sells the good at the first stage [see Selvaggi (2003)]. As shown in



To see what this solution implies for exclusive-dealing contracts, suppose buyer 1's use value is indeed equal to 6 whereas buyer 2's is stochastic. There are two equally likely states of the world and before knowing which prevails, buyer 2 is faced with a binary choice. If buyer 2 does not invest, then the good is worth 8 in one state and nothing in the other. Investment costs 1.25 and boosts buyer 2's value of the good by 4 in each state, making it 12 in one state and 4 in the other.

Maximization of expected aggregate surplus clearly requires that buyer 2 invests, but in the absence of exclusive dealing there is underinvestment. As just noted, when buyer 2 does not invest he pays 7 for the good in the state in which he is the high-value agent. In the event that buyer 2 is the low-value agent his payoff is zero. So if buyer 2 does not invest, his expected revenue is  $(8 + 7) \times 0.5 = 7.5$ . If buyer 2 invests the good is obtained in one of the states at a price of  $(6 + 12) \times 0.5 = 9$ . In the other state, as the low-value customer, buyer 2's payoff is zero, so his expected revenue is  $(12 + 0) \times 0.5 = 6$ . Investment only raises buyer 2's gross payoff by 1, less than its cost. Thus, due to the standard hold-up problem, there is underinvestment.

In contrast, when the seller enters into an exclusive trade agreement with buyer 2, full efficiency is achieved. Suppose that buyer 2 chooses to invest. In the state in which his investment succeeds there is bilateral bargaining with the seller, and the good is sold for  $(12 + 0) \times 0.5 = 6$ . In the other realization, once buyer 2 obtains the good it is resold to buyer 1 for  $4 + (6 + 4) \times 0.5 = 5$ . Therefore, in the first-stage bargaining with the seller, buyer 2 splits the difference between 5 and 0, giving an initial transfer price of 2.5.<sup>14</sup> Thus, if buyer 2 invests his expected revenue is  $(6 + 2.5) \times 0.5 = 4.25$ . Using the same logic, if buyer 2 does not invest expected revenue is  $(4 + 1.5) \times 0.5 = 2.75$ . Investment increases expected revenue by 1.5, which now exceeds the cost of 1.25. So exclusive dealing creates an efficient outcome.

Holding an exclusive-dealing contract naturally enhances the exclusive buyer's bargaining power - his share of the available cake. This does not of itself change the incentive to invest if the payoff increases by the same amount whether or not investment is undertaken. This though is not the case. In the absence of an exclusive contract, irrespective of whether investment has been undertaken, buyer 2 is in effect cut out of the bargaining in the fail state and obtains zero net payoff. With an exclusive contract, the fact that with investment buyer 2 has a

the Appendix A.1, a version of our result also applies in this case.

<sup>14</sup>This result is related to Rubinstein and Wolinsky (1987). They study a market configuration in which there are three types of agents involved in Nash bargaining: sellers, buyers and middlemen. In Rubinstein and Wolinsky's model direct transactions between sellers and buyers are costly due to the time-consuming matching technology that randomly brings them together. These frictions in the trade process enable the middlemen - simple intermediaries in their set up - to capture some rents in return for shortcoming the time period sellers and buyers must wait until trade takes place. However, Rubinstein and Wolinsky note that if a seller can pass the good to a buyer only through the middleman (e.g., sellers and buyers are almost never matched), then in the seller-middleman bargaining they split the difference between the price of resale and zero. Therefore their case is analytically similar to our exclusive-dealing situation in which the seller writes an exclusivity deal with the least efficient customer.

greater valuation of the good means that at the resale stage a higher price can be negotiated with buyer 1. Some but not all of this extra second-stage surplus is appropriated by the seller in the first-stage bargaining. When the contracted agent has the highest valuation, the extra gross surplus created by investment is shared equally with the seller. Without the contract, exactly the same split would occur, though now the mechanism is that the good is worth more to buyer 1 in the resale market and the consequent intensified competition at the first stage pushes up the price. It is the increased payoff when the protected buyer does not end up using the good that causes an exclusivity deal to foster incentives to invest. Put differently, exclusive dealing increases the sensitivity of the buyer 2's payoff to his investment.

This result carries over straightforwardly to the continuous investment case considered later in the paper. In the presence of exclusive dealing, the protected party obtains marginal investment returns even when the low-value buyer. These additional returns offset the detrimental effects of potential hold ups. Moreover, under some circumstances exclusivity may give rise to overinvestment. Exclusive contracts that stipulate infinite rather than infinite penalties for breach (i.e., liquidated damage clauses) may then be appropriate. They provide some extra investment incentives but limit their magnitude, thereby preventing an excessive investment level by the exclusive buyer.

The general message of our model is that exclusive dealing can never worsen the contracted party's marginal investment incentives. This stands in sharp contrast to existing claims based on cooperative bargaining. In a cooperative framework, exclusivity merely eliminates the surplus otherwise created by a coalition of the seller and the uncontracted buyer but does not affect what can be achieved by any coalition of which the contracted firm is a member. If only the contracted buyer has an investment opportunity, it is immediate that exclusivity cannot enhance marginal investment incentives - nothing changes in any coalition of which he is a member. This is the basis for Segal and Whinston's Irrelevance Result.<sup>15</sup> In our non-cooperative set up, exclusive dealing does have a major negative impact on the seller's bargaining payoff. This is due to the elimination of competition for the input (though the contracted firm pays for the advantage ex ante). The existence of a subsequent resale market implies that exclusivity does not necessarily impinge on the uncontracted buyer. Rather, it is the exclusive customer who benefits from a lower price when he ends up using the good. The key point is that exclusive dealing makes all the difference for marginal investment incentives because it makes the protected firm's payoff sensitive to its investment even when it is not the ultimate user of the good. That exclusivity promotes relationship-specific investments turns out to be robust to alternative non-cooperative bargaining solutions (see the Appendix) and is much more in line with the empirical evidence.

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<sup>15</sup>A common theme in these models is that exclusivity affects negatively the uncontracted party's bargaining payoff. However, de Meza and Selvaggi (2003) show that this mechanism can in fact be efficiency-enhancing when both buyers make specific investments that are (imperfect) substitutes and do not exhibit technological dependencies. We return to this issue in Section 2.

Che and Sákovics (2003b) also find a role for exclusive contracts under non-cooperative bargaining but the mechanism is very different. They utilize their dynamic hold-up model [Che and Sákovics (2003a)] to analyse the relationship between exclusivity and incentives for specific investments. Their basic set-up is a dynamic non-cooperative bargaining model with two parties and multi-stage (cumulative) investment opportunities. Roughly speaking, high-investment equilibria can be sustained because each party has the opportunity to make up for low investment in one period by supplementary expenditures in the future. So, if an agent deviates by investing low, the other party rationally makes a low offer knowing that the attempt to free ride will be cancelled once the equilibrium path is resumed next period. Thus downward deviations are heavily punished, allowing equilibria that are close to first-best if the chance of breakdown is sufficiently small. If firms have good alternative trading opportunities the punishment opportunity is limited. Exclusive contracts are modelled as reducing disagreement payoffs (what the parties to the contract can get elsewhere if negotiations break down), thereby permitting equilibria with higher investment levels than would otherwise be possible.

Multiple equilibria are intrinsic to this dynamic model. For example, the regular “static” hold-up outcome is also an equilibrium. Che and Sákovics’ assumptions imply that exclusivity has no effect on this equilibrium for though the level of disagreement payoffs are altered, their sensitivity to relationship-specific investment is not. So in Che and Sákovics exclusivity adds equilibria when the “individual rationality” constraint is binding for a party, whilst in our formulation the nature of the equilibrium alters. This reflects our recognition that resale possibilities mean that an exclusive contract does not necessarily determine the final user of a good.

Of course the two approaches are complementary, but building a model with both features is left for future work.

The rest of this paper has the following structure. Section 2 describes concisely the central features of our non-cooperative bargaining game and examines the effects of exclusive dealing on the parties’ equilibrium payoffs. Then, Section 3 presents a simple model in which relationship-specific investments and potential hold-up problems are also taken into account. This section characterizes incentives for specific investment in the nonexclusive and socially optimal benchmark cases, and also explains how in our model exclusivity unambiguously promotes its recipient’s investment incentives (see Proposition 5). In addition, it describes the mechanism whereby stipulated penalties for breach of contract (liquidated damage clauses) can on some occasions curb the exclusive party’s incentives to overinvestment, thus facilitating the achievement of the first-best outcome. Finally, Section 4 draws conclusions.

## 2 Three-party bargaining with resale

This opening section outlines the major features of the non-cooperative bargaining game applied in the remainder of the paper. The model is based on Selvaggi

(2003, Section 2), extended to examine the impact of exclusive-dealing contracts on the parties' subgame-perfect equilibrium payoffs. For now we abstract from investment decisions. The solution obtained is utilized in subsequent sections of the paper to evaluate whether exclusivity provisions safeguard against ex post opportunism, thereby fostering relationship-specific investments.

The basic game comprises the seller,  $S$ , of an indivisible good who bargains with two heterogeneous buyers,  $H$  and  $L$ , who value the good at  $v^H$  and  $v^L$  respectively, with  $v^H > v^L > 0$ . The use value of the good to  $S$  is normalized to zero.

The bargaining protocol is a version of the Rubinstein (1982) alternating-offer game. Specifically, there is no discounting but a probabilistic risk of breakdown in negotiations at the end of each round (the modelling of breakdown is discussed below). The alternative case of discounting but no breakdown possibility proceeds along the same lines but yields an outside option version of the results. This solution is developed in Selvaggi (2003) and applied to exclusive contracts in Appendix A1.

Time is divided into periods of equal length, denoted by  $\Phi > 0$ , and offers are made at  $0, \Phi, 2\Phi, \dots, t\Phi, \dots$ . In period 0 the seller is matched with  $H$ , a proposer is then selected at random (i.e., each player has probability  $1/2$  of being the proposer), and the other party responds with acceptance or rejection of the proposal. In the case of acceptance, the good is immediately transferred to the buyer. Following rejection, negotiations may either break down irretrievably or reach the next period, in which case the seller is matched with  $L$  and the cycle is repeated.

If the seller reaches agreement with  $H$ , the game immediately terminates. However, if  $S$  initially trades with  $L$ , in the following period negotiations may be opened up with  $H$  to resell the good. This second-stage price determination subgame is referred to as the "resale stage" or "secondary market", where negotiations again follow an alternating-offer protocol with random selection of proposer and a chance of breakdown in each round.

The exogenous or "forced" breakdown in negotiations is modelled in the following way [see, e.g., Binmore et al. (1986), Osborne and Rubinstein (1990) and Muthoo (1999)]. At the end of any period  $t\Phi$  (whether at first or resale stage), and independently of a particular offer being accepted or rejected, with probability  $p \in (0, 1)$  negotiations irrevocably break down and with probability  $(1 - p)$  the game proceeds to period  $(t + 1)\Phi$ . These probabilities are independent of all past events. Although the exogenous breakdown precludes further negotiations between any of the parties, it does not prevent the agent who possesses the good from consuming it instantly. It is easiest to think of breakdown involving the owner of the item walking away from the negotiating table (perhaps he gets fed up with negotiations) and immediately consuming the good. This random human behaviour obviously precludes subsequent bargaining. [Selvaggi (2003) provides alternative interpretations of the breakdown technology.]

So, all the risk-neutral agents are indifferent about the period in which agreement is reached and have full information about the history of the market at all times. As usual, it is assumed that as the interval between two consecutive

price offers decreases, the probability of breakdown between those offers also decreases. Indeed, we consider the limiting case in which  $p \rightarrow 0$  as  $\Phi \rightarrow 0$ .

The bargaining game is solved by Selvaigi (2003) using backwards induction. The subgame-perfect equilibrium of the secondary market is first obtained and these payoffs used to compute the "unique" equilibrium of the entire game. Here, we simply state the main result together with some intuition.

**Proposition 1** In the limit, as  $\Phi \rightarrow 0$ , the unique subgame-perfect equilibrium payoffs to  $S$ ,  $L$  and  $H$  respectively converge to:

$$\frac{v^H + v^L}{2}, 0 \text{ and } \frac{v^H - v^L}{2}$$

Proof. See Selvaigi (2003, Section 2). ■

The good is instantly sold to  $H$  for  $\frac{v^H + v^L}{2}$ , a price halfway between the valuations of the two buyers (note that if buyers were identical, the seller would capture the entire surplus). As the item always falls into the high-value buyer's hands the bargaining process is efficient. The equilibrium price also coincides with what  $H$  would have paid for the good had it been acquired in the secondary market, albeit resale is off the equilibrium path.<sup>16</sup> In effect the competition between the buyers at the outset of the negotiations process allows the seller to capture the extra rents generated at the potential resale stage, and  $L$  is ultimately left with nothing whatever.

In a sense, the proof of Proposition 1 reflects the idea that, in the presence of resale, both buyers behave "symmetrically" even though their use values differ. Neither buyer would be willing to pay the seller more than  $\frac{v^H + v^L}{2}$  at the first stage - that is the equilibrium price in the secondary market. Further, if a buyer's failure to reach agreement with the seller is followed by the other buyer agreeing with the seller next period, then it is clear that neither buyer gains by rejecting a seller's price offer of  $\frac{v^H + v^L}{2}$  or less. What this implies is that the good is sold instantly to  $H$  for an amount that leaves him indifferent between trading with  $S$  or  $L$ . The final payoffs are those of the second-stage subgame and the lowest-value buyer gets nothing.<sup>17</sup>

The conclusion that  $L$  ends up with zero is worth emphasizing because it stands in sharp contrast to the predictions of most cooperative bargaining models used in the literature. Consider, for instance, Shapley values. In the case under consideration, this cooperative solution gives rise to the payoffs vector  $(s^S, s^H, s^L) = (\frac{v^H}{2} + \frac{v^L}{6}, \frac{v^H}{2} - \frac{v^L}{3}, \frac{v^L}{6})$ . Hence,  $L$  obtains a positive

<sup>16</sup>Since players are infinitely patient, when the chance of breakdown becomes vanishingly small the standard "split-the-difference" rule applies. As noted by Binmore (1994, 2003), in the case under consideration the equilibrium outcome converges to the Nash bargaining solution for the problem  $(X, b, b)$ , i.e., the breakdown and deadlock points are  $b = (\frac{v^L}{2}, 0)$ . So the buyers split the difference between  $v^L$  and  $v^H$ .

<sup>17</sup>This conclusion carries over to a broad range of solution concepts such as outside-option bargaining, bargaining with both forced and unforced breakdowns, and Nash bargaining [see Selvaigi (2003)]. See also the Appendix in this paper.

payoffs although he is the low-value customer and therefore never consumes the good [i.e.,  $L$  contributes nothing to the coalition  $\{S, H\}$ ]. Reasonable strategic bargaining games in general do not exhibit this feature [see, e.g., Binmore (1985, 2003), Osborne and Rubinstein (1990) and Bolton and Whinston (1993)]. By the same token, concepts such as ordering of players and probability distribution over orderings, coalition formation and fairness, all material ingredients of the cooperative frameworks, play no role whatsoever in our strategic model. As we now demonstrate, this non-cooperative approach implies that the effect of exclusivity on the parties' bargaining payoffs is very different to the previous literature.

## 2.1 Bargaining payoffs in the presence of exclusivity

Suppose the seller enters into an "enforceable" exclusive trade agreement with one of the buyers. This exclusivity deal deters  $S$  from trading the good with any customer other than the exclusive-rightholder.<sup>18</sup> Following Segal and Whinston (2000), we also assume that the contract does not specify a positive trade between  $S$  and the contracted buyer must take place. Although we later introduce an investment stage and assume that such choices are observable but not verifiable, this does not preclude trades being verifiable (i.e., there is partial exclusive contractual incompleteness). For now we do not explain why an exclusive contract might emerge but merely examine its impact on the players' ex post bargaining payoffs. In the next section we shall study the role of exclusive dealing in a richer economic context comprising specific investments and hold-up problems.

The proposed bargaining game easily accommodates an exclusivity provision. When the seller may only trade with the contracted buyer negotiations at the first stage of the game boil down to a two-party bargaining in which, as it is well known, the seller and the contracted buyer split the relevant surplus (for both agents now have identical bargaining power). That aggregate surplus depends in turn on whether the exclusive buyer consumes the good or resells it to the other buyer.

To be specific, suppose the seller has entered for some reason into an exclusive-dealing arrangement with buyer  $L$ . Once  $L$  acquires the good it is resold to buyer  $H$  for  $(v^L + v^H)/2$ . Thus,  $S$  and  $L$  split the difference between  $(v^L + v^H)/2$  and 0 at the outset, which determines an initial transfer price of  $(v^L + v^H)/4$ .<sup>19</sup>

<sup>18</sup>Analytically, this situation is akin the existence of an infinite penalty for breach of contract, that is to say, a compensatory payment that is so high that, if it must be paid, it precludes any trade between the seller and the uncontracted customer. The role of liquidated damages in our framework is analysed in Section 3.

<sup>19</sup>Alternatively but equivalently  $L$  could be paid  $(v^L + v^H)/4$  to relinquish its exclusive right. This implies that in our full model embodying specific investment renegotiation of the exclusivity provision does not hamper the potential achievement of first-best allocations. Hence presently renegotiation is both ex ante and ex post advantageous from an efficiency point of view, as opposed to the cases pointed out by Tirole (1999) where it is, instead, ex post beneficial but ex ante detrimental for investment incentives. The result that contracting might in some situations be efficiency-improving even in the presence of ex post renegotiation

The following proposition states the resulting equilibrium payoffs to the parties.

**Proposition 2** Suppose  $S$  has an exclusive-dealing contract with  $L$ . Then in the limit, as  $\Phi \rightarrow 0$ , the unique subgame-perfect equilibrium payoffs to  $S$ ,  $L$  and  $H$  respectively converge to

$$\frac{v^H + v^L}{4}, \quad \frac{v^H + v^L}{4} \quad \text{and} \quad \frac{v^H + v^L}{2}$$

So the equilibrium outcome is again Pareto efficient and the good ultimately falls into buyer  $H$ 's hands. Also, observe that buyer  $L$  now captures a strictly positive payoff albeit he is the lowest-value buyer. The fact that this payoff depends on  $L$ 's own valuation will play a major role in our subsequent analysis, and indeed distinguishes our approach from previous models. Moreover, we find that the nonexclusive buyer's bargaining payoff is immune to the exclusionary provision.<sup>20</sup> Exclusivity merely transfers rents from the seller (an indispensable player) to the exclusive-rightsholder without having a negative externality on the excluded buyer [contrary to Aghion and Bolton (1987), Segal and Whinston (2000) and Segal (2003)].<sup>21</sup>

Next, consider the case in which the seller writes the exclusive contract with  $H$ . Resale is now irrelevant, and the surplus generated by trade simply consists of  $v^H$ . Hence, the entire game reduces to a two-party bargaining between the seller and buyer  $H$ . The following result is then immediate.

**Proposition 3** Suppose  $S$  has an exclusive-dealing contract with  $H$ . Then in the limit, as  $\Phi \rightarrow 0$ , the unique subgame-perfect equilibrium payoffs to  $S$ ,  $L$  and  $H$  respectively converge to

$$\frac{v^H}{2}, \quad 0 \quad \text{and} \quad \frac{v^H}{2}$$

Unsurprisingly, in the presence of exclusive dealing buyer  $H$  pays a lower price for the item and his stake increases from  $(v^H + v^L)/2$  to  $v^H/2$ . Note, however, that in this case  $H$ 's extra payoff does not depend upon  $H$ 's use value but rather on  $L$ 's.

Some of the conclusions in this section differ markedly from those based on cooperative bargaining. First, we find that if buyer  $L$  holds an exclusive contract his expected payoff increases with his use value, whereas in cooperative

seems to shed new light on traditional contract theory.

<sup>20</sup> This means that the so-called negative bargaining effects on the uncontracted agent's payoff identified by Segal and Whinston (2000) and Segal (2003) do not obtain in our model.

<sup>21</sup> Although we do not explicitly deal with renegotiation issues, this is clearly a natural way in which final payoffs might be obtained in a one-step fashion (see also footnote 19). We include a brief discussion of this point in the subsequent section of the paper.

bargaining it depends on the value created by coalition  $f(S, Hg)$ . Secondly, Segal and Whinston maintain that exclusivity gives rise to a negative externality on the uncontracted buyer because he now generates zero when paired with the seller (trade between the two parties is prohibited). Coalition formation and the ordering of players are the main forces driving their results.<sup>22</sup> In our non-cooperative bargaining model the negative externality on the uncontracted party does not obtain. Rather, an exclusive contract in principle harms the seller whose payoff is lower than under a nonexclusive regime due to the suppression of initial competition between the buyers.

The next section uses these results to examine the link between exclusive trade agreements and incentives to make relationship-specific investments. For simplicity, we assume only one buyer has investment opportunities but our central message also applies if there are multiple investors (see the Appendix for an example).

### 3 Exclusivity and Investment Incentives

We focus on a vertical structure comprising an input monopolist, denoted by  $U$ , and two downstream firms designated by  $D_0$  and  $D_1$ .<sup>23</sup> The seller initially possesses a single indivisible unit of an essential input that the downstream units can transform into consumption goods on a one-for-one basis.<sup>24</sup> This means that  $U$  is unproductive with the input whereas  $D_j$ ,  $j = 0, 1$ , is unproductive without the intermediate good. To simplify matters, we suppose throughout that the downstream units sell their respective products in independent markets.

Let  $V_j$  stand for the aggregate surplus or "value" that  $D_j$  generates in the consumption market when it has access to the intermediate good. Buyer  $D_0$  has a known valuation of the input,  $V_0$ . This may reflect the application of a technology already patented by  $D_0$  or prior investments in human capital, or just an intrinsic capability. For convenience we assume that  $V_0 \geq 0$ . For buyer  $D_1$ , operating in a different market, the value of the good depends on some yet to be undertaken specific investment, perhaps R&D. The extent to which this succeeds in generating a viable process is uncertain.<sup>25</sup> That is,  $V_1$  is stochastic and also depends upon  $D_1$ 's "noncontractible" effort level. We

<sup>22</sup> Cooperative bargaining solutions are also best justified as incorporating notions of justice or fairness, but this is not necessarily a basis for positive economics.

<sup>23</sup> Our model is somewhat a special case of Bolton and Whinston (1993). However, in that paper both downstream firms make relationship-specific investments and the authors are interested in analysing optimal ownership structures.

<sup>24</sup> The case of a manufacturer signing an agreement to buy all its supplies from one of a number of upstream firms (Segal and Whinston's model) is analytically identical.

<sup>25</sup> Aghion and Tirole (1994) examine a related model in which a research unit performs non-contractible activities that increase the chances of discovery of an innovation. Their analysis concentrates though on bilateral relationships and optimal ownership structures. Here, unlike Aghion and Tirole's formulation, only one party makes a "sunk investment" and there are no cash constraints.



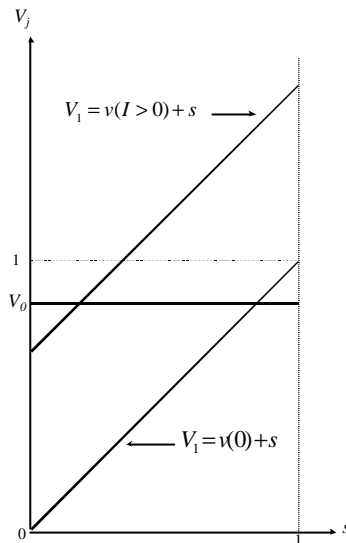


Figure 1: Relationship between the downstream firms' valuations

suppose that  $D_1$ 's use value is additive

$$V_1(I, s) = v(I) + s \quad (1)$$

where  $I \in \mathbb{R}_+$  is  $D_1$ 's (unverifiable) investment level and  $v$  is an increasing strictly concave function with the properties:  $v(0) = 0$  and  $\lim_{I \rightarrow 1} v(I) < V_0$ . The latter guarantees that there is always a positive probability of  $D_0$  being the efficient buyer. We also assume that the expected marginal productivity of investment at its zero level is infinite so as to guarantee interior solutions. The random variable  $s$  is drawn from a density function  $f(s)$  that is strictly positive on its support  $[0, 1]$ .

The monetary equivalent cost of  $D_1$ 's specific investment is  $c(I)$ , where  $c$  is an increasing strictly convex function with the following properties:  $c(0) = 0$  and  $c'(0) = 0$ . Further, there are no production costs and resale of the intermediate input is feasible.

Figure 1 depicts the relationship between the downstream firms' valuations. Note that the probability that  $D_1$  is ex post the highest-value customer depends on both  $D_0$ 's use value and  $D_1$ 's effort level.

The sequence of events is illustrated in Figure 2. At date 1 firm  $D_1$  invests, then the state of the world is realized, and subsequently there is a three-party bargaining session in which the allocation of the input and its transfer price are determined. Lastly, at date 4, trade and production take place. The seller may

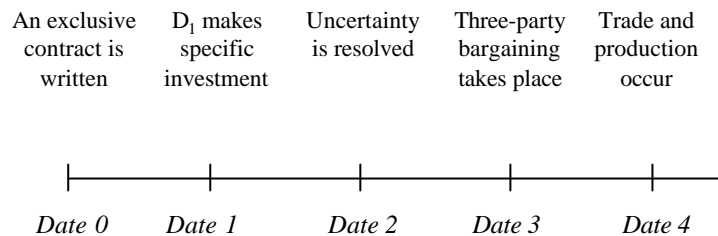


Figure 2: Sequence of events

write ex ante, at date 0, an exclusive-dealing contract with  $D_1$  that confers this form exclusive rights over trade with  $U$ . Following Segal and Whinston (2000) and our discussion in Section 2, we assume that the exclusive contract exhibits some degree of incompleteness, in the sense that it does not specify in advance a positive trade between the parties to the contract. In fact this is a desirable feature of the contract allowing better incentives to emerge but there may be no choice over the issue. This may be because the exact nature of the input is ill-defined ex ante and so agents cannot contract for a specific delivery. This is a standard assumption in the “incomplete contracting” literature [Grossman and Hart (1986), Hart and Moore (1990) and Hart (1995)].<sup>26</sup> The implication is that only the identities of trading partners are verifiable by courts; this assumption is not always applicable, but seems appropriate in many circumstances.<sup>27</sup>

We first study  $D_1$ 's marginal investment incentives in the nonexclusive benchmark case. In the absence of exclusive dealing,  $D_1$  captures ex post a positive bargaining payoff only in those realizations in which it is the high-value buyer. Using Proposition 1,  $D_1$ 's payoff is  $(V_1 - V_0)/2$  when  $V_1 > V_0$  and zero in the remaining states of the world.

Letting  $S_j(I) = \{I \mid V_j > V_i\}$  designate the set of states of the world in

<sup>26</sup>See Tirole (1999) for a comprehensive and critical discussion of the more recent developments in this literature.

<sup>27</sup>As argued by Hart and Tirole (1990), exclusive dealing can sometimes be unenforceable for either informational or legal reasons. In those situations vertical integration might be preferred to exclusivity. See the Conclusion for further discussion.

which it is efficient for  $D_j$  to use the input, we write  $D_1$ 's expected revenue as:

$$\begin{aligned} \pi_1(I, s) &= \int_{v_0}^{s_1} \frac{V_1 - V_0}{2} f(s) ds \\ &= \int_{v_0}^{s_1} \frac{v(I) + s - V_0}{2} f(s) ds \end{aligned} \quad (2)$$

where we used the fact that  $V_1 > V_0$  implies that  $s > V_0 \Rightarrow v(I)$ .  $D_1$ 's optimal investment level is then characterized by the first-order condition  $\pi_1'(I) = c'(I) = 0$ , namely:<sup>28</sup>

$$\int_{v_0}^{s_1} \frac{v(I^{ne}) + s - V_0}{2} f(s) ds = c'(I^{ne}) \quad (3)$$

where superscript "ne" stands for non-exclusive.

Next, note that a social planner chooses  $I$  to maximize the expected aggregate surplus created by the vertical relationship, which in the case under consideration is given by:

$$\begin{aligned} W(I, s) &= \int_{v_0}^{s_0} V_0 f(s) ds + \int_{s_1}^{s_1} V_1 f(s) ds - c(I) \\ &= \int_0^{s_0} V_0 f(s) ds + \int_{v_0}^{s_1} [v(I) + s] f(s) ds - c(I) \end{aligned} \quad (4)$$

The efficient (or "first-best") investment level is then characterized by the first-order condition:

$$\int_{v_0}^{s_1} v(I^B) f(s) ds = c'(I^B) \quad (5)$$

Since  $v'(0) > c'(0)$  and  $0 < V_0 < 1$ , we conclude that  $I^B > 0$ . Hence, by simply comparing equations (3) and (5) we have the following.

**Proposition 4** In the absence of exclusive dealing,  $D_1$  is exposed to the threat of hold-up and underinvests relative to the first-best level.

**Proof.** This follows directly from (3), (5), and the assumed properties of  $v$  and  $c$ . ■

Underlying this result is the standard hold-up problem. Although  $D_1$  pays the full marginal investment cost, it captures ex post only half of the marginal return on its investment. The rest is expropriated by  $U$  in the trilateral bargaining process. Private investment returns are then smaller than the social ones and, under a nonexclusive regime,  $D_1$  underinvests relative to the efficient level.

Our previous discussion established the benchmark "nonexclusive" and "socially optimal" outcomes. In the next subsection we analyse the impact of exclusivity on  $D_1$ 's incentive for investment. Interestingly, exclusivity always promotes its recipient's incentives to make relationship-specific investments.

<sup>28</sup>We assume throughout that second-order conditions automatically hold.

### 3.1 Investment incentives in the presence of exclusivity

Suppose the upstream monopolist writes an enforceable exclusive contract with  $D_1$  that prevents  $U$  from trading with any customer other than  $D_1$ . The price at which the good is exchanged is still bargained ex post and there is still the possibility of resale to  $D_0$ .

Propositions 2 and 3 imply that, in the presence of exclusivity,  $D_1$  obtains a positive bargaining payoff in all possible states of the world. More precisely,  $D_1$ 's payoff is  $V_1/2$  when  $V_1 \leq V_0$  and  $(V_0 + V_1)/4$  in the remaining states of the world.

$D_1$ 's expected revenue is now:

$$\begin{aligned} \pi_1^e(I, s) &= \int_0^{s_0} \mu \frac{V_0 + V_1}{4} f(s) ds + \int_{s_1}^{\infty} \mu \frac{V_1}{2} f(s) ds \\ &= \int_0^{s_0} \nu_{0i} \nu(I) \cdot \frac{V_0 + v(I) + s}{4} f(s) ds + \int_{\nu_{0i} \nu(I)}^{\infty} \nu(I) \cdot \frac{v(I) + s}{2} f(s) ds \end{aligned} \quad (6)$$

Under exclusivity,  $D_1$ 's optimal investment choice is thus characterized by the first-order condition:

$$\int_0^{\nu_{0i} \nu(I^e)} \nu(I^e) \cdot \frac{v^0(I^e) + s}{4} f(s) ds + \int_{\nu_{0i} \nu(I^e)}^{\infty} \nu(I^e) \cdot \frac{v^0(I^e) + s}{2} f(s) ds = c^0(I^e) \quad (7)$$

That is,  $D_1$  captures not only half of the marginal returns on investment when  $V_1 \leq V_0$  (as in the nonexclusive benchmark), but also a quarter of the marginal investment return when the input ends up in  $D_0$ 's hands. The latter increases in  $V_1$  are not in principle socially valuable, for the social benefits of  $D_1$ 's investment only accrue when  $V_1 > V_0$ . But the extra investment is potentially efficiency-enhancing because counteracts the incentive for underinvestment (due to hold ups) existing when  $D_1$  is ex post the highest-value buyer. So exclusivity unambiguously encourages  $D_1$ 's specific investment.

The following proposition summarizes the main message of this paper. (It follows directly from the comparison of expressions (3), (5) and (7).)

**Proposition 5 (The Relevance Result)** If the seller writes an exclusive-dealing contract with  $D_1$ , then the latter invests more than under a nonexclusive regime. So exclusivity unambiguously fosters  $D_1$ 's relationship-specific investment (i.e.,  $I^e > I^{ne}$ ).

It is worth comparing the rationale for Proposition 5 with that underlying the "Irrelevance Result" obtained in earlier papers. In the cooperative frameworks utilized previously, exclusivity merely eliminates the surplus otherwise created by a coalition of the seller and the nonexclusive customer - in the presence of exclusive dealing they cannot trade. It is evident that the contracted buyer's bargaining payoff must then go up. Whether this additional payoff is sensitive

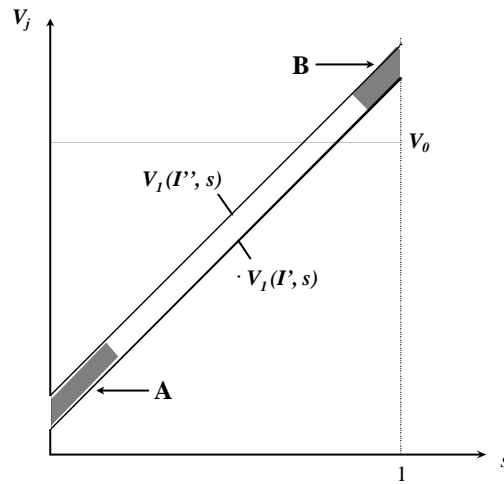


Figure 3:  $D_1$ 's investment incentives in the presence of exclusive dealing

to the contracted buyer's investment level is less obvious. The point is that the value of coalitions which include the contracted firm is unchanged but the value of coalitions that do not include the contracted firm is reduced. Thus the surplus brought by the contracted firm relative to the nonexclusive case does not depend on the exclusive firm's own use value. This is the basis for Segal and Whinston's result. On the other hand, the first term of (7) implies that in our model  $D_1$ 's extra payoff does depend on its investment level even in the absence of cross-effects between firms. This stems from the contracted firm's (credible) threat of using the input internally when the lowest-value buyer.  $D_1$ 's increased bargaining power is thus sensitive to its investment at the margin, and this is precisely the source of our "Relevance Result".

Figure 3 illustrates the simple intuition behind this Relevance Result. Consider the change in  $D_1$ 's expected payoff when this firm holds an exclusive-dealing contract and increases its investment from  $I'$  to  $I'' = I' + \Phi I$ , for  $\Phi I$  infinitesimally small. Roughly speaking, the area denoted by "A" corresponds to the first term of equation 7; it represents the expected change in  $D_1$ 's return on investment when this firm is ex post the lowest-value buyer. In the absence of exclusivity this payoff is zero. On the other hand, the area designated by "B" corresponds to the second term of equation 7. It illustrates the fact that  $D_1$  captures only half of the marginal increases in  $V_1$  when this firm is ex post the highest-value buyer. Note that if  $A = B$  at the socially optimal investment level, then exclusive dealing yields the first-best outcome.

In our set up it is clear that exclusivity can also give rise to overinvestment

relative to the efficient level. This is because the contracted firm captures marginal investment returns even when the lowest-valuing buyer. If the exclusive firm is the less efficient buyer under most realizations a socially excessive level of investment obtains. It can be easily verified that overinvestment relative to the first-best level arises in our model whenever  $V_0 > v(I^*) > 2/3$ . The following proposition states this result.

**Proposition 6** In the presence of exclusive dealing the contracted firm has incentives for overinvestment whenever  $V_0 > v(I^*) > 2/3$ , in which case  $I^e > I^* > I^{ne}$ .

When the condition identified in Proposition 6 does not hold an exclusive contract certainly raises efficiency. When the condition is satisfied a modification of the exclusive contract suffices to ensure that a first-best outcome arises. This is shown in the next section.

Implicit in our approach is that the efficient contract will emerge as a result of prior negotiations between the three parties. What is required is that this pre-bargaining is itself efficient. If so, the contract that will be agreed on will prevent one of the buyers from dealing directly with the seller. Though the exclusive contract has so far been treated as being signed between the seller and a buyer, a contract between the two buyers that only one of them is allowed to deal with the seller leads to identical incentive effects. A contract between the buyers may be per se illegal under competition laws, but if not it clearly undermines the bargaining power of the seller, implying the exclusive contract must be given away by the seller.<sup>29</sup> When the buyers cannot easily collude, the seller will be able to extract a fee for the exclusive contract.

This concludes the main analysis of the current paper. In short, our overall message is that the relationship between an exclusivity provision and the incentive for specific investment seems to be much more robust than existing models suggest.

### 3.2 Liquidated damage provisions

Thus far we have analysed exclusive contracts that completely block trade between the seller and the uncontracted buyer (i.e. involve infinite penalties for external trade). In practice more flexible contracts are often written stipulating finite damages to be paid in the event of breach. In this section we relax our

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<sup>29</sup> As pointed out by Jones and Sufrin (2000), horizontal agreements restricting the parties' freedom to negotiate buying prices are bound to infringe Article 81 (1) of the EEC Treaty. For example, in the "Zinc Producer Group" case (OJ L220/27, 1984) the European Commission concluded that an agreement restricting the freedom of each member company to negotiate its purchase price of raw material was illegal. More particularly, the co-ordinated individual buying up of zinc on the London Metal Exchange by the colluding companies was considered an infringement of Article 81 (1) owing to its alleged "restriction of competition".

previous assumption and briefly examine contractual provisions that only specify liquidated damages, i.e., a finite compensation for breach of contract. Such liquidated damage clauses may have a positive role in our framework in curbing overinvestment. The reason is that such a provision bounds the number of states in which the contracted firm's payoff, when the low-value buyer, depends on its marginal investment choice. When exclusive dealing gives rise to overinvestment, there exists an optimal breach penalty that induces the first-best level of specific investment.

According to Spier and Whinston (1995), two branches of literature exist with rather different views of the role of liquidated damages: one argues that they are socially desirable because they protect relationship-specific investments, whilst the other asserts that they are socially undesirable because they exclude efficient competitors. The analysis in the current paper leads to a striking third view, namely, that liquidated damage provisions are in general efficiency-enhancing because they "curb" the exclusive buyer's incentives for overinvestment.

Prior to considering investment decisions, the parties' ex post bargaining payoffs in the presence of damage payments will be examined. We focus again on the three-party bargaining game discussed in Section 2. Let  $d$  denote the (finite) privately stipulated penalty for breach of the original contract.

First assume that the seller enters into an exclusive trade agreement with  $L$ . Using Proposition 2 we can immediately see that if  $d < (v^H + v^L)/4$  the seller will unilaterally breach. Put differently, in the SPE of the game  $S$  obtains  $(v^H + v^L)/2 > d$  independently of the buyer she trades with. Thus, in the case under consideration, the good is sold to  $H$  for  $(v^H + v^L)/2$ , as under a nonexclusive regime, and the contracted buyer gets paid the stipulated damage  $d$ . In this instance  $L$ 's payoff does not depend on its use value. If instead  $d > (v^H + v^L)/4$ , then the model boils down to the (fully) exclusive regime analysed in Subsection 2.1, and therefore Proposition 2 applies. In summary;

**Proposition 7** Suppose  $S$  has an exclusive-dealing contract with  $L$  that stipulates liquidated damages  $d$ . If  $d < (v^H + v^L)/4$ , then in the limit, as  $\epsilon \rightarrow 0$ , the unique subgame-perfect equilibrium payoffs to  $S$ ,  $L$  and  $H$  respectively converge to

$$\frac{v^H + v^L}{2} > d, \quad d \quad \text{and} \quad \frac{v^H - v^L}{2}$$

If, on the other hand,  $d > (v^H + v^L)/4$ , then Proposition 2 applies.

Proposition 7 casts doubts on the chief point made by Aghion and Bolton's (1987) influential paper. In effect they interpret liquidated damage provisions as implicit fees that a future entrant (buyer  $H$  in the above case) will have to pay the incumbents to access a particular market. In their model delivery is contractible ex ante and the damage payment generates social losses because the incumbents set a socially excessive level of damages to capture extra rents from

the potential entrant, thereby blocking efficiency-improving entry. In contrast, our analysis suggests that while stipulated damages for breach do redistribute bargaining power between the parties to the contract, they have no effect whatsoever on the nonexclusive party's payoff. Since efficiency-enhancing entry is not blocked, liquidated damage clauses turn out to be in principle neutral from a welfare point of view. Spier and Whinston (1995) have shown that the introduction of renegotiation alone destroys Aghion and Bolton's result, but they nevertheless conclude that damages for breach still create inefficient barriers to entry in the presence of relationship-specific investment due to the contracted agent's incentive for overinvestment. However, in our model with specific investment these provisions do have in general a positive role, insofar as they may induce the first-best investment level (see below).

Let us look now at the case in which the seller writes an exclusive contract with  $H$ . From Proposition 3 it is immediate that if  $d \leq v^L/2$ , the seller will be willing to unilaterally breach the original contract and trade with either buyer. Since in equilibrium the item falls into  $H$ 's hands, the contract is ultimately honoured and the liquidated damage is not paid along the equilibrium path. However, the provision still matters because it impinges on the agreed upon transfer price, which in the case under consideration is smaller than the one prevailing under a nonexclusive regime. With damages set at this level there is no SPE in which  $H$  will pay the seller more than  $(v^H + v^L)/2 - d$  at the outset of the negotiations. If, however,  $d > v^L/2$ , then the game boils down to a two-party bargaining between the parties to the contract, and therefore Proposition 3 applies.

**Proposition 8** Suppose  $S$  writes an exclusive-dealing contract with  $H$  that stipulates liquidated damages  $d$ . If  $d \leq v^L/2$  then in the limit, as  $\Phi \rightarrow 0$ , the unique subgame-perfect equilibrium payoffs to  $S$ ,  $L$  and  $H$  respectively converge to

$$\frac{v^H + v^L}{2} - d, \quad 0 \quad \text{and} \quad \frac{v^H - v^L}{2} + d$$

If, on the other hand,  $d > v^L/2$ , then Proposition 3 applies.

The remainder of this section examines the impact of stipulated damages for breach on the contracted firm's investment incentives. Specifically, suppose the seller writes an exclusive contract with  $D_1$  that stipulates damages  $d \cdot (V_0 + V_1)/4$  for some subset of feasible values of  $V_1$ . Consider whether there exists a level of damage payment that not only protects specific investments but also curtails  $D_1$ 's incentives for overinvestment arising under a "fully" exclusive regime. The answer turns out to be affirmative (bear in mind that when  $D_1$  holds an exclusive-dealing contract, it overinvests relative to the efficient level if and only if  $V_0 - v(I^B) > 2/3$ ).

To clinch the point, suppose  $d < V_0/2$  [which implies  $4d - V_0 - v(I^B) < V_0 - v(I^B)$ ]. For notational convenience, let  $s$  stand for  $4d - V_0 - v(I)$ . Then,



using Propositions 7 and 8 we can write  $D_1$ 's expected revenue as:

$$\pi_1^d = \int_0^{(V_0 + V_1)/4} f(s) ds + \int_{(V_0 + V_1)/4}^{V_0} d f(s) ds + \int_{V_0}^{V_1} \frac{(V_1 - V_0)}{2} + d f(s) ds \quad (8)$$

The first two terms of (8) refer to realizations in which  $V_0$  exceeds  $V_1$ . Efficiency then calls for the nonexclusive buyer to use the input. The first term of (8) covers cases in which  $d \geq (V_0 + V_1)/4$  and therefore  $D_1$ 's bargaining payoff is  $(V_0 + V_1)/4$  [using Proposition 7]. The second term of (8) refers to situations in which  $d < (V_0 + V_1)/4$ , which implies that  $D_1$ 's bargaining payoff is simply  $d$  [again using Proposition 7]. Finally, the last term of (8) is due to the fact that when  $d < V_0/2$  and  $V_1 > V_0$ ,  $D_1$ 's bargaining payoff is  $(V_1 - V_0)/2 + d$  [using Proposition 8].

$D_1$ 's optimal investment choice is therefore characterized by the first-order condition:

$$\int_0^{4d - V_0} \frac{v^0(I^d)}{4} f(s) ds + \int_{V_0}^{V_1} \frac{v^0(I^d)}{2} f(s) ds = c^0(I^d) \quad (9)$$

Comparing equations (7) and (9), it is readily seen that finite - as opposed to infinite - stipulated damages for breach are sometimes surplus-improving because they curb the contracted firm's incentives for overinvestment. The route is the introduction of an upper bound on the number of realizations in which  $D_1$  gets positive marginal investment returns when the low-value user, because now there are states of nature in which  $D_1$  receives just  $d$ .

As pointed out above, Spier and Whinston (1995) argue that renegotiable damage penalties may give rise to overinvestment by the contracted party. In a way our previous results confirm their finding. However, the models differ in many important respects. Following Aghion and Bolton (1987), they assume that a buyer can write a "contract for delivery" with a seller who makes an unverifiable specific investment. The ex ante contract stipulates a "transfer price" and a damage payment in case of breach (i.e., quantities are verifiable). A more efficient seller may randomly show up ex post. Spier and Whinston then use a Nash bargaining formulation in which the original contract determines the threat point of the renegotiation process between the incumbents. Also, and more crucially, the potential entrant is able to make a take-it-or-leave-it offer to the buyer (this in effect precludes three-party bargaining). The latter assumption implies that in all states of nature the incumbents receive the surplus jointly created. This in turn induces too high a level of investment in order to capture extra rents from the entrant. In a model with explicit three-party bargaining and incomplete contracting (i.e., unverifiable quantities), we also find that high damage payments can give rise to socially excessive investment [whereas, in a similar context, Segal and Whinston (2000) deny any relationship between stipulated damages and specific investments]. It is precisely in those cases, though, that there exists an optimal damage payment that induces the first-best investment and thus maximizes expected aggregate surplus.

To illustrate we now present a numerical example. Suppose  $V_1 = I + s$ ,  $c(I) = (3/4) I^2$  and  $V_0 = 11/12$ . The random variable  $s$  is uniformly distributed within the interval  $[0, 1]$ . It can then be shown that the first-best outcome is  $I^* = 1/6$ . Further, since  $I^{ne} = 1/24$  and  $I^e = 13/60$ , we have  $I^e > I^* > I^{ne}$ . Under a fully exclusive regime ( $d = 1$ ),  $D_1$  overinvests relative to the efficient level (note that  $V_0 > I^* = 3/4 > 2/3$ ). However were stipulated damages for breach fixed at  $d^* = 19/48$ ,  $D_1$  would invest at exactly the socially optimal level. As explained above, the optimal breach penalty establishes an upper bound  $s^* = 4d^* > V_0 > I^d = 1/2$  on the set of states of nature in which  $D_1$  gets positive investment returns when  $V_1 < V_0$ , so as to just compensate the contracted firm for the expected hold ups arising when it does end up using the good.

## 4 Conclusion

This paper shows that the relationship-specific investment of a downstream firm may be encouraged by a contract that prevents the upstream supplier of an essential input from selling it to another buyer. Of course this does not mean that the input will end up being used by the firm with the exclusive right to buy, but the contract does enhance the downstream firm's ex post bargaining power enabling it to extract an increased share of the value created by its investment. In particular, when the contracted firm is not the highest-value user of the input, the price at which it can resell it (or which it must be paid to relinquish the exclusive contract) is increasing in its own use value. This offsets the underinvestment incentive due to the usual hold-up problem that arises when the contracted buyer is the highest-value user. Since the firm's investment is only socially productive when it does get to use the input, an exclusive-dealing contract may therefore result in excessive investment. This can be avoided by a provision that the seller can void the contract on payment of a fixed fee set ex ante. When the contracted firm's use value is low, this provision is utilized by the seller, so in these states the firm's payoff is no longer dependent on its investment.

An exclusive contract is not the only way investment incentives can be altered. Sometimes the downstream firm may be able to buy input prior to the investment decision (in effect backward integration). The owning firm now captures the full marginal benefit of investment when it is the high value user, but also gains something from investment when it is the low-value user. The good is still sold on in these circumstances, but by increasing the owner's use value investment improves its terms of trade. There is thus overinvestment and to a greater extent than an exclusive contract would generate [see, e.g., Bolton and Whinston (1993)]. So an exclusive contract could "beat" backward integration and non-integration with no ex ante contractual relationship.

The semi-cooperative bargaining adopted in other papers fails to find a role for exclusive contracts because a firm's payoff only depends on the value its presence adds to a coalition. Holding an exclusive contract increases the number

of coalitions to which a firm adds value, but if exclusivity makes a difference to whether a firm contributes to surplus, the contracted firm is the low-value user so its investment does not influence coalition value and yields no private return. When a firm is the high-value user, if it has an exclusive contract removing it from the grand coalition means the seller and the other buyer cannot produce at all, but leaves unchanged the marginal contribution of investment. So under cooperative bargaining, exclusivity does not boost the marginal return to investment.

Non-cooperative bargaining is not only more reasonable given non-cooperative investment, it establishes a new role for exclusive contracts in protecting the returns to marginal investment.<sup>30</sup>

The assumptions of the paper can be relaxed in various ways. In Appendix A.1 a different bargaining protocol is applied leading to the Outside Option Principle holding. We show that our main conclusion still applies. Sometimes firms have discretion which potential partner benefits from its investment. Appendix A.2 shows that exclusive contracts can eliminate the strategic inefficiencies that otherwise occur. A new potential efficiency gain from exclusivity clauses arises when more than one potential partner is able to undertake relationship-specific investment. Appendix A.3 presents an example in which both buyers may invest. When there are multiple Nash equilibria in the investment game exclusive dealing may eliminate inefficient equilibria in which too many firms invest too little.<sup>31</sup>

In many cases exclusive contracts between firms involve investments that are partly general. In our benchmark case of two buyers it is easy to see that if the investment of one buyer boosts the value of the good to the other buyer this diminishes the incentive to invest when there is no exclusive contract (it increases the price paid for the input) but, with the possibility of resale, spillovers increase investment incentives under exclusivity. So although to make the novel analytical point we assume relationship-specific investment, the effects we consider can coexist with and augment the usual horizontal externalities argument.

Exclusivity may also confer other benefits. By providing a return even when investment fails, exclusive dealing provides insurance, which may be important for risk-averse firms.

Perhaps the most important application of the ideas in the paper is to employment contracts. What defines an employee is that they cannot sell their output to other firms. Moreover, even in the absence of statutory employment provision firms typically constrain themselves from replacing workers at will. Relative to self employment, the effect may be to stimulate relationship-specific employment.

Holmström and Roberts (1998) argue that “contractual assets” can often

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<sup>30</sup> Whenever exclusive dealing promotes efficiency it will tend to be adopted since the gains will be shared between the parties in the ex ante bargaining over contractual terms (a reflection of the Coase Theorem).

<sup>31</sup> A similar point is made by de Meza and Selvaggi (2003), albeit our working paper follows the existing literature in assuming cooperative bargaining.

provide the same redistribution of bargaining power that the property rights theory of the firm normally attributes to physical assets. The current paper formalizes this notion by setting forth a model where exclusive dealing emerges as a powerful governance structure for enhancing its recipient's incentives to make relationship-specific investments.

# Appendix

## A.1. Outside-option bargaining

Consider a two buyer one seller set up as discussed in the main text except that instead of an exogenous risk of breakdown in negotiations there is discounting between rounds. As before, resale is feasible. Since the good is non-durable and only of value when consumed, the outside-option principle applies. For the sake of conciseness, we focus throughout on the parties' subgame-perfect equilibrium payoffs for the case in which the interval between successive offers becomes vanishingly small. (A thorough discussion of this bargaining model can be found in Selvaggi 2003, Section 3.)

Suppose  $H$  and  $L$  value the good at 12 and 10 respectively. Then, in the absence of exclusive dealing the item is instantly sold to  $H$  for 10 [note that similar conclusions are obtained by Osborne and Rubinstein (1990), Bolton and Whinston (1993) and Binmore (2003)]. The rationale for this equilibrium outcome is exactly the same as in the breakdown case; namely, resale means that  $L$  will be willing to pay up to the SPE price of the resale game at the outset of the negotiations with the seller. That resale value is equal to 10 because if the game reaches the secondary market  $L$  possesses the "binding" outside option of consuming the good (i.e.,  $10 > 0.5 \times 12$ ). Consequently, the sequential bargaining payoffs to  $S$ ,  $L$  and  $H$ , respectively, are 10, 0 and 2.

Now assume that before bargaining takes place, the seller enters into an enforceable exclusive trade agreement with buyer  $L$ . As a result of this contract, the first-stage game reduces to a two-party bargaining process between the seller and the contracted buyer in which they split the relevant gains from trade equally (notice that both parties' outside options are zero). In the case under consideration that surplus equals 10. Hence, the item is initially sold to buyer  $L$  for  $0.5 \times 10 = 5$  and this buyer then resells the object to buyer  $H$  for 10. In the frictionless limit, the parties' equilibrium payoffs are therefore 5 to the seller, 5 to buyer  $L$  and 2 to buyer  $H$ . Two main features of this result are worth stressing. First, note that as before, exclusivity does not have any negative externality on the nonexclusive buyer. Secondly, in the presence of exclusive dealing, buyer  $L$ 's bargaining payoff is again sensitive to his own use value whenever  $L$ 's outside option at the second-stage subgame is binding. It is therefore immediate that an exclusivity deal affects its recipient's incentive for relationship-specific investment at the margin.

Suppose a firm can undertake risky R&D. A low-level investment program yields with equal chance a value of the input of 22 or 8. Higher investment boosts value to 24 or 10. An established firm values the input at 12. Without an exclusive contract the expected value of investment is 1 but with exclusivity expected value equals 2, the expected increase in the social value of investment.

## A.2. Exclusivity and Strategic Investment

As in the main text, suppose the seller of a unit of an indivisible item confronts two heterogeneous buyers. There is, however, no uncertainty. Buyer 1 values the good at  $\hat{v}$  whereas buyer 2 values the good at  $v_2 > \hat{v}$ . When the

outside-option principle applies the item is sold to buyer 2, the high-value type, at a price  $\hat{v}$  (i.e.  $\hat{v} \geq v_2/2$  so the seller's outside option is binding). Suppose the seller can undertake some discrete relationship-specific investments. Let  $\Phi\hat{v}$  and  $\Phi v_2$  represent the respective boosts in the buyers' valuations when the seller invests at cost  $i_1$  and  $i_2$  respectively, and assume that  $\Phi\hat{v} \leq \Phi v_2$  and  $\hat{v} \geq (v_2 + \Phi v_2)/2$ .

It is efficient to undertake the investment that raises buyer 2's use value as long as  $i_2 < \Phi v_2$ . Also, note that undertaking investment  $i_1$  is always socially unproductive. Since in the absence of an exclusive-dealing contract with buyer 2, the seller obtains positive returns only on the investment that increases  $\hat{v}$  (unless  $i_2$  raises the value of the good to buyer 2 in excess of  $2\hat{v}$ , in which case the seller gets  $0.5 \leq v_2$ ),  $i_2$  will not be undertaken even though it is efficiency-improving. If  $i_1 < \Phi\hat{v}$ , then the seller chooses the wrong investment because it influences his bargaining power and thereby the price obtained for the good.

An exclusive-dealing contract signed between the seller and buyer 2 results in the seller obtaining 50% of the returns to the relationship-specific investment that increases buyer 2's use value. The seller's outside option is now zero and so the incentive to make the wrong investment  $i_1$  - that is, the one that boosts the value of the good to buyer 1 - is eliminated. Since both changes are efficiency-enhancing, an exclusive contract will be adopted if the seller is the only party with investment opportunities. There is though a potential drawback. In the absence of an exclusivity provision the price of the object is fixed at  $\hat{v}$  independently of buyer 2's investment, who therefore captures the full extra value of any relationship-specific investment he may undertake. Therefore the effect of exclusivity is to demotivate the buyer but to motivate the seller (and, in addition, to eliminate the seller's incentive to make wasteful investments to increase the value of the good to the alternative user). Equalizing both parties' investment incentives may well raise efficiency, in which case an exclusivity provision increases aggregate surplus.

Under "split-the-difference bargaining" the efficiency gains derived from exclusive dealing are lower. In effect each party gets 50% of the extra value its own investment creates whether or not an exclusionary contract is signed. Hence, there is no direct incentive for exclusive dealing. An exclusive contract does eliminate socially unproductive expenditures, however. Since the seller benefits from increases in the low-type agent's valuation because this forces up the price paid by the successful buyer, exclusivity eliminates the seller's incentive to expend resources to make the good more attractive to the lowest-valuing buyer in order to improve her bargaining position. Yet, once the effects of investment are stochastic even with split the difference bargaining an exclusive-dealing contract may have direct benefits in encouraging relationship-specific investment.

This analysis is in general applicable not only to trade between firms but also to employment contracts (what follows is partially based on Baker et al. (2002) which in turn is in the spirit of GHM). Interpret the supplier as a worker utilising an asset to produce a good of potential value to two firms. Without access to the asset the worker's investment is useless. One possibility (integration) is that the worker is an employee of buyer 2 who owns the asset. Another possibility is

outsourcing, that is the worker owns the asset and so is an independent supplier. The former arrangement eliminates the worker's incentive to undertake wasteful investments to increase bargaining power but also implies there is no reason to make the productive investment. Our analysis adds to the Baker et al. menu; the best organisational form may be outsourcing (the worker owns the asset) but the buyer has an exclusive contract with the supplier. In effect exclusivity not only eliminates the seller's incentives to make  $i_1$  type investment that is socially unproductive, but may encourage efficient  $i_2$  type investment. The latter effect is absent from a spot employment contract. Thus, without imposing any additional informational assumptions to the model we find that exclusivity is in fact better than spot employment (i.e., integration).

### A.3. Exclusivity as a selection device

Suppose that both buyers are ex ante symmetric and may choose to invest either "low", or "high" or not at all. A non-investing buyer is unproductive. There are two equally likely states of nature. If a buyer invests low, then the good is worth 12 in one state and nothing in the other. For simplicity, suppose that when both buyers invest low their payoffs occur in different states (perhaps they operate indoor and outdoor restaurants, and the uncertainty is due to the weather). This assumption is not necessary for our results, however. If on the other hand a buyer invests high, then he values the object at 12 no matter which state prevails. Costs are 2.5 and 3.5 for "low" and "high" investment respectively. To fix ideas, we focus throughout on pure-strategy Nash equilibria.

Without exclusive dealing there is an equilibrium in which both buyers invest low. In effect our bargaining solution implies that a customer pays 6 for the good in the state in which his investment succeeds. Thus, investing low yields expected net payoff of  $3 \frac{1}{2} - 2.5 = 0.5$ . Consider next a buyer's deviation to high investment when the other buyer invests low. The deviant pays 6 when his rival's investment fails. In the realization in which both investments succeed there is stiffer competition for the provision of the good. Both buyers value the item at 12, and our bargaining solution involves the item being sold to either buyer for 12 and the seller capturing the entire surplus. This means that a deviation to "high" is not profitable.

There are, however, other two (corner-type) Nash equilibria in which one buyer invests "high" and the other remains inactive. These allocations maximize aggregate surplus. To show that they constitute Nash equilibria, note that the investing party expects to pay 6 for the good in both states of the world. Thus, his expected net payoff is  $6 \frac{1}{2} - 3.5 = 2.5$ . A deviation to "low" implies that the investing party is now productive in only one state, which gives an expected net payoff of  $3 \frac{1}{2} - 2.5 = 0.5$ . So he does not gain by deviating. Using similar arguments, it can be shown that the non-investing party has no incentives to deviate either (expected payoffs are negative for either investment level).

An exclusive trade agreement removes the inefficient two-active firms equilibrium, i.e., only the surplus-maximising allocation in which a single buyer invests high survives exclusivity. Interestingly, exclusivity does not necessarily imply that the contracted buyer is the only potential investor. Indeed, there is

an exclusive equilibrium in which the uncontracted buyer invests high and the exclusive buyer does not invest at all. Let us briefly look at this case. We know from the above arguments that the uncontracted customer has no incentives to deviate from "high" when his rival is not active - for exclusivity does not affect the uncontracted party's bargaining payoffs. So, we shall demonstrate that the exclusive buyer has no incentives to deviate either. If he does not invest, expected revenue is 3. This stems from the fact that the resale price is 6 in both states of the world and he splits the difference between 6 and 0 with the seller. Deviations to "low" and "high" investments give him respectively expected net payoffs of  $4.5 - 2.5 = 2$  and  $6 - 3.5 = 2.5$ . Since both are smaller than 3, they are not profitable. There is of course another Nash equilibrium in which only the protected buyer invests "high". But the bottom line of our analysis is that both 'exclusive' equilibria achieve the efficient outcome.

The equilibrium in which the contracted buyer is in the end not active may nonetheless be eliminated through the initial negotiations over which one of them obtains the access privilege. More specifically, observe that if the buyers cannot contract with each other, then the seller can capture all the expected surplus by auctioning ex ante the exclusive-dealing contract. In effect the input is sold for 3.5 up-front with a further 6 paid on delivery. Hence, the exclusive contract also allows for full rent capture.<sup>32</sup>

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<sup>32</sup>The aforementioned shows that exclusivity can most often be used as a purely rent-extraction device, as previously noted by Aghion and Bolton (1987), Bernheim and Whinston (1998) and de Meza and Selvaggi (2003).



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