Are Exclusive Contracts Anticompetitive?

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1 Introduction

While antitrust law is often hostile to exclusive contracts that say "you agree not to purchase this product from anyone besides me", economic theory so far has provided only partial support for such a hostility.[1] This paper shows that this hostility can be justified under more general circumstances than has been established so far in the literature: a firm may introduce exclusivity clauses in its contracts with (some of) its customers in order to drive a rival out of the market by depriving it of the minimal required scale, so as to increase its market power.

The first analysis of exclusive contracts emanated from the "Chicago school". It came to the conclusion that whenever such contracts are observed, their rationale must be the (socially desirable) protection of upstream firms against free-riding or opportunistic behavior by downstream firms, rather than the (socially harmful) protection or extension of market power. The Chicago school argument is simply that expanding or protecting market power by imposing exclusivity clauses cannot constitute a profitable strategy, because, if such exclusion is socially inefficient, the transfer from the excluding firm to consumers should exceed the incumbent firm's gain from deterring entry or inducing exit[2].

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[1]See Wiley (1998) for a survey.

[2]This argument has been made in particular by Posner, (1976, p.212) and Bork (1978,

This view has been challenged on several grounds, and economic theory has identified several circumstances under which socially harmful exclusive contracts may arise. However, these models start from the assumption that some of the adversely affected parties (consumers, or a potential entrant) do not participate to the contracting game, or they arbitrarily restrict the contracting environment by considering linear pricing schemes exclusively.

On the one hand, Matthewson and Winter (1987) showed that a manufacturer may profitably use impose exclusivity to a local retailer in order to foreclose a rival in a local market, and that this outcome may be (but need not be) socially harmful.[3] But, as O'Brien and Shaffer (1997) argued, this result is true only if nonlinear pricing is not available: otherwise, instead of requiring exclusivity, the manufacturer could earn the same profits by offering a nonlinear contract specifying the same quantity and price, without any further restrictions[4].

On the other hand, several authors have shown that exclusivity clauses may facilitate profitable entry deterrence or competitors' eviction. The common feature of these various models is that, although exclusivity is inefficient, it may occur because one of the affected parties is absent at the contracting stage.

For example, in Aghion and Bolton (1987), an exclusive contract may allow an incumbent firm and its customer(s) to jointly extract rents from a potential entrant whose costs are uncertain. In their model, only partial exclusion happens: entry must take place with some probability if rents are to be extracted from the potential entrant. Such rent extraction is possible because consumers can escape the exclusionary clause by paying liquidated damages. While this provision deters entry in some cases (when the entrant is only slightly more efficient than the incumbent), its other effect is that it induces very efficient entrants to offer lower prices than they would have absent any exclusive contract. This allows to extract some of the entrant's rents, making the partially exclusive contract jointly efficient for the incumbent and its consumers, even though it is socially inefficient.

p.309). Theories of exclusive contracts as a way to align the incentives of an upstream firm and retailers selling its good have been developed, among others, by Marvel (1982) and Segal and Whinson (2000b).

[3]See also Comanor and Frech (1985) for a related analysis.

[4]In O'Brien and Shaffer (1997), exclusive contracts may occur in equilibrium but they are always Pareto-dominated (from the manufacturers' point of view) by equilibria without exclusion.

Both Aghion and Bolton's (1987) assumptions - uncertainty about the potential entrant's costs, the presence of a "liquidated damages" clause - and the result that profitable exclusion must be partial limit the scope of their model. In contrast, other papers have established that, if increasing returns make a minimum scale of operation necessary for profitable activity, full exclusion can happen if an incumbent exploits the lack of buyers' coordination, or if it can discriminate between buyers. The idea in Rasmusen et al. (1991) is that even if buyers as a whole lose when entry is deterred, discriminatory offers can make entry deterrence profitable because it allows the excluding firm to "buy off" the consent of a subset of buyers, large enough to deprive the potential entrant from the minimum viable scale, and thus allowing the incumbent to fully exploit its market power vis-à-vis all buyers, including those who did not sign an exclusive contract. Coordination failure may lead to the same result: each buyer may agree to sign an exclusive contract against a low monetary transfer if it believes that its agreement is not pivotal in inducing exclusion.[5] Similarly, Bernheim and Whinston (1998, section IV) showed that a firm can use exclusive contracts in order to profitably evict a rival if this reduces competition in a future, "noncoincident" market: their result relies on the assumption that buyers who are harmed in this noncoincident market are not part to the initial contracting game.

This paper's contribution

While the aforementioned papers showed that socially harmful eviction through exclusive contracts may occur in equilibrium, they all analyze situations where one of the affected parties is not present at the contracting stage.[6] In all these papers, the contracting parties "conspire" against other agents, some or all of whom are not present, and thus unable to defend themselves by making counteroffers.

This is a serious limitation when considered against the background of most antitrust cases involving exclusive contracts, since many of them involve

[5] On Rasmusen et al.'s (1991) result, see Segal and Whinston's (2000a) criticism.

[6] The aforementioned papers focus on the relationship between firms and final consumers. In the context of the relationship between manufacturers and their local retailers, several papers (e.g. Hart and Tirole, 1990; Lin, 1990; O'Brien and Shaffer, 1993) find that socially harmful exclusive contracts may occur in equilibrium because of their impact on the nature of downstream competition. Our general comment applies to these papers as well, since they rely on the fact that consumers, who are affected by exclusive contracts between manufacturers and retailers, play no role during the contracting stage.

situations where the excluded firm(s) could in principle react to eviction attempts by the firm offering exclusive contracts, and where the theory of "noncoincident" markets does not apply. For example, in one of the most famous cases involving exclusive contracts, the *Lorain Journal* case, was indeed a particular instance where exclusive dealing contracts occurring in such a setup were challenged. In that case the only newspaper in town, and thus presumably a monopolist, refused to accept advertisements from customers that advertised on radio stations that competed with it for advertising revenues. The court held this refusal violated Section 2 of the Sherman Act. The Lorain Journal was not accused of attempting to prevent entry by other media outlets, of discriminating between buyers of advertising space, and nonlinear pricing is commonplace in newspaper advertising. As explained above, current theory cannot explain why exclusivity requirements could be undesirable in such a context[7].

This paper aims to fill this gap. I consider a simple model with two firms and two identical consumers, and I assume that fixed costs prevent either firm from profitably operating in the market if it is barred from selling its good to the two consumers. The central result of this paper is that if discrimination across consumers is allowed and there is enough asymmetry between firms, then a firm may profitably enter into an exclusive agreement with one of the consumers, in order to exclude the rival firm and thus exert increased market power vis-à-vis the other consumer. The intuition is close to that of Rasmusen et al. (1991), because it relies on discriminating across consumers in order to deny a rival the minimum required scale. But the result proved below is stronger than theirs, because the assumptions are, *a priori*, less conducive to exclusive contracts: I assume all firms to be on an equal footing as regards opportunities to offer contracts to consumers; on the contrary, Rasmusen et al. (1991) assume that the excluded firm is a potential entrant which cannot react when exclusive contracts are offered to its potential customers in order to deter it from entering.

Of course, an inefficiency result in a context where all the affected parties

[7]Contrary to Rasmusen *et al.* (1999), we do not believe that Rasmusen *et al.* (1991) can be applied to the *Lorain Journal* case: the model assumes the excluded firm to be a potential entrant and thus does not consider potential counteroffers it could make, while a satisfactory analysis of the case should address possible counterstrategies by the alleged victims of the disputed practice. This remark notwithstanding, Rasmusen *et al.* (1999) is an excellent discussion of how theories of exclusive contracts relate to the most famous legal cases.

- the two firms and the two consumers - are present at the contracting stage cannot but result from some restrictions on the institutional setup. Absent such limitations, a "Coasian" argument applies: since any inefficient outcome can, by definition, be improved upon, the four agents in this model could sit around a table and agree on a different, Pareto-superior outcome. The bite of the Coasian argument thus depends on whether reaching efficiency requires implausibly complex institutional setups or whether simple enough contracts are enough to deliver efficiency. In other words, this paper asks how easy it is for firms and consumers to sit around a table and avoid a suboptimal outcome involving inefficient exclusion.

Organization of the paper

The paper is organized as follows: the general model is presented in section 2. For the sake of tractability, the model is kept extremely simple, with only two firms, two consumers, and unit consumption of each good, which allows us to avoid discussions of linear versus nonlinear contracts or of possible coordination failures between buyers. In Section 3, we show that inefficient exclusion can occur in several relatively simple contractual environments. Section 4 addresses the robustness of this result by analyzing more complex contractual environments. Since it turns out that the key reason behind the possible occurrence of inefficient exclusion is a coordination failure between the excluded firm and the consumer suffering from the exercise of market power by the excluding firm, we examine whether enriching the set of possible contracts (by allowing for contracts that are conditional on signing by several agents) is enough to prevent inefficient exclusion. We find that this is not the case: only the combination of such contracts and of a rich enough timing structure (in the form of there being several rounds of observable decisions by consumers to sign contracts) guarantees that inefficient exclusion cannot occur. This means that the validity of the Coasian argument requires a quite complex contracting environment. Section 5 concludes.

2 The model

2.1 Technology and preferences

Since comparing several contracting environments, including some complex ones, is a cumbersome exercise, the assumptions of the model are kept as simple as possible for the sake of tractability. There are two firms and two consumers. Firms are (in general) different, while consumers are characterized by identical preferences.

Preferences

Both consumers (labeled a and b) have identical preferences. The quantity of good i (i=1,2) that a consumer can consume is either 0 or 1. Each consumer's utility is given by

$$\begin{aligned} U(0,0,y) &= y \\ U(1,0,y) &= U_1 + y \\ U(0,1,y) &= U_2 + y \\ U(1,1,y) &= U^* + y, \end{aligned}$$

where y is the numéraire. Goods 1 and 2 are substitutes, in the sense that

$$U_1 + U_2 > U^* > Max(U_1, U_2) \geq Min(U_1, U_2) > 0. \tag{1}$$

Technology

Both firms' marginal costs are zero, but firm i incurs a fixed cost F_i if it decides at some stage to stay in the market (see the description of the timing of the various games, below).

Remark. Nonlinear and linear contracts are the same when consumption of any good can be either zero or one. Therefore, a result showing that exclusive contracts may be used in equilibrium cannot be subject to O'Brien and Shaffer's (1997) critique of Matthewson and Winter's (1985) result: if exclusive contracts are found to arise in equilibrium, the reason cannot be the lack of nonlinear pricing.

2.2 Institutional setup

The various games considered below all share have the following structure:

- In Stage 1, firms may long-term offer contracts, specifying the price that is going to be paid for one unit of the good, and, possibly, an exclusionary clause. The details of this stage (which contracts can be offered, whether all contracts are offered simultaneously or not, whether discrimination between the two consumers is allowed) will vary according to the versions analyzed below. At the end of this stage, each consumer is facing a set of contracts. We assume that a consumer does not observe the contracts offered to the other consumer.

- In Stage 2, each consumer chooses between the long-term contracts possibly offered to them (it is possible that no contract at all was offered, or that a consumer chooses no contract). Again, the details of this stage can change according to the various institutional setups analyzed belown (for example this stage can consist of a single period or of two sub-period.) Of course, choosing an exclusive contract offered by a firm prevents from also choosing a contract offered by the other firm. We assume that at the end of Stage 2, both firms observe which contracts have been signed.[8] We also assume that, for either consumer, signing a contract entails a very small but positive cost, and that this cost is greater for an exclusive than for a non-exclusive contract ($\eta > 0$ in the case of an exclusive contract, $\eta' \in (0, \eta)$ for a non-exclusive one). While this assumption is made for technical reasons, it can easily be justified: the assumption that signing a contract entails a cost can be justified in terms of transaction costs; and the assumption that this cost is greater for an exclusive contract can be justified by the fact that for a customer, entering into an exclusive supply relationship may involve forgoing supply alternatives that may not be captured in the model, i.e. for example, if a third supplier has a small but positive probability of being present in the later stages of the game.

- In Stage 3, each firm that is not bound by a long-term contract signed in stage 2 with one or two consumers decides whether or not to stay in the market. If firm i decides not to exit, it incurs the cost F_i.

- In Stage 4, contracts offered by firms in stage 1 and chosen by consumers in stage 2 are enforced. In addition, each firm bargains with

[8] The assumption that contracts become public information when they are signed, but not when they are simply offered to potential customers, is consistent with the way many markets work.

the consumer(s) with whom it is not bound by contract. Each firm's bargaining power is α: the surplus from the relationship between a firm and a consumer not bound to it by contract is divided according to the proportions α, $1-\alpha$.

In general, there exist multiple equilibria[9]. Following the existing literature, and in order to rule out situations where exclusive contracts result only from of a lack of coordination between consumers (a possibility arising, for example, in Rasmusen et al., 1991), we restrict our attention to equilibria such that at any of the first three stages of the game, the equilibrium of the continuation game is Pareto-optimal from the point of view of the players having to choose an action at this stage. More precisely,

- The equilibrium of the continuation game starting in Stage 3 is not Pareto-dominated by another equilibrium from the point of view of firms. (C1)

- Similarly, and subject to the above condition, we restrict our attention to equilibria such that:

  Subject to condition (C1), the equilibrium of the continuation game starting in period 2 is not Pareto-dominated by another equilibrium from the point of view of consumers. (C2)

- Similarly, and subject to the above conditions, we restrict our attention to equilibria such that:

  Subject to conditions (C1)-(C2), the equilibrium is not Pareto-dominated by another equilibrium from the point of view of firms. (C3)

[9]Equilibrium multiplicity is pervasive when exclusive contracts are possible (see, e.g., Bernheim and Whinston, 1998, and O'Brien and Shaffer, 1997).

This restriction is common in the literature[10] and only makes the occurence of exclusive contracts less likely - thus strengthening any result showing that exclusion may nevertheless occur.

2.3 Assumptions about parameters

Assumption 1.

$$2\alpha(U^* - U_1) > F_2 \text{ and } 2\alpha(U^* - U_2) > F_1 \tag{A1}$$

(A1) simply means that if no contracts are signed at the end of the second stage, then both firms choose to stay in the market: the profits they earn as a result of the bargaining process exceed their fixed costs of staying. In other words, I am considering situations where, absent exclusive contracts, both firms would be active.

Remark. Assumption (A1) implies that exclusion of either firm is socially inefficient.

Assumption 2.

$$For\ i = 1, 2,\ U_i < F_i \tag{A2}$$

(A2) implies that conditional on a consumer signing an exclusive contract with firm j, total welfare is greater if firm i leaves the market than if it stays.

Notations.

I define the following magnitudes:

V = utility of a consumer when it bargains with both firms.
π_i =firm $i's$ revenues when both firms bargain with both consumers.
$J_{i,excl}$ = joint surplus of firm i and consumer a when firm j is not present in the market and firm i bargains with consumer b.

[10] Most of the literature on exclusive dealing adopts a similar approach, i.e. focuses on equilibria that are undominated from the point of view of manufacturers. See, for example, Berheim and Whinston (1998, p. 69) and O'Brien and Shaffer (1997, p. 776-777).

$J_{i,no\ excl}$ =joint surplus of firm i and consumer a when firm j is present in the market and bargains with consumer b while firm i bargains with consumer a.

They are given by:

$$\begin{aligned} V &= U^* - \alpha(U^* - U_1 + U^* - U_2) = \alpha(U_1 + U_2) + (1 - 2\alpha)U^*, \\ \pi_i &= 2\alpha(U^* - U_j), \\ J_{i,excl} &= U_i + \alpha U_i = (1 + \alpha)U_i, \text{ and} \\ J_{i,no\ excl} &= \pi_i + V = U^* + \alpha(U_i - U_j). \end{aligned}$$

Remark. If $J_{i,excl} > J_{i,no\ excl}$ (which happens as soon as α, the parameter measuring firms' bargaining power vis-à-vis consumers, is close enough to 1), and if only firm i could offer contracts in Stage 1, firm i could increase its profits relative to the situation where both firms bargain with consumers (i.e. relative to the situation where no contracts are signed in Stage 2), by offering one consumer (say, consumer a) a contract leaving him with the same utility level V : doing so would increase firm i's profits by $J_{i,excl} - J_{i,no\ excl}$. This means that if we did not consider the possibility of counteroffers by the excluded firm, exclusion would be pervasive. Of course, there is no reason to assume that one firm can offer exclusive contract while the other sits idle: on the contrary, the goal of this paper is to allow for full symmetry (in terms of the possibilities of offering contracts), as opposed to the papers mentioned in the introduction, which model how an incumbent firm may use exclusive contracts in order to deter a potential entrant.

3 Simple contractual environments: inefficient exclusion may occur

3.1 A simple setup: firms simultaneously offer contracts

I first investigate the following institutional setup (labeled "game 1" hereafter): Stage 1 comprises only one period, in which each firm can offer each customer at most one contract. A contract specifies (i) a price; and (ii) possibly (but not necessarily) an exclusivity clause. As explained above, if no contract is signed between a firm and a consumer, then the price is determined during the bargaining stage (Stage 4), unless (i) the firm chose to exit in Stage 3; or (ii) the consumer signed an exclusive contract with the other firm, in Stage 2. As explained above, we assume that once a firm is commited to a long-term relationship (i.e. if it offered a contract to a customer, who accepted it) then it cannot decide to exit in Stage 3.

Proposition 1 *(i) If it is the case that no firm would like to offer exclusive contracts even if its rival offered no contract (i.e.* $J_{i,excl} \leq J_{i,no\ excl}$ *for* $i = 1$ *and* $i = 2$*), then no exclusive contracts are signed in any equilibrium satisfying conditions (C1)-(C3).*

(ii) If it is the case that each firm would like to offer an exclusive contract if the other did not ($J_{i,excl} > J_{i,no\ excl}$ *for* $i = 1$ *and* $i = 2$*), and (for example)* $J_{i,excl} - F_i > J_{j,excl} - F_j$*, then, in any equilibrium satisfying conditions (C1)-(C3), firm* j *exits and firm* i *earns profits equal to* $J_{i,excl} - F_i - Max(J_{j,excl} - F_j, V)$*. This is the case, in particular, if preferences are symmetric across goods and firms hold all the bargaining power* ($\alpha = 1$)*.*

(iii) If firm i *would like to offer an exclusive contract in case firm* j *did not, but the converse is not true* ($J_{i,excl} > J_{i,no\ excl}$ *and* $J_{j,excl} < J_{j,no\ excl}$)*, then:*

a) if $J_{i,excl} < J_{j,no\ excl} - F_j + \pi_i$*, then in any equilibrium satisfying conditions (C1)-(C3) both firms are active, firm* i*'s profits are* $\pi_i - F_i$*, and firm* j*'s profits are* $J_{j,no\ excl} - F_j + \pi_i - J_{i,excl}$*.*

b) if $J_{i,excl} > J_{j,no\ excl} - F_j + \pi_i$*, then in any trembling-hand perfect equilibrium satisfying conditions (C1)-(C3), firm* j *exits, and firm* i*'s profits are equal to* $J_{i,excl} - F_i - J_{j,no\ excl} + F_j > \pi_i$*.*

Corollary 2 *1. For some parameter values, exclusion takes place in an equilibrium satisfying conditions (C1)-(C3). This happens in particular as soon as* α *is close enough to 1.*

2. For some parameter values, both firms are worse off in an equilibrium satisfying conditions (C1)-(C3) than they would be were exclusive contracts not allowed. This occurs for example in the symmetric case if firms hold a lot of bargaining power: writing U *for the common value of* U_1 *and* U_2*, exclusion occurs as soon as* $(1 + \alpha)U > U^*$ *and causes both firms to have zero profits.*

3. For some parameter values, exclusion takes place in an equilibrium satisfying conditions (C1)-(C3),and the excluding firm is better off than it would be were exclusive contracts not allowed.

The possibility for both firms to be worse off than they would be if exclusive contracts were not feasible can be interpreted as follows: if exclusive con tracts were infeasible, then firm i would earn revenues equal to$2\alpha(U^* - U_j)$, which depend on (i) the firm's bargaining power vis-à-vis consumers, and (ii) the marginal utility of good i when both goods are consumed, $U^* - U_j$. But the possibility to compete in Stage 1 by offering exclusive contracts introduces a "price competition" dimension: when firms compete for the right to exclude (which occurs if exclusion if efficient from the point of view of a pair comprising one firm and one consumer), the logic of price competition applies, so that if preferences and costs are symmetric and exclusion occurs, competition for exclusivity drives both firms' profits down to zero. Another way to explain this result is to say that in the absence of any contract, firms earn positive profits because their products are imperfect substitutes. Once offering exclusive contracts becomes possible, firms do not sell their products any more, they sell "utility", in the sense that they compete to offer monetary compensation to a buyer, in exchange for exclusivity. Since "utility" is a homogeneous good, differentiation disappears, which brings profits to zero in the case of symmetric preferences[11].

The reason why the possibility of exclusive contracts may lower both firms' profits and even drive them to zero in the symmetric case is simply that, as Krattenmaker and Salop (1986) state it, "*the market for exclusionary rights essentially is a market for competition.*"

3.2 A richer setup: Firms simultaneously offer menus of contracts

The above Proposition, and the possibility that exclusion might occur in equilibrium even though it harms the excluding firm, as well as overall welfare, may result from excessive restrictions imposed on the contractual environment. In particular, one may conjecture that allowing a firm to offer each consumer a menu of contracts - i.e. two contracts, one exclusive, one non-exclusive - could make exclusion less likely, by facilitating the simultaneous

[11] The possibility that the equilibrium profits of the firm offering exclusive contracts be lower than they would be if exclusive contracts were not possible is also a result of O'Brien and Shaffer (1997). Ordover et al. (1990) find an equivalent result in the context of vertical integration: while firms bid for their suppliers in order to foreclose their rivals and increase their profits, competition for the right to foreclose may bring the foreclosing firm's profits down to zero.

offering of non-exclusive contracts by both firms.

This section addresses such an institutional setup (labeled "Game 2" hereafter) by making the following change to Game 1: in Stage 1, each firm is now assumed to be able to offer two contracts per consumer - equilibrium analysis can be restricted to the case where at most one contract is exclusive and at most one is non-exclusive.

This possibility indeed narrows down - without eliminating it - the set of cases where exclusion occurs:

Proposition 3 *(i) If it is the case that no firm would like to offer exclusive contracts even if its rival offered no contract (i.e.* $J_{i,excl} \leq J_{i,no\ excl}$ *for* $i = 1$ *and* $i = 2$*), then no exclusive contracts are signed in an equilibrium satisfying conditions (C1)-(C3).*

(ii) If it is the case that firm i would like to offer an exclusive contract in case firm j did not (i.e. $J_{i,excl} > J_{i,no\ excl}$*) and* $J_{i,excl} - F_i \geq J_{j,excl} - F_j$*, then*

a) if $J_{i,excl} \leq J_{j,no\ excl} - F_j + \pi_i$*, then in any equilibrium satisfying conditions (C1)-(C3) both firms are active.*

b) if $J_{i,excl} > J_{j,no\ excl} - F_j + \pi_i$*, then in any equilibrium satisfying conditions (C1)-(C3), firm j exits, and firm i's profits are equal to* $J_{i,excl} - F_i - Max(J_{j,excl}, J_{j,no\ excl}) + F_j$*.*

Corollary 4 *1. For some parameter values (in particular if* α *is close enough to 1), exclusion takes place in an equilibrium satisfying conditions (C1)-(C3) and the excluding firm may be better off as well as worse off than in the situation where exclusive contracts would be prohibited. For example, if* $J_{i,excl} > J_{i,no\ excl}$ *for* $i = 1$ *and* $i = 2$*, and (for example)* $J_{j,no\ excl} < J_{i,excl} + F_j - \pi_i < J_{j,excl}$*, then the possibility of exclusive contracts makes both firms worse off.*

2. Exclusion is less likely when firms can offer each consumer a menu of contracts (i.e. an exlusive and a non-exclusive contract) than when they can offer only a single contract: the set of parameter values inducing exclusionary equilibria in Game 2' is included in, and smaller than, the corresponding set for Game 2.

3. For example, in the symmetric case, then writing U for the common value of U_1 *and* U_2*, exclusion occurs as soon as* $(1+\alpha)U > U^* + 2\alpha(U^* - U) - F_2$ *and causes both firms to have zero profits.*

While inefficient exclusion occurs less often when firms can offer each consumer a menu of contracts rather than a single contract, it can still occur.

The reason is very simple: in the limit case where profits in a competitive situation are far below monopoly profits, a no-exclusion equilibrium cannot be sustained because the amount each firm is ready to offer in order not to be excluded is low: it is limited by the level of profits in a competitive world. On the contrary, the amount each firm is ready to offer in order to exclude its rival is commensurate to the level of monopoly profits. If the difference between monopoly and competitive profits is very large, exclusion occurs, even though the price paid for exclusion by the excluding firm can make it worse off than in the case were exclusive contracts are illegal.

3.3 An even richer setup: Firms can respond to offers made by their rivals

The above results are not fully satisfactory because one may consider that their assumptions are still too "biased" toward exclusive contracts. One might thus ask whether exclusive contracts would still arise in a contractual environment providing each firm with more possibilities to respond to exclusive contracts offered by its rivals. We address this question by amending the model as follows: we assume that Stage 1 is divided into two periods:

Period 1. Both firms may offer contracts, which can be exclusive or not. If no contracts are proposed, then stage 1 ends. Otherwise, period 2 takes place.

Period 2. If one or more contract was offered in period 1, then firms can offer contracts again (without withdrawing contracts offered in period 1). Then, stage 1 ends[12].

Intuitively, exclusion should occur less frequently in this game (labeled "Game 3" hereafter) than in Games 1 and 2. Consider a hypothetical situation where $J_{1,excl} > J_{1,no\ excl}$ and firm 2 offers no contract in period 1. In Game 1 above, the inequality $J_{1,excl} > J_{1,no\ excl}$ implied that in such a situation, offering an exclusive contract increased firm 1's profits by $J_{1,excl} - J_{1,no\ excl}$. This is not true anymore in Game 3, because if firm 1 were to offer such a contract in period 1, it would have to take into account firm 2's future reaction in period 2. However, as the Proposition below shows, even in these

[12] This assumption parallels an assumption made in Ordover et al. (1990): considering two upstream firms U_1 and U_2, and two downstream firms D_1 and D_2, they assume that U_2 and D_2 can choose to merge only if a prior merger between U_1 and D_1 took place.

circumstances, exclusion can arise in equilibrium and allow a firm to profitably evict a rival - though less often than in the contractual environments considered in the previous sections.

Proposition 5 *Subject to conditions (C1)-(C3):*

1. If parameters are such that exclusion is not the outcome of an equilibrium of Game 2 then it is not the outcome of an equilibrium of Game 3 either.

2. If parameters are such that exclusion of firm j is the outcome of an equilibrium of Game 2, then

a) If firm i's profit in this equilibrium of Game 2 exceeds $\pi_i - F_i$ (i.e. if $J_{i,excl} - Max(J_{j,excl}, J_{j,no\ excl}) + F_j > \pi_i$), then exclusion occurs in all the equilibria of Game 3 and firm i is better off in any equilibrium than it would be if exclusive contracts were not allowed.

b) If on the contrary $J_{i,excl} - Max(J_{j,excl}, J_{j,no\ excl}) + F_j < \pi_i$, then in any equilibrium of Game 3, no exclusive contracts are signed and both firms are active. Both firms are then better off than in any equilibrium of Game 2.

Corollary 6 *Subject to conditions (C1)-(C3):*

1. For some parameter values, exclusion occurs in equilibrium.

2 If exclusion occurs in equilibrium, the excluding firm is better off than it would be if exclusive contracts were not allowed.

3. If firms have maximal bargaining power, then exclusion does not occur in equilibrium.

4. For example, in the symmetric case ($U_1 =$,U_2 and $F_1 = F_2$), exclusion cannot occur in equilibrium .

This result shows that exclusion may occur even though a firm offering an exclusive contract exposes itself to the threat of retaliation by its rival, in the form of another contract, exclusive or non-exclusive.

3.4 Role of the various assumptions

Proposition 7 *Subject to conditions (C1)-(C3):*

1. Assume that firms cannot discriminate across consumers. Then in any equilibrium of any of the three games defined above, exclusive contracts are not signed and both firms are active.

2. Assume that firms' fixed costs are zero. Then in any equilibrium of any of the three games defined above, exclusive contracts are not signed and both firms are active.

This Proposition illustrates the relationship between the above results and Rasmusen et al. (1991): exclusion arises only because by offering an exclusive contract to one of the two consumers, a firm can induce its rival to leave the market (because fixed costs make profitable operation impossible if it can sell to only one consumer) and thus exert market power at the expense of the other consumer, who did not sign an exclusive agreement. These results extend Rasmusen et al. (1991) by showing that such a strategy can be used to evict a current rival (which is also able to offer exclusive or non exclusive contracts), and not only to deter entry.

4 Robustness to an enlargement of the contract set

Obviously, if the institutional setup is rich enough, inefficient exclusion should not occur in equilibrium: if the outcome of negotiations between parties were such that one of the firms is excluded, all the affected parties could simply agree on a Pareto-improving change by allowing both firms to be active and making compensatory transfers. The above results show that under relatively simple contractual environments, the Coasian argument fails to apply. In this section, we investigate whether this result is robust to enlarging the contract set.

In the cases analyzed above, exclusion occurs because the contractual setup imposes limitations on feasible transfers. To sum up, the reason why firm 1 may in some cases offer an exclusive contract to consumer a yielding that consumer a utility level that firm 2 is unable to match, either through an exclusive, or through a non-exclusive contract, is that there is no way for consumer b and firm 2 to *jointly* compensate consumer a and induce him not to pick firm 1's exclusive contract (which would harm both firm 2, constrained to leaving the market, and consumer b, left defenceless in front of firm 1's monopoly power). An obvious way to try to remedy this situation would be for firm 2 to be able to offer contracts whose validity is conditional on acceptance by both consumers: for example, firm 2 could offer consumer a a greater compensation for not picking firm 1's exclusive contract, conditional on firm 2 "subsidizing" this offer through the acceptance of a higher price than would occur otherwise during the bargaining stage. However, as is shown below, this possibility alone is still not enough to prevent socially inefficient exclusion.

In order to consider an environment that is *a priori* least likely to induce inefficient exclusion (thus strengthening any result pointing to the possibility of exclusion), we consider the same timing of moves as in Game 3, i.e. we allow for counteroffers and we assume that if no contracts are offered in the first period, then agents go directly to the bargaining stage. As is established in Proposition 3, this timing is less likely to lead to inefficient exclusion than a simpler timing whereby firms simultaneously offer contracts, during a single stage.

4.1 Conditional contracts do not suffice to rule out exclusion

We consider in this section the same game as in Game 3, except that we allow for contracts whose validity is conditional to acceptance by both consumers. To state this more precisely, a contract offered by firm i ($i = 1$ or $i = 2$) now includes (i) a price; (ii) possibly an exclusivity clause; (iii) possibly a clause stating that the contract is valid only if the other consumer also signs a long-term contract with firm i (possibly under different price and/or exclusivity terms). It is easy to notice that the possibility of conditional contracts does not make exclusion less likely. Indeed, assume that $J_{i,excl} - Max(J_{j,excl}, J_{j,no\ excl}) + F_j > \pi_i$ (implying that the only equilibrium of Game 3 without conditional contracts satisfying conditions (C1)-(C3) induces exclusion of firm j). What is firm j's best response to firm i offering in period 1 of Stage 1 an exclusive contract to consumer a, leaving consumer a with a utility level equal to $Max(J_{j,excl}, J_{j,no\ excl}) - F_j + \varepsilon$? In order to avoid being excluded, firm 2 must offer consumer a a contract yielding him at least the same utility level as the one offered by firm 1, which implies offering consumer a a utility level strictly greater than $J_{j,no\ excl} - F_j$. This would induce firm j to suffer losses unless consumer b is willing to sign a contract leaving it with a utility level strictly below V, i.e. strictly below the utility level it would get if both firms remained active and it signed no contract at all. But it is impossible that in equilibrium both consumers sign this contract. The reason is very simple: if both consumers sign this contract in equilibrium, then no consumer signs an exclusive contract with firm 1 (a consumer cannot sign an exclusive contract with firm 1 and at the same time another contract with firm 2, by definition). Therefore, given a hypothetical equilibrium where consumer a signs a non-exclusive, conditional contract with firm 2, consumer b has absolutely no reason to sign a contract yielding a utility level below V: even if it refused to sign it, the simple fact that consumer a chooses not to sign the exclusive contract offered by firm 1 is enough to guarantee that firm 2 will stay in the market, even if the long-term contract between firm 2 and consumer a in the end fails to apply because consumer b did not sign it. In other words, acceptance of the contract by consumer b cannot be pivotal in preventing exclusion if both consumers make their decisions simultaneously. No consumer is thus willing to "subsidize" the other in order to induce him to reject exclusive offers.

4.2 Very complex contractual environments: back to Coase

In this section we show that the Coasian logic may apply (i.e. inefficient exclusion may be ruled out) if the contractual environment is further enriched. As in the previous section, the central idea is that, for consumer a to be induced not to pick the exclusive contract offered by firm 1, firm 2 must find a way to induce consumer b to financially contribute to providing the proper incentives to consumer a. This could be achieved through a contract whose validity is conditional on acceptance by both consumers. In the above section we showed that allowing for such contracts is not enough if consumer b knows that his decision is not pivotal, i.e. has no impact on consumer a's decision about whether or not to accept the exclusive contract offered by firm 1. Therefore, we modify the contractual environment by allowing several rounds of observable contract acceptance by consumers. This implies that consumer b is willing, if this is needed, to financially contribute to the provision of incentives to consumer a, in order to induce him not to accept the exclusive contract offered by firm 1. More precisely, we consider a game characterized as follows:

- Stage 1 consists of two periods, just as in Game 3 and in the above section (there are two periods of contract proposal by firms unless no firm offered any contract in period 1).

- Contracts can be conditional on acceptance by both consumers (as in the above section).
- In addition, we assume that Stage 2 consists of two periods: in the first period, consumers may choose to pick contracts (subject to complying with any exclusivity requirements that may be present in some contracts); in the second period, each consumer observes the actions taken (i.e. the contracts signed) in the first period and may again pick contracts.

In such an institutional setup, inefficient exclusion cannot occur in any equilibrium satisfying conditions (C1)-(C3). The reason is simply that for exclusivity to occur, the excluding firm (say, firm 1) should be able to offer consumer a an exclusive contract that consumer a is willing to sign and which yields firm 1 a utility level at least equal to π_1. But if exclusion is inefficient, there exists amounts of money m and m' such that (i) $\pi_2 - m - F_2 > 0$; (ii) $V - m' > (1-\alpha)U_1$; (iii) $V + m + m' > J_{1,excl}$-π_1. Condition (i) means that firm 2 is willing to contribute at least m in order to induce consumer a not to pick firm 1's exclusive contract; Condition (ii) means that consumer b is willing to pay m' for the same purpose; and condition (iii) means that consumer a, faced with an offer by firm b of a non-exclusive contract at a price that is lower than the "bargained over" price $\alpha\,(U^* - U_1)$ by $m + m'$, necessarily prefers such a non-exclusive contract over any exclusive contract offered by firm 1 and guaranteeing firm 1 with a profit at least equal to π_1. Since condition (C1) (Pareto-optimality within the set of equilibria, from the point of view of firms in period 1) together with the two-period structure of Stage 1 implies that in any equilibrium, firm 1's profit is at least π_1, this means that firm 1 cannot exclude firm 2 in equilibrium. Indeed, if such a hypothetical equilibrium existed (meaning in particular that firm 1 offers an exclusive contract to consumer a), firm 2 could increase its profit from zero to $\pi_2 - m - F_2 > 0$ by offering during Stage 1 a contract conditional on acceptance by both consumers, that would include a price $\alpha\,(U^* - U_1)$-$(m+m')$ for consumer a and a price $\alpha\,(U^* - U_1)+m'$ for consumer b. During the first period of Stage 2, it is optimal for consumer b to sign the contract: by doing so it induces consumer a to sign it as well (inducing a utility level $V - m'$ for consumer b) while by not signing it it induces consumer a to sign in period 2 of Stage 2 the exclusive contract offered by firm 1, which leads instead to a utility level of $(1-\alpha)U_1$ for consumer b.

Notice that it is the combination of conditional contracts and of multiple rounds of contract acceptance that "delivers" efficiency. As explained in the previous section, conditional contracts alone are not enough. Similarly, in the absence of conditional contracts, exclusion occurs in any equilibrium satisfying (C1)-(C3) as soon as the condition laid down in Proposition 3 holds (i.e. if $J_{i,excl} - Max(J_{j,excl}, J_{j,no\ excl}) + F_j > \pi_i$). Indeed, this condition simply means that firm 2 alone is better off leaving the market than matching profit-enhancing exclusive contracts offered by firm 1 (by offering either an exclusive contract of its own, or a non-exclusive one.) Given this, no refinement pertaining to the timing of the game can avoid exclusion by firm 1 since the impossibility of conditional contracts prevents firm 2 and consumer b from jointly subsidizing consumer a's refusal of firm 1's exclusive offer.

5 Conclusion

Recapitulating results

The table below summarizes the results:

Institutional setup	**Outcome: firm 1 excludes firm 2 in an undominated equilibrium if...**
Firms simultaneously decide whether to offer contracts, exclusive or not.	$J_{1,excl} > J_{1,no\ excl}$ and $J_{2,excl} > J_{2,no\ excl}$ and $J_{1,excl} - F_1 \geq J_{2,excl} - F_2$ or $J_{1,excl} > J_{1,no\ excl}$ and $J_{2,excl} < J_{2,no\ excl}$ and firm 1 can increase its profit when countering firm 2's best non-exclusive offer, i.e. $J_{1,excl} - (J_{2,no\ excl} - F_2) > \pi_1$.
Firms simultaneously offer menus of contracts.	$J_{1,excl} > Max(J_{2,excl} + F_1, J_{2,no\ excl} + \pi_1) - F_2$.
1. Firms simultaneously decide whether to offer contracts. 2. If contracts were offered, a new round of contract proposals takes place.	Firm 1 can increase its profit when countering firm 2's best offer, i.e. $J_{1,excl} > Max(J_{2,excl}, J_{2,no\ excl}) + \pi_1 - F_2$.
Same as above + firms can make contracts' validity conditional on both consumers' acceptance.	Same as above.
Same as above (including conditional contracts) + several rounds of observable decisions by consumers to sign contracts.	Exclusion never occurs.

The above results imply that the Coasian argument requires a quite complex contractual environment, which may be implausible in many situations. This means that exclusive contracts aiming at excluding rivals by foreclosing demand might occur in setups that are broader than previously thought. In particular, this possibility may arise in situations where all the affected parties (rival firms and customers alike) are present during the contracting stage - such as in the *Lorain Journal* case. Also, this possible anticompetitive use of exclusive contracts is not limited to markets where buyers are intermediaries, selling to final consumerson a downstream market: all the models presented above assume that firms directly sell to final consumers[13].

Finally, let us stress that this theory of foreclosure (as well related ones such as in Rasmusen *et al.*, 1991) does not require an outcome as extreme as full exit by the excluded firm. "Exit" should be considered as a continuous variable: rather than fully exiting, a firm may scale down investment (in R&D, production facilities, or marketing). The economic analysis is exactly the same: partial consumer foreclosure induces to scale down investment, which reduces the competitive constraint exerted by the victim vis-à-vis those consumers who did not sign an exclusive contract - and thus provides the firm offering exclusive contracts to some consumers with an enhanced market power vis-à-vis *all* consumers.

Last but not least, like any theoretical paper in Industrial Organization, this work would gain from being complemented with empirical studies ascertaining its relevance.

[13]This remark does not mean that our results only apply to situations where buyers are final consumers. Rather, it means that the mechanism inducing inefficient exclusion has nothing to do with the impact of practices taking place in an upstream market on the functioning of a downstream market .

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6 APPENDIX

Proof of Proposition 1:

Step 1. Assume first that no firm would like to offer exclusive contracts even if its rival offered no contract (i.e. $J_{i,excl} < J_{i,no\ excl}$ for $i = 1$ and $i = 2$).

Step 1.a. We prove first that there exists an equilibrium where firms offer no contract in Stage 1. Indeed, assume the above inequalities hold and firm 2 offers no contract in Stage 1. If it chooses to offer no contract and to wait until the bargaining stage, firm 1 gets profits equal to π_1. Firm 1 could alternatively do the following:

- offer consumer a a contract that yields consumer a a payoff no greater than V: consumer a would then choose not to pick this contract, and such an option would thus not increase firm 1's profit.

- offer consumer a a non-exclusive contract that increases consumer a's payoff strictly above V: doing this would only lower firm 1's revenue (to $\pi_1 - b$ if the contract yields consumer a a payoff of $V + b$.) This possibility would not increase firm 1's profit either.

- offer consumer a an exclusive contract that increases consumer a's payoff strictly above V, to $V + b > V$. This would yield firm 1 a revenue equal to $J_{1,excl} - V - b = J_{1,excl} - b - (J_{1,no\ excl}\text{-}\pi_1) = \pi_1 - b - (J_{1,no\ excl} - J_{1,excl}) < \pi_1$. Therefore it is a best response for each firm not to offer any contract.

Step 1.b. We prove now that exclusion cannot happen in equilibrium satisfying (C1)-(C3). Assume for example that there exists an equilibrium E where firm 1 is excluded. This means that in equilibrium E firm 1 signs no contract with any consumer, while firm 2 signs at least an exclusive contract with a least one consumer, say consumer a. Condition (C2) implies that at least one consumer gets a utility level of at least V, which implies that in equilibrium E firm 2's profit is at most $J_{2,excl} - V - \eta - F_2 < J_{2,excl} - V - F_2 = \pi_2 - F_2$. This means that in equilibrium E both firms' profit levels are strictly below what they are in the equilibrium described in Step 1.a. where no contract is signed.

Step 2. Assume now that $J_{1,excl} > J_{1,no\ excl}$ and $J_{2,excl} > J_{2,no\ excl}$.

Step 2.a. We first prove that exclusion occurs in any equilibrium. We assume that there exists an equilibrium E where no consumer picks an exclusive contract and we prove that this leads to a contradiction. We must distinguish between the following cases. Case 1: in the hypothetical equilibrium, no consumer gets a utility level greater than V. This implies that the price paid for each transaction is exactly equal to the one that would be the outcome of bargaining in Stage 4, minus the transaction cost η'. Therefore, the only impact of any contract is to have each firm bear a deadweight loss equal to η' per contract signed. Either firm could therefore increase its profit by offering no contract at all. In addition, the inequality $J_{1,excl} > J_{1,no\ excl}$ implies that firm 1 can increase its profit by an amount $J_{1,excl} - J_{1,no\ excl} - \varepsilon$ by offering consumer a (for example) an exclusive contract leaving it with a utility level equal to $V + \varepsilon$. Therefore, E cannot be an equilibrium. Case 2: in the hypothetical equilibrium, at least one consumer, say consumer a, gets a utility level V_{aE} strictly greater than V. This implies that at least one firm, say firm 1, signs a non-exclusive contract with consumer a such that the selling price of the good is strictly below what it would be in the bargaining stage with both firms present, i.e. strictly below $\alpha(U^* - U_2)$. For firm 1 to offer such a contract in equilibrium, it must be the case that in equilibrium consumer a is indifferent between picking this contract and picking an exclusive contract offered by firm 2 - otherwise firm 1 could increase its profit by offering a non-exclusive contract specifying a slightly greater price. This implies that in equilibrium consumer a signs a contract only with firm 1. But the inequality $J_{1,excl} > J_{1,no\ excl}$ implies that firm 1 could simultaneously increase consumer $a's$ utility level by ε and increase its own profit by $J_{1,excl} - J_{1,no\ excl} - \varepsilon$. Therefore E is not an equilibrium.

Step 2.b. Second, we prove that there indeed exists an equilibrium where one firm is excluded. Assume, for example, that $J_{1,excl} - F_1 > J_{2,excl} - F_2$. It is easy to check that there exists an equilibrium where (i) both firm offers a contract to consumer a only; (ii) firm 2 offers consumer a an exclusive contract leaving it with a utility level equal to $J_{2,excl} - F_2$;(iii) firm 1 offers consumer a an exclusive contract leaving it with a utility level equal to $Max(J_{2,excl} - F_2, V)$, and (iv) consumer a picks the contract offered by firm 1, so that firm 2 exits in Stage 3. Indeed, faced with such offers, it is a best response for consumer a to accept firm 1's offer, which yields him a payoff at least as large as the one he would get by accepting firm 2's offer $(J_{2,excl} - F_2)$ or by rejecting both offers (V). Firm 2 cannot increase its payoff above zero: it can either offer less to consumer a (in which case consumer a still picks firm 1's contract and firm 2 is still bound to exit in Stage 3) or it can offer more than firm 1 is offering, but then the resulting contract, if accepted by consumer a, yields losses. Firm 1 cannot do better either. If $J_{2,excl} - F_2 < V$ then by offering a contract yielding consumer a less than $Max(J_{2,excl} - F_2, V) = V$ firm 1 would induce consumer a to reject both contracts, so that firm 1's profits would be $\pi_1 - F_1$ instead of $J_{1,excl} - F_1 - V = J_{1,excl} - F_1 - (J_{1,no\ excl} - \pi_1) = J_{1,excl} - F_1 - (J_{1,no\ excl} - \pi_1) = \pi_1 - F_1 + J_{1,excl} - J_{1,no\ excl} > \pi_1 - F_1$. If on the contrary $J_{2,excl} - F_2 > V$ then by offering a contract yielding consumer a less than $Max(J_{2,excl} - F_2, V) = J_{2,excl} - F_2$ firm 1 would induce consumer a to accept firm 2's exclusive contract, yielding firm 1 a profit of zero instead of $(J_{1,excl} - F_1) - (J_{2,excl} - F_2) > 0$.

<u>Step 2.c.</u> Third, we prove that if $J_{1,excl} - F_1 > J_{2,excl} - F_2$ then in equilibrium the excluded firm is necessarily firm 2. <u>Step 2.c.α.</u> First, we show that in equilibrium only one consumer signs a contract, which is exclusive. We know that in equilibrium at least one consumer, say consumer a, signs an exclusive contract with the excluding firm (say, firm i): otherwise there would be no exclusion at all). It is impossible that in equilibrium consumer b sign a contract with firm j, for if it did, then both firms would remain in the market, which we know is ruled out in equilibrium. If consumer b signs a contract with firm i, then the prices paid by both consumers to firm i are those set in the long-term contracts they sign, and are thus independent of whether firm 1 is excluded or not. This implies that whether consumer a's contract is exclusive or non-exclusive is irrelevant to the firm with which it signs a contract, because. Therefore, firm i could increase its profit by offering consumer a a non-exclusive contract against at a price equal to the one offered in the hypothetical equilibrium, plus $\eta/2$. This implies that only one consumer signs a contract with firm i, which is exclusive. <u>Step 2.c.β</u> Second, we show that the excluding firm is firm 1. Assume the excluding firm is firm 2. Since in equilibrium firm 2 earns a nonnegative profit, the consumer with whom it signs an exclusive contract in equilibrium enjoys a utility level no greater than $J_{2,excl} - F_2 - \eta$. Therefore, firm 1 can increase its profit, from zero to $(J_{1,excl} - F_1) - (J_{2,excl} - F_2) - \varepsilon$ by offering consumer a an exclusive contract yielding the consumer the same utility level as in the hypothetical equilibrium plus ε - which is incompatible with firm 1's strategy being optimal.

<u>Step 3.</u> Assume now that $0 < J_{1,excl} - J_{1,no\ excl} < \pi_2 - F_2$ and that $J_{2,excl} < J_{2,no\ excl}$.

<u>Step 3.a.</u> We prove first that there exists an equilibrium where (i) firm

1 offers consumer a an exclusive contract which, if accepted by consumer a, would yield consumer a a utility level equal to $V + (J_{1,excl} - J_{1,no\ excl}) - \eta$; (ii) firm 2 offers consumer a a non-exclusive contract which, if accepted by consumer a, would yield him the same utility level; (iii) consumer a picks the (non-exclusive) contract offered by firm 2; (iv) no contract is signed between consumer b and either firm.

To prove this, it suffices to notice that (i) given firm 2's strategy, firm 1 has no interest in excluding firm 2: the only way to achieve this would be to offer a contract yielding consumer a a utility strictly greater than $V + (J_{1,excl} - J_{1,no\ excl}) - \eta$, which would bring firm 1's profit strictly below π_1. Similarly, firm 2's strategy is optimal: offering better terms to consumer a would be useless since the price offered to consumer a is enough to prevent him from choosing firm 1's exclusive contract; on the other hand, offering less would induce firm 2 to exit the market in Stage 3, and thus to earn a profit of 0 instead of $(\pi_2 - F_2) - (J_{1,excl} - J_{1,no\ excl}) > 0$.

<u>Step 3.b.</u> We prove now that exclusion cannot occur in an equilibrium satisfying conditions (C1)-(C3). If exclusion occurs in an equilibrium, then for the same reasons as explained above, only one consumer (say consumer a) signs a long-term contract, which is exclusive. But it is impossible that the excluding firm be firm 2, for firm 2 can always increase its utility by offering a non-exclusive contract yielding consumer a the same utility level as the exclusive contract, by virtue of the inequality $J_{2,excl} < J_{2,no\ excl}$. If in equilibrium an exclusive contract is signed between consumer a and firm 1, then the arguments developed in $Step 3.a.$ imply that both firms' equilibrium profits are below their level in the equilibrium described in Step 3.a. Therefore any equilibrium where exclusion takes place violates condition (C1).

<u>Step 3.c.</u> We prove now that in any equilibrium satisfying conditions (C1)-(C3) the payoffs are those of the equilibrium described in Step 3.a.

<u>Step 4.</u> Assume now that $J_{1,excl} > J_{1,no\ excl}$ and $J_{2,excl} < J_{2,no\ excl}$ and $J_{1,excl} - J_{1,no\ excl} > \pi_2 - F_2$.

<u>Step 4.a.</u> We prove first that in any equilibrium firm 2 is excluded. First, the inequality $J_{2,excl} < J_{2,no\ excl}$ implies that there exists no equilibrium where firm 1 is excluded. We prove now that there also exists no equilibrium where both firms remain in the market. Assume that such an equilibrium E exists. First, as explained above, if in equilibrium a consumer signs a non-exclusive

contract with a firm, it must be the case that this consumer is indifferent between this non-exclusive contract and an exclusive contract offered by the other firm. Now, we distinguish three cases, depending on how many consumers sign non-exclusive contracts in the hypothetical equibrium. Case 1. No consumer signs a non-exclusive contract in equilibrium. Then firm 1 can increase its profit by $J_{1,excl} - J_{1,no\ excl} - \varepsilon - \eta$ by offering to one consumer an exclusive contract yielding it a utility level of $V + \varepsilon$, which contradicts the assumption that E is an equilibrium. Case 2. Exactly one consumer, say consumer a, signs a non-exclusive contract in equilibrium. Assume first that the contract is signed with firm 1. This implies that in equilibrium firm 2 offers consumer a an exclusive contract, so that firm 1 can increase its profit by $J_{1,excl} - J_{1,no\ excl} - \varepsilon - \eta$ by offering consumer a an exclusive contract yielding it a utility level of $V + \varepsilon$, which contradicts the assumption that E is an equilibrium. Assume now that the contract is signed with firm 2. Since firm 2's equilibrium profit is nonnegative, consumer a's equilibrium utility level is no greater than $V + \pi_2 - F_2 - \eta' = J_{2,no\ excl} - F_2 - \eta'$. For firm , providing consumer a with the same utility level through an exclusive contract would yield a revenue equal to

$$\begin{aligned} J_{1,excl} - (J_{2,no\ excl} - F_2 - \eta') - \eta &= J_{1,excl} - V - \pi_2 + F_2 + \eta' - \eta \\ &= J_{1,excl} - (J_{1,no\ excl} - \pi_1) - \pi_2 + F_2 + \eta' - \eta \\ &= \pi_1 + J_{1,excl} - J_{1,no\ excl} - \pi_2 + F_2 + \eta' - \eta \\ &> \pi_1 \text{ (if } \eta, \eta' \text{ are small enough)}, \end{aligned}$$

implying that E is not an equilibrium. Case 3. Both consumers sign a non-exclusive contract in equilibrium. In this case, both consumers's utility levels in equilibrium is at least as large as V: otherwise, picking no contract would be the only best response for at least one consumer. This means that any non-exclusive contract that is signed must involve a lower price than the one that would arise in the bargaining stage (stage 4) if no contracts at all has been signed. Offering such non-exclusive contracts is rational for a firm only if it allows it to avoid being excluded, i.e. if each consumer is indifferent between the non-exclusive contract it ends up signing in equilibrium, and an exclusive contract offered by the other firm. Consider consumer a. In the hypothetical equilibrium, it signs a non-exclusive contract with one firm, say firm i. - meaning that in equilibrium firm j offers it an exclusive contract, with which it is indifferent. This means that firm i offers consumer a an exclusive contract yielding him a utility level strictly greater than V. Consider a small deviation by consumer a, i.e. the possibility that consumer a picks the exclusive contract offered by firm 1, while other agents stick to their equilibrium actions - meaning that consumer b signs a non-exclusive contract with firm 2, and that it does not exit the market. Therefore, in Stage 4, firm 1 would sell its good to consumer b for the same price as in the situation where no contracts would have been signed, while the selling price to consumer a is greater than in that situation (by (1-α)$(U^* - U_1) + \eta$). Therefore, a best-response to any such tremble by either consumer is to offer no contract at all, exclusive or non-exclusive. Offering no contract also does not change firm 1's profit given all other agents' equilibrium actions. Therefore, an equilibrium where both consumers sign a non-exclusive contract is not a proper equilibrium.

Step 4.b. It can easily be checked that there exists a trembling-hand perfect equilibrium where firm 2 is excluded. Consider the following actions: (i) firm 2 offers consumer a a non-exclusive contract at a price equal to the price occuring in Stage 4 if no prior contract had been signed, plus $\pi_2 - F_2$, i.e. at a price equal to $\alpha(U^* - U_1) + \pi_2 - F_2$; (ii) firm 1 offers consumer a an exclusive contract yielding him the same utility as if it accepted the contract offered by firm 2; (iii) no contract is offered to consumer b; (iii) consumer a picks the exclusive contract offered by firm 1.

Step 4.c. Any trembling-hand perfect equilibrium satisfying conditions (C1)-(C3) yields each firm the same payoffs as the equilibrium described in Step 4.b.

Proof of Proposition 3:

We prove first that if firm 1 excludes firm 2 in an undominated equilibrium, then the three inequalities

$$J_{1,excl} > J_{1,no\ excl}; \quad (2)$$
$$J_{1,excl} - F_1 \geq J_{2,excl} - F_2; \quad (3)$$
$$J_{1,excl} - (J_{2,no\ excl} - F_2) > \pi_1 \quad (4)$$

are satisfied. We denote as customer a the customer who signs an exclusive contract with firm 1 in the hypothetical equilibrium. The first inequality must be satisfied: if it were not, then firm 1 could increase its profit by removing its exclusive contract and by offering instead a non-exclusive contract leaving customer a with the same utility plus $\varepsilon>0$ small enough: whatever the contracts offered by firm 2, if they led customer a to sign the exclusive contract with firm 1, then it is optimal for him to sign the nonexclusive contract with firm 1. Therefore firm 1 is not maximizing profits, which is a contradiction. Similarly, if the second inequality were not satisfied, then firm 2 could increase its profit from zero in the hypothetical equilibrium to $((J_{2,excl} - F_2) - (J_{1,excl} - F_1))/2$ by offering customer a an exclusive contract leaving him a utility level equal to $(J_{1,excl} - F_1) + ((J_{2,excl} - F_2) - (J_{1,excl} - F_1))/2$, which is greater than customer a's utility level in the hypothetical equilibrium.

In order to prove (4), two cases must be distinguished according to the sign of $J_{2,excl} - J_{2,no\ excl}$. If $J_{2,excl} \leq J_{2,no\ excl}$ then if in an undominated equilibrium an exclusive contract is signed between firm 1 and customers a, it must be the case that firm 1's equilibrium revenues are equal to $J_{1,excl} - J_{2,no\ excl} + F_2$ and that the most attractive contract offered by firm 2 to customer a (from customer a's point of view) is a non-exclusive contract leaving firm 2 zero profit, i.e. leaving customer a with exactly the same utility level (when picked in conjunction with no contract at all with firm 1) as in equilibrium. By offering no contract at all, firm 1 would thus cause customer a to pick firm 2's nonexclusive contract and to bargain with firm 1 in stage 4 of the game, leaving firm 1 with revenues π_1. This deviation should not increase firm 1's profit, so $\pi_1 \leq J_{1,excl} - J_{2,no\ excl} + F_2$ which is (4) since $J_{2,excl} < J_{2,no\ excl}$.

If $J_{2,excl} > J_{2,no\ excl}$, consider the following strategies: each firm offers both an exclusive and a nonexclusive contract to customer a, and none to customer b. The nonexclusive contract offered by firm i involves a price that is equal to the price at which the good would be sold in stage 4 if no contract were signed, i.e. $\alpha(U^* - U_j)$, plus an amount equal to $J_{j,excl} - J_{j,no\ excl}$. The exclusive contract offered by both firms are such that customer a is indifferent between picking the exclusive contract offered by firm 1, the exclusive contract offered by firm 2, and the nonexclusive contracts offered by the two firms. In addition, faced with this choice, customer a chooses to pick the two nonexclusive contracts. Given these strategies, each firm is indifferent as to whether customer a is going to pick its exclusive or its nonexclusive contract: in either case, firm i's profit is equal to $\pi_i - (J_{j,excl} - J_{j,no\ excl})$. Consequently, a sufficient condition for these strategies to be equilibrium strategies is that each of the two firms make a positive profit, i.e. that

$$\pi_1 - (J_{2,excl} - J_{2,no\ excl}) \geq F_1 \tag{5}$$

and

$$\pi_2 - (J_{1,excl} - J_{1,no\ excl}) \geq F_2 \tag{6}$$

Assuming that these inequalities hold, let E denote the hypothetical undominated equilibrium where firm 1 excludes firm 2 and E' denote the equilibrium described above, where no firm is excluded. It is impossible for firm 1's profits to be strictly greater in equilibrium E than in equilibrium E': if they were, this would mean that customer a's utility in E is less than in E'. Since in equilibrium E' firm 2 can offer customer 2 an exclusive contract yielding customer 2 the same utility as the one offered him by firm 1, and yielding firm 2 a positive profit, this would imply that given firm 1's strategies in equilibrium E, firm 2 could offer an exclusive contract that would be picked by customer a while yielding firm 2 a positive profit - meaning the E is not an equilibrium. Therefore, if (5) and (6) are satisfied, then firm 1 does not exclude firm 2 in any undominated equilibrium. Therefore, if firm 1 excludes firm 2 in an undominated equilibrium, then at least one of the two inequalities (5) and (6) must be violated. But it is possible to show that if inequalities (2) and (3) hold (which is the case if firm 1 excludes firm 2 in an undominated equilibrium, as proved above), then (6) is necessarily violated if (5) is: assume indeed that (2) and (3) are satisfied while (5) is violated. Then

$$\begin{aligned}
& \pi_2 - (J_{1,excl} - J_{1,no\ excl}) - F_2 \\
< \ & \pi_2 - J_{2,excl} + J_{1,no\ excl} - F_1 \text{ (by (2)} \\
= \ & \pi_2 - J_{2,excl} + \pi_1 + V - F_1 \\
= \ & \pi_1 - J_{2,excl} + J_{2,no\ excl} - F_1 \\
< \ & 0 \text{ (because (5) is violated.}
\end{aligned}$$

meaning that (6) is violated. This means that if firm 1 excludes firm 2 in an undominated equilibrium, then inequalities (2), (3) and (4) hold (indeed, (4) is the converse of (6)).

Conversely assume that inequalities (2), (3) and (4) hold. We first show that there exists no undominated equilibrium where both firms are present. Assume that such an equilibrium exists. Then firm 1's profit is at most π_1

(it is impossible to try to increase profit above this level by offering a less generous non-exclusive contract because a customer offered such a contract can simply wait until the bargaining stage). Also, if in this equilibrium a non-exclusive contract is signed between a customer and firm 2, it decreases the price paid by the customer for good 2 (relative to what would be paid in the bargaining game, in the absence of any prior contract) by no more than $(J_{2,no\ excl} - F_2)$: otherwise firm 2 would make negative profits. But this means that firm 1 can increase its profit by offering customer a a contract leaving him the same utility level plus ε, yielding firm 1 a profit equal to $J_{1,excl} - (J_{2,no\ excl} - F_2) - \varepsilon > \pi_1$ if ε is small enough. Similarly there exists no equilibrium where firm 2 excludes firm 1. If it did so through an exclusive contract signed with customer a, it would leave customer a with a utility no greater than $J_{2,excl} - F_2$ (otherwise firm 2 would make a negative profit). But then firm 1 could offer an exclusive contract giving customer a the same utility level plus ε and yielding firm 1 a profit of $J_{1,excl} - F_1 - J_{2,excl} + F_2 - \varepsilon$ which is positive if ε is small enough.

Therefore the existence of an undominated equilibrium where firm 1 excludes firm 2 is equivalent to conditions (2), (3) and (4) being met, which is equivalent to the inequality $J_{1,excl} > Max(J_{2,excl} + F_1, J_{2,no\ excl} + \pi_1) - F_2$.

Proof of Proposition 5:

Part 3. is obvious: if preferences are symmetric, then $J_{i,excl} = J_{j,excl}$ so that $J_{i,excl} - Max(J_{j,excl}, J_{j,no\ excl}) + F_j \leq F_j \leq \pi_j = \pi_i$.

In order to prove part 1, notice that the conditions for exclusion of firm j to occur in an undominated equilibrium of Game 3 are:

$$\begin{aligned} J_{i,excl} &> J_{i,no\ excl} \text{ and} \\ J_{i,excl} - Max(J_{j,excl}, J_{j,no\ excl}) + F_j &> \pi_i, \end{aligned}$$

which are equivalent to

$$\begin{aligned} (1+\alpha)U_i &> U^* + \alpha(U_i - U_j), \\ (1+\alpha)(U_i - U_j) + F_j - 2\alpha(U^* - U_j) &> 0, \text{ and} \\ (1+\alpha)U_i - U^* - \alpha(U_j - U_i) - 2\alpha(U^* - U_j) + F_j &> 0, \end{aligned}$$

or

$$U^* < (1+\alpha)U_i + \alpha U_j, \tag{7}$$
$$F_j > 2\alpha U^* - (1+\alpha)U_i + (1-\alpha)U_j, \text{ and} \tag{8}$$
$$F_j > (2\alpha+1)(U^* - U_i) - \alpha U_j. \tag{9}$$

In order to prove that parameters can be such that (1), (A1), (A2), and (7)-(9) simultaneously hold, it is only necessary to show that U_1, U_2, U^*, and α can be found satisfying

$$\left\{\begin{array}{c} 2\alpha(U^* - U_1) > U_2 \\ 2\alpha(U^* - U_2) > U_1 \\ U_1 + U_2 > U^* \\ U^* < (1+\alpha)U_1 + \alpha U_2 \\ 2\alpha U^* - (1+\alpha)U_1 + (1-\alpha)U_2 < 2\alpha(U^* - U_1) \\ (2\alpha+1)(U^* - U_1) - \alpha U_2 < 2\alpha(U^* - U_1), \end{array}\right.$$

or

$$\left\{\begin{array}{c} 2\alpha(U^* - U_1) > U_2 \\ 2\alpha(U^* - U_2) > U_1 \\ U_1 + U_2 > U^* \\ U^* < (1+\alpha)U_1 + \alpha U_2 \\ U_1 > U_2 \\ U^* < U_1 + \alpha U_2. \\ \alpha < 1 \end{array}\right.$$

These conditions are satisfied for example if

$$\begin{array}{c} Max(U_1 + \frac{U_2}{2}, U_2 + \frac{U_1}{2}) < U^* < U_1 + U_2, \\ U_1 > U_2, \end{array}$$

and α is close enough (but not equal) to 1.