Exclusive Contracts and Demand Foreclosure*

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Abstract

In the presence of fixed costs, a firm may decide to include exclusivity clauses in the contracts offered to some of its customers, in order to deprive a rival of the minimum required size, induce it to leave the market, and enjoy increased market power - even if the rival's exclusion is socially inefficient. Such a possibility does not require some adversely affected party (a rival firm, or some future customers) to be absent at the contracting stage. This result therefore strengthens the "critique of the Chicago critique" by showing that anticompetitive exclusive contracts may occur under very general assumptions. While a complex enough contractual environment allows all agents to reach a Pareto-optimum, thus ruling out inefficient exclusion, plausible and relatively weak restrictions on the institutional setup suffice to make inefficient exclusion possible.

1 Introduction

This paper aims to clarify the circumstances under which a firm may sign exclusive contracts with some of its customers in order to exclude a rival, even though exclusion reduces social welfare. This clarification is important both for its own sake and from the viewpoint of antitrust policy. Indeed, the

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legal treatment of exclusive dealing appears to be responsive to the twists and turns of economic theory. For example, the so-called Chicago critique, which purported to prove that the reasonings underpinning the traditional hostility toward exclusive dealing were flawed, seems to have induced U.S. Courts to progressively soften their handling of exclusivity clauses.[1]

From a theoretical viewpoint, the need for clarification stems from the fact that, while the recent body of literature rigorously described several "scenarios" of welfare-reducing exclusion through the use of exclusive contracts, it still leaves readers wondering which conditions exactly are necessary for these anticompetitive outcomes to occur in equilibrium. The main contribution of this paper is to show that, although all the models of anticompetitive exclusion assume that some of the adversely affected parties are not present during the contracting stage, this assumption is unnecessary. Anticompetitive exclusion can also occur when all affected parties are present, provided that too complex contracts are ruled out. This theoretical result is relevant for antitrust policy, because contrary to those established in the earlier literature, it relies on assumptions which are not blatantly at odds with the facts of the relevant case law.

Summary of the literature

The first analysis of exclusive contracts emanated from the "Chicago school" and dismissed the view that these contracts could be used by a firm in order to exclude a rival and increase its market power. The Chicago school argument is simply that if such exclusion is socially inefficient, the payment which the excluding firm has to grant consumers in order to "bribe" them into agreeing to exclusivity would exceed the incumbent firm's gain from deterring entry or inducing exit[2] Exclusive dealing must them have other, probably procompetitive motives.[3]

The "post-Chicago" literature 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

[1]See Wiley (1998) and Gilbert (2000) for a survey of the legal treatment of exclusive contracts and an economic discussion.

[2]See Posner, (1976, p. 212) and Bork (1978, p. 309).

[3]See, e.g., Marvel (1982) and Segal and Whinson (2000b).

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.[4] But, as O'Brien and Shaffer (1997) argued, this result breaks down if nonlinear pricing is feasible[5].

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 (a potential entrant, or some future consumers) is absent at the contracting stage. The key idea is that, if complex contracts are ruled out, the scope for Coasian bargaining may be limited because some adversely affected parties (the excluded firm, or the customers who fall prey to the excluding firm's market power) may be unable to make payments to other parties in order to prevent an inefficient outcome.

The seminal paper in this branch of the literature is Rasmusen et al. (1991, henceforth, RRW), complemented by Segal and Whinston (2000a, henceforth SW). It shows that, if increasing returns make a minimum scale of operation necessary for profitable entry, an incumbent can achieve full exclusion relatively cheaply by exploiting the lack of buyers' coordination, or by discriminating between buyers. The idea is that even if buyers as a whole lose when entry is deterred, entry deterrence can be profitable because the excluding firm does not need to bribe all its potential customers to sign an exclusivity agreement. It only needs to "buy" the consent of a subset of them, just large enough to deprive the potential entrant from the minimum viable scale. The incumbent can then fully exploit its market power vis-à-vis *all* the potential customers, including those who did not sign an exclusive contract and whose consent was not bought. The entrant's need for a minimum scale of operation generates a contracting externality across customers (a consumer signing an exclusive contract has an impact on overall

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

[5] 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. However, Spector (2004) shows that Mathewson and Winter's (1987) result may still hold under nonlinear pricing if the seller does not know each customer's demand function. This is simply a consequence of the more general fact that nonlinear pricing together with asymmetric information resembles linear pricing.

entry) which the incumbent can exploit[6]. In this case, the Chicago critique breaks down because the excluding firm does not need to compensate the loss suffered by all buyers, but only that suffered by some of them. Coordination failures may lead to the same result: each customer may agree to sign an exclusive contract against a low monetary transfer if it believes that its agreement is not pivotal in inducing exclusion.[7] Variants of RRW consider the possibility of buyers forming coalitions[8] or the impact of competition among buyers[9]. But all of them stick to the assumption that the potential entrant does not take part to the contracting game.

A related idea can be found in models assuming that some adversely affected parties, other than the excluded firm, cannot take part in the contracting game. These parties can be consumers in a future market, whose identity cannot be known in advance (even to themselves)[10], or they may be too small to profitably participate to the contracting game because of transaction costs (Gans and King, 2002). In yet one more category of papers, socially harmful exclusion may result from contracts signed between wholesalers and retailers because final consumers are unable to participate to the general bargaining which could induce an efficient outcome.[11]. 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.

While the aforementioned papers show 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. In all these papers, the contracting parties "conspire" against other agents, some or all of whom (a potential entrant, or some future consumers, or final

[6] For a systematic treatment of contracting with externalities, see Segal (1999, 2003) and Segal and Whinston (2003).

[7] Segal and Whinston (2000a) show that the equilibria in which exclusion is achieved by exploiting the lack of coordination among buyers is not a perfectly coalition-proof equilibrium.

[8] Innes and Sexton (1994).

[9] Motta and Fumagalli (2005), Simpson and Wickelgren (2003).

[10] Bernheim and Whinston (1998), section IV

[11] Hart and Tirole (1990); Lin (1990); O'Brien and Shaffer, (1993). Simpson and Wickelgren (2003) belongs to this set of papers (since the presence of downstream consumers exacerbates the inefficiency) while at the same time being a variant of RRW (since the excluded firm in their model is a potential entrant unable to participate to the contracting game).

consumers) are unable to defend themselves by making counteroffers.

This paper's contribution

This common feature of all these models - the inability of some adversely affected parties to participate to make payments to other parties so as to avoid exclusion - raises two issues. The first one is theoretical. In most of the aforementioned models, contracts are restricted to take a rather simple form. For example, they all consider bilateral contracts between a firm and a customer, ruling out the possibility of conditional contracts, i.e. contracts the terms or the validity of which depends on which contracts other parties have signed. Also, the possibility of allowing firms to include a penalty for breach is not systematically taken into account.[12] A natural question emerges then: is the possibility of socially harmful eviction driven by the absence of some adversely affected parties during the contracting game, or by the restrictions imposed on the type of feasible contracts? Clearly, if these two assumptions were lifted, i.e. if all affected parties could enter into very complex contracts, Coasian bargaining would take place and induce an efficient outcome. But should socially harmful exclusion be a concern when, for example, all affected parties can enter into contracts, albeit not too complex ones?

This question brings us to the second issue. The aforementioned literature is at odds with the facts of much of the relevant case law, which deals with settings where the excluded firm(s), or other potentially harmed parties, could in principle have responded to the alleged exclusionary strategy. This point has been made by Whinston (2001, pp. 68-69) in his discussion of the *US v Microsoft* case. Similarly, in the landmark *Lorain Journal* case, Courts challenged exclusive dealing contracts occurring in a setup where the alleged victims where already present. In that case, the only newspaper in town refused to accept advertisements from customers that advertised on radio stations that competed with it for advertising revenues. The court held that 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, nonlinear pricing is commonplace in newspaper advertising, and while future purchasers of advertising time or space could be harmed, this does not appear to have been

[12] Aghion and Bolton (1987) is an exception, but their results are entirely driven by uncertainty about the potential entrant's costs. A section of SW considers breach penalties, but under very specific assumptions.

a central concern. As explained above, current theory cannot explain why exclusivity requirements could be undesirable in such a context[13].

This paper addresses these issues within a general model of which RRW, its variant considered in Segal and Whinston (2000a), and Bernheim and Whinston (1998) are particular cases. The main findings are the following:

- Even when one of the firms is a potential entrant which cannot participate to the contracting game, the possibility of socially harmful eviction disappears if the incumbent is able to offer complex contracts, namely contracts that are conditional on acceptance by both customers, and that include breach penalty clauses.
- When all firms can participate to the contracting game, but contracts cannot be too complex (i.e. only simple bilateral contracts, or bilateral contracts with breach penalty clauses but without conditionality clauses, or with conditionality clauses but no breach penalties), socially harmful exclusion can occur, although it is less likely than in the situation where one of the firms is a potential entrant which is unable to participate in the contracting game.

This means that, contrary to the way the existing literature could be construed, anticompetitive exclusion through exclusive contracts can be an equilibrium outcome even when the excluded firm is already present in the market, provided that contracts cannot be too complex. Limitations on the type of contracts which can be written and enforced, rather than the absence of some adversely affected parties, is key to socially harmful 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: there are only two firms and two consumers, and profits and utility levels are specified under reduced forms. In Section 3, we consider the case of an incumbent

[13] Contrary to Rasmusen *et al.* (1999), we do not believe that RRW captures all the relevant aspects of 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 - since the case was both about deterring entry and inducing exit. This remark notwithstanding, Rasmusen *et al.* (1999) is an excellent discussion of how theories of exclusive contracts relate to the U.S. case law.

and a potential entrant, and compare various contractual environments. Section 4 performs a similar analysis under the assumption that both firms are on symmetric terms regarding which contracts can be offered and the timing of contract offerings. Section 5 concludes.

2 The model

The assumptions of the model are kept as simple as possible for the sake of tractability. There are two firms, labeled Firm 1 and Firm 2 and two consumers (a and b). Firms are (in general) different, while consumers are characterized by identical preferences.[14]

In order to conduct the analysis at a general enough level, we specify reduced forms rather than detailed preferences and technologies. More specifically, we assume that the institutional context is as follows:

First, consumers and firms enter into contracts which may involve a commitment to purchase exclusively from a given firm, or a commitment not to enter into an exclusive agreement with a given firm. These contracts may also involve lump-sum transfers, and have more complex features, such as being conditional on acceptance by other parties. Which type of contract can be offered, whether discrimination across consumers is allowed, the timing of offers, etc..., is described in greater detail below. Different assumptions regarding these points lead to different "contractual environments", and the point of this paper is precisely to compare different contractual environments.

Second, the contracts which have been proposed and signed give rise to a situation in which firms and consumers negotiate over prices and quantities, subject to the constraints induced by the contracts which have been signed (e.g., exclusivity requirements). This negotiation could take the form of firms making take-it-or-leave it offers involving price-quantity pairs (non-linear pricing), or of firms offering a single price (linear pricing, as in RRW), or of each firm-consumer pair engaging into bargaining and dividing the joint surplus from their relationship. For our purposes, there is no need to enter into these details, because the only relevant variables are, for each possible situation, the profit accruing to each firm and each consumer's surplus. Therefore, the various games we study all have the same structure. First,

[14] The assumption that consumers have identical preferences is made in RRW as well. RRW also assumes that firms are identical (except for the fact that one is incumbent), but SW relaxes this assumption when discussing breach penalties (in Section IV).

firms offer contracts to consumers, specifying lump-sum transfers, as well as possible restrictions (such as exclusivity requirements) which constrain the identity of the firms with which each consumer will be able to deal, and consumers decide which contracts to accept (if any). Then, firms decide which consumers they want to deal with. Finally, the list of firm-consumer deals determines each firm's profit and each consumer's surplus - to (from) which the lump-sum transfers previously agreed upon must be added (subtracted).

2.1 Consumer preferences

Consumers are assumed to have identical preferences, given by Table 1 below.

Table 1: consumer preferences

Situation	Consumer's utility
A consumer is served by both firms	V
A consumer is served by Firm i only	U_i

2.2 Firm profits

Firm 1's profit is equal to $\lambda\pi_1 + \mu\hat{\pi}_1$ where λ and μ are, respectively, the number of consumers served by both firms and the number of customers served by Firm 1 only. It is assumed that $\hat{\pi}_1 > \pi_1$ in order to capture the idea that Firm 1's profit is greater in monopoly than in duopoly. The assumption that Firm 1's per customer profit only depends on the degree of competition for that customer is consistent with the assumption that Firm 1's technology displays constant returns to scale.

Firm 2's technology is assumed to be characterized by economies of scale in the following sense. If Firm 2 serves both consumers, then its profit is equal to $\lambda\pi_2 + \mu\hat{\pi}_2$ where λ and μ are, respectively, the number of consumers served by both firms and the number of customers served by Firm 2 only (with, obviously, $\lambda+\mu = 2$, with the assumption $\hat{\pi}_2 > \pi_2$). However, if Firm 2 serves a single customer, its profit is equal to $\hat{s}_2$ (if it is alone in serving that customer) or s_2 (if that customer is also served by Firm 1), with $\hat{s}_2 > s_2$ (in order to account for the fact that Firm 2's profit is greater under monopoly than under duopoly), and the two inequalities $\hat{\pi}_2 > \hat{s}_2$ and $\pi_2 > s_2$. These last two inequalities capture the presence of economies of scale, in that, given the nature of competition (duopoly or monopoly) per-customer profit is greater when serving two customers than when serving one.

The following assumptions about parameters are made throughout the paper for i=1 and $i = 2$:

$$\pi_i \geq 0 \tag{1}$$

$$V > U_i \tag{2}$$

$$V + \pi_1 + \pi_2 > U_i + \hat{\pi}_i \tag{3}$$

$$s_2 < \hat{s}_2 < 0 \tag{4}$$

These assumptions have the following interpretation. (1) implies that competition leads to nonnegative profits for both firms if each has unrestricted access to both consumers. (2) and (3) imply that consumer as well as aggregate welfare is greater under competition than under monopoly. Finally, (4) means that because of economies of scale, Firm 2 is better off serving no customer at all than serving only one of them. This assumption is central to all our results: it implies that if Firm 1 succeeds in signing an exclusive contract with one consumer, then Firm 2 is better off not serving any of the two consumers, because serving only one of them would not allow it to recover its fixed costs. This assumption is indeed central to the results in RRW, SW, and Bernheim and Whinston (19998).

Notice that all the assumptions above are satisfied in RRW. The correspondence is as follows.

- In RRW, $\pi_1 = \pi_2 = 0$ since both firms produce homogeneous goods and have identical marginal costs equal to their variable costs. Our assumptions allow for π_1 and π_2 to be different from each other as well as strictly positive, in order to account for more general cost functions and for product differentiation.

- In RRW, the entrant makes losses when serving a single consumer if N^* is equal to 1.[15]

[15] In RRW, both firms have identical costs, but the assumption that the incumbent would make losses if it served only a small number of customers is irrelevant because of

- In RRW, $V = CS(\overline{c})$ and $U_1 = U_2 = CS(p^m)$.
- In RRW, $\hat{\pi}_1 = \hat{\pi}_2 = (p^m - \overline{c})q(p^m)$.
- RRW's assumption stated as "$\pi < x^*$" is equivalent to (3), since it means that aggregate welfare is greatest when both firms serve consumers.

Notice that our formulation is far more general than that of RRW. For example, it allows for the possibility that both firms sell differentiated goods as well as for nonlinear pricing.

3 Foreclosing an entrant through exclusive contracts

In this section, we deal with the situation analyzed in RRW and SW, i.e. that of an incumbent able to offer exclusive contracts. We start by assuming that the incumbent is only able to offer simple exclusive contracts (i.e. without any breach possibility), and we examine two alternative cases, depending on the incumbent's ability to discriminate across consumers. Our results in the case where discrimination is allowed coincide with those of SW. We then turn to the possibility that contracts include a breach penalty provision, and we show that this possibility reduces, but does not eliminate, the occurrence of exclusion.

3.1 Case 1: simple exclusive contracts without discrimination

In accordance with RRW and the related literature, we start by considering the following simple game.

Stage 1. Firm 1 may offer each consumer a contract specifying that (i) the consumer commits not to purchase from Firm 2; and (ii) a lump-sum transfer

its first-mover advantage. In this paper, because firms are on equal terms regarding the timing of offers, we need to depart from the assumption of identical costs for simplicity, in order to limit the number of equilibria. In this sense, firms are not on equal terms as regards costs. But the point of this paper is simply to investigate the consequences of them being in equal terms as regards contracts, not costs.

from Firm 1 to the consumer. Firm 1 cannot discriminate across consumers: a contract offered to one consumer must be available to the other one.

Stage 2. Consumers simultaneously decide whether to sign the contracts possibly offered to them in Stage 1. The lump-sum payments corresponding to the contracts which end up being signed are made.

Stage 3. Observing the outcome of Stage 2, Firm 2 decides which consumers it wants to serve. It cannot decide to serve a consumer who signed an exclusive contract in Stage 2. However a firm can serve a consumer with which no contract has been signed at the previous stage.

Stage 4. Each consumer's welfare level and each firm's profit is determined according to Table 1 and to Firm 2's choices in Stage 3. Lump-sum payments provided in exclusive contracts signed in Stage 2 are subtracted from Firm 1's profit and added to the signing consumer's welfare level.

Equilibrium multiplicity is pervasive when exclusive contracts are possible[16]. Following the existing literature, and in order to rule out situations where exclusive contracts result only from of a lack of coordination between consumers or firms (a possibility arising, for example, in Rasmusen et al., 1991), we restrict our attention to perfectly coalition-proof Nash equilibria (PCPNE). This restriction means that the continuation equilibrium of any subgame must be optimal among the set of perfect continuation equilibria, from the point of view of the parties having to choose an action at the initial node of the subgame considered. In more down-to-earth terms, this implies for example that if an exclusive contract is offered to consumers and there exist two subgame-perfect equilibria, one in which both accept it and one in which none accepts it, only the equilibrium yielding consumers the largest surplus is considered. This assumption is in fact equivalent to saying that consumers coordinate on an equilibrium which is Pareto-optimal from their joint viewpoint.

Proposition 1 *In the only PCPNE, Firm 2 is excluded if and only if* $U_1 + \hat{\pi}_1 > V + \pi_1$.

Notice that for exclusion to happen in Proposition 1, it must be the case that $\pi_2 > 0$. The reason is that, if $\pi_2 = 0$, assumption (3) is equivalent to

[16] Bernheim and Whinston, 1998, and O'Brien and Shaffer, 1997.

$U_1 + \widehat{\pi}_1 < V + \pi_1$. Consequently, under the assumptions of RRW and SW, exclusion cannot occur in a PCPNE is discrimination is prohibited.

3.2 Simple exclusive contracts with discrimination

We assume now that the incumbent can discriminate across customers. In this case, exclusion is more likely because in order to exclude, the incumbent only needs to convince one consumer to sign an exclusive contract: if it does, the entrant will decide to serve no customer at all rather than only one, and the incumbent will exert its market power vis-à-vis both consumers while only having to compensate one of them. This is established in the following Proposition.

Proposition 2 *In the only PCPNE, Firm 2 is excluded if and only if* $U_1 + 2\widehat{\pi}_1 > V + 2\pi_1$, *i.e. if the joint surplus of Firm 1 and one customer is greater under exclusion than under no-exclusion.*

Proposition 2 coincides with Proposition 3 in SW if the special assumptions of RRW are made. The proof of this result is straightforward. Coalition-proofness implies that for Firm 1 to induce a consumer to enter into an exclusive contract, it must guarantee this consumer a welfare level equal to at least V. Indeed, if in equilibrium both consumers earn less than V, they could form a coalition and jointly decide not to sign contracts. This would yield each consumer a welfare level of V (because Firm 2's entry would not be deterred) and not signing would be an equilibrium (since signing an exclusive contract when the other consumer does not would cause the signing consumer's welfare level to fall below V). Therefore, Firm 1 can sign an exclusive contract only against a lump-sum transfer equal to at least $V - U_1$, which is the minimum amount needed to keep the signing consumer's welfare level equal to V while deterring entry. Firm 1's maximum profit when offering such an exclusive contract is thus $2\widehat{\pi}_1 + V - U_i$ (because, as a consequence of assumption (4), Firm 2 will decide not to enter if it observes that a consumer signed an exclusive contract), and such a contract is offered only if this is greater than the profit which Firm 1 could earn by offering no contract at all, i.e. $2\pi_1$.

3.3 Exclusive contracts with discrimination and breach penalties

We now increase contract complexity by allowing Firm 1 to offer contracts including a breach penalty clause. Unlike SW, we choose to address the question of breach penalties without modifying the assumptions about the firms' cost structure. This will allow us to assess what exactly the impact of allowing for breach penalty provisions is, leaving everything else unchanged. The game under consideration is changed accordingly.

Stage 1. Firm 1 may offer each consumer a contract specifying that (i) the consumer commits not to purchase from Firm 2; (ii) a lump-sum transfer from Firm 1 to the consumer; and (iii) a penalty which the consumer must pay to Firm 1 if it breaches the exclusivity commitment. Firm 1 can discriminate across consumers, i.e., for example, offer an exclusive contract to one consumer only.

Stage 2. Consumers simultaneously decide whether to sign the contracts possibly offered to them in Stage 1.

Stage 3. Observing the outcome of Stage 2, Firm 2 may decide to offer some consumers a lump-sum payment in exchange for these consumers breaching the exclusive contract signed with Firm 1.

Stage 4. Consumers who signed an exclusive contract in Stage 2 and were offered by Firm 2 to breach it in Stage 3 decide whether to accept Firm 2's offer or not. A consumer breaching an exclusive contract signed in Stage 2 receives the lump-sum payment proposed by Firm 2 in Stage 3, and pays Firm 1 the breach penalty provided in the exclusive contract it breaches.

Stage 5. Firm 2 decides which consumers it wants to serve. It cannot decide to serve a consumer who signed an exclusive contract in Stage 2 and did not breach it in Stage 4.

Stage 6. Observing the outcome of Stage 2, Firm 2 decides which consumers it wants to serve. It cannot decide to serve a consumer who signed an exclusive contract in Stage 2.

Stage 7. Each consumer's welfare level and each firm's profit is determined according to Table 1 and to Firm 2's choices in Stage 6. Lump-sum payments or breach penalties provided in the various contracts are added to or subtracted from firms' profits and consumers' welfare level.

The following result, proved in the appendix, shows, unsurprisingly, that if exclusive contracts can provide breach penalties, then Firm 2's exclusion occurs only if the joint surplus of Firm 1, Firm 2, and one consumer, is greater under exclusion than under competition.

Proposition 3 *If breach penalties are possible, then in the only PCPNE , Firm 2 is excluded if and only if* $U_1 + 2\widehat{\pi}_1 > V + 2\pi_1 + 2\pi_2$*, i.e. if and only if the joint surplus of both firms and one customer is greater under exclusion than under no exclusion.*

It should be noted that if the assumptions of RRW are made, then allowing for breach penalties has no impact on the likelihood of exclusion. This is because, following the logic of Aghion and Bolton (1987), the role of breach penalties is to induce the entrant to transfer part of its rent to the pair comprising the incumbent and one consumer. But in RRW, the entrant has no rent, because both firms' profits under competition are equal to zero. In a more general setting however, firms may earn positive profits under competition. If that is the case (namely, if $\pi_2 > 0$), then the possibility of introducing breach penalties in exclusive contracts reduces the likelihood of exclusion. However, it does not completely eliminate it, because the condition for exclusion not to take place does not coincide with the inequality stating that exclusion is inefficient. The source of the discrepancy is that in order to assess efficiency, all agents are taken into account, while the outcome of the game considered in this subsection only takes into account one consumer (in addition to both firms), leaving the other consumer aside.

3.4 Exclusive contracts with breach penalties and conditional offers

We now further complexify the institutional setup, up to the point where it is rich enough to allow Coasian bargaining to take place, implying that exclusion occurs in a PCPNE only if it is efficient.

Stage 1. Firm 1 may offer each consumer a contract specifying that (i) the consumer commits not to purchase from Firm 2; (ii) a lump-sum transfer from Firm 1 to the consumer; and (iii) a penalty which the consumer must pay to Firm 1 if it breaches the exclusivity commitment. Firm 1 can discriminate across consumers, i.e., for example, offer an exclusive contract to one consumer only.

Stage 2. Consumers simultaneously decide whether to sign the contracts possibly offered to them in Stage 1.

Stage 3. Observing the outcome of Stage 2, Firm 2 can make the following offers to consumers. To consumers who signed an exclusive contract with Firm 1, it may offer a lump-sum payment in exchange for breaching it. From consumers who did not sign an exclusive contract with Firm 1, it may ask for a lump-sum transfer (from the consumer to itself). Finally, if Firm 2 makes offers to both consumers (counting as an offer also the demand for a lump-sum transfer from a consumer), it may state that these offers are valid only if both consumers sign it in Stage 4.

Stage 4. Consumers who were made offers by Firm 2 in Stage 3 decide whether to take them up or not. If these offers were made conditionally on acceptance by both consumers, and only one of them accepts the offer made by Firm 2, then the takeup decision is not taken into account. In particular, if a consumer (say, consumer a) signed an exclusive contract in Stage 2, agreed to breach it in Stage 3, but Firm 2's offer to breach it was conditional on consumer b making a lump-sum payment to Firm 2, and this last offer is not taken up, then consumer a remains bound by the exclusive contract signed with Firm 1.

Stage 5. Firm 2 decides which consumers it wants to serve. It cannot decide to serve a consumer who signed an exclusive contract in Stage 2 and did not breach it in Stage 4.

Stage 6. Observing the outcome of Stage 2, Firm 2 decides which consumers it wants to serve. It cannot decide to serve a consumer who signed an exclusive contract in Stage 2.

Stage 7. Each consumer's welfare level and each firm's profit is determined according to Table 1 and to Firm 2's choices in Stage 6. Lump-sum payments or breach penalties provided in the various contracts are added to or subtracted from firms' profits and consumers' welfare level.

The following result, proved in the appendix, shows that in this institutional context, exclusion does not occur in equilibrium.

Proposition 4 *Under the above assumptions, exclusion does not occur in a PCPNE.*

4 Foreclosing an already present competitor

We assume now that both firms are present at the time when contracts can be offered to consumers and that both are on an equal footing as regards the ability to offer contracts. Beyond the variations regarding the nature of the clauses which can be included in contracts (or the possibility to discriminate between the two consumers), the games considered in this section all share the same structure, which is as follows.

Stage 1. Both firms offer contracts to each consumer. The specific restrictions imposed on contracts (i.e. which type of clause it may contain, whether discrimination is allowed, etc...) are specified in each of the following subsections. A contract also specifies a payment to the consumer. A firm may offer as many contracts as it wishes. Also, depending in some of the specific institutional environment considered below, Stage 1 may be broken down into several periods, in order to allow firms to respond to each other's offers. However, a common feature of all the variants considered hereafter is that both firms are exactly on the same footing, in the sense that none has a first-mover advantage over the other, and both can offer the same type of contracts.

Stage 2. Consumers simultaneously decide whether to sign the contracts possibly offered to them in Stage 1. The lump-sum payments corresponding to the contracts which end up being signed are made.

Stage 3. Observing the outcome of Stage 2, both firms simultaneously decide which consumers they want to serve. A firm cannot serve a consumer who signed an exclusive contract with the other firm in Stage 2 (assuming such a contract has been offered and accepted). However a firm can serve a consumer with which it did not sign a contract at the previous stage.

Stage 4. Each consumer's welfare level and each firm's profit is determined according to the assumptions of sections 2.1 and 2.2 above. Lump-sum payments provided in contracts signed in Stage 2 are subtracted from firms' profits and added to the signing consumers' utility levels.

Just like in the previous Section, the focus is on perfectly coalition-proof Nash equilibria (PCPNE).

4.1 Simple exclusive contracts without discrimination

We assume in this subsection that (i) each firm must offer the same contracts to both consumers, and (ii) only simple exclusive or non-exclusive contracts are allowed. Both a non-exclusive and an exclusive contract commit each party to deal with the other one (i.e. the firm commits to serve the consumer, and the consumer commits not to sign an exclusive contract with the rival of the firm with which it signs a contract) and may include a lump-sum transfer. In addition, an exclusive contract commits the customer not to deal with the rival firm. In this setting, as Proposition 1 establishes, exclusion cannot occur in equilibrium. The reason is simple: the prohibition of discrimination implies that when offering contracts, the potentially excluding firm (Firm 1) takes into account the utility level of both consumers. But the fact that both firms make simultaneous offers implies that Firm 2 is able to transfer its profits to consumers (through non-exclusive contracts together with lump-sum payments) in order to deter them from signing exclusive contracts with Firm 1. This ability for Firm 2 to make lump-sum payments to consumers implies that Firm 2's profits are taken into account in the relationship between Firm 1 and consumers. Therefore, all parties are taken into account, and the equilibrium outcome must be optimal - which rules out exclusion.

Proposition 5 *Exclusion cannot occur in a PCPNE.*

4.2 Simple exclusive contracts with discrimination

In this subsection, we still assume that only simple exclusive or non-exclusive contracts are allowed, but we relax the no-discrimination rule. As Proposition (6) shows, the possibility to discriminate causes exclusion to occur in equilibrium for some parameter values.[17] The reason is simply that, since discrimination is allowed, Firm 1 needs only one consumer to sign an exclusive contract in order to evict Firm 2. As a consequence, the parties whose surplus is taken into account when contracts are offered and taken up are Firm 1 (which has the choice whether to offer an exclusive contract)[18], one consumer (the one to whom a hypothetical exclusive contract is offered), and Firm 2 (which can transfer its expected profits by offering non-exclusive contracts). This leaves out one of the two consumers. Exclusion thus occurs if it maximizes the joint surplus of firms and one consumer - which is possible even if exclusion is suboptimal.

Proposition 6 *Under the assumptions made above, there exists a PCPNE in which no firm is excluded, and there exists no equilibrium in which Firm 1 is excluded. In addition, there exists a PCPNE in which Firm* 1 *excludes Firm* 2 *if and only if* $2\hat{\pi}_1 + U_1 > 2\pi_1 + 2\pi_2 + V$.

Corollary 7 *1.* ***Inefficient eviction of an already present competitor is possible.*** *In particular, in the RRW model, if cost and preference parameters are such that exclusion occurs when Firm 2 is a potential entrant, it also occurs when Firm 2 is already present and firms can only offer simple exclusive contracts.*

2. ***With simple exclusive contracts, efficient eviction is however less likely than inefficient entry deterrence.*** *If parameters are such that Firm i evicts Firm j in a PCPNE of the game in which both firms can simultaneously offer simple exclusive contracts, then Firm i also deters Firm j's entry in the case in which Firm j cannot make any offer and only simple exclusive contracts are allowed (case 1 of Section 2). This means that while the presence of both firms does not eliminate the possibility of exclusion, it reduces its likelihood.*

[17] Proposition 6 and the following ones only consider PCPNE which are also trembling-hand perfect (THPCPNE). This quite usual restriction is meant to rule out counter-intuitive equilibria in which the excluded firm offers contracts which would cause it to lose money if they were chosen by consumers. While this restriction is not mentioned in the above propositions, it can be checked that all the equilibria described therein are in fact trembling-hand perfect.

[18] Firm 2 also has the option of offering an exclusive contract, but this cannot be an equilibrium strategy because Firm 1 faces no increasing returns and there are thus no cross-customer externalities regarding the acceptance of exclusive contracts hypothetically offered by Firm 2.

Proof of the corollary. Claim 1 results from the fact that under the assumptions of RRW, $\pi_1 = \pi_2 = 0$, so that the condition for discrimination to occur in Proposition 6 coincides with that in Proposition 2. Claim 2 results from the assumption that $\pi_2 \geq 0$.

4.3 Case 2: exclusive contracts with breach penalties

We now increase contract complexity by allowing firms to offer contracts including a breach penalty clause (providing for a breach payment). More precisely, Stage 1 is now broken down into two periods. In period 1, each firm may offer contracts. A contract can be non-exclusive or exclusive, and in addition an exclusive contract may include a penalty for breach. In period 2, having observed the contracts offered in period 1, both firms can offer contracts again.

Proposition 8 shows that, unlike in the case where one of the firms is the potential entrant unable to offer contracts of its own, the possibility of introducing breach penalties does not affect the likelihood of exclusion, relative to the situation where firms can discriminate and offer simple exclusive contracts. The reason is the following. When one of the firms is a potential entrant, a breach penalty is the only way for the incumbent to "force" the entrant to transfer its expected profit (i.e., π_2) to the incumbent-consumers set. However, when both firms are present, the entrant can be induced to make this transfer upfront, in order to deter a consumer from signing an exclusive contract with its rival - this is in fact the logic driving Proposition 6.

Proposition 8 *If breach penalties are possible, there exists a PCPNE in which no firm is excluded, and there exists no equilibrium in which Firm 1 is excluded. In addition, there exists a PCPNE in which Firm* 1 *excludes Firm* 2 *if and only if* $2\widehat{\pi}_1 + U_1 > 2\pi_1 + 2\pi_2 + V$, *i.e. if the joint surplus of both firms and one customer is greater under exclusion than under no-exclusion. Although the set of likelihood of exclusion is exactly the same as when provisions for breach penalties are not available, payoffs are not identical in the two contractual environments.*

4.4 Case 3: exclusive contracts with breach penalties and conditional contracts

We now further complexify the institutional setup, by assuming that each firm can state that a given contract is valid only if some other contract is also taken up by the other consumer. The following result shows that in this institutional context, exclusion does not occur in equilibrium.

Proposition 9 *If contracts can include breach penalties and conditional offers are possible, then exclusion does not occur in a PCPNE.*

This result is not surprising. Since the possibility to offer conditional contracts with breach penalty provisions is enough to rule out exclusion when one of the firms is a potential entrant, it is a fortiori the case when both firms can offer contracts early on (which generally reduces the likelihood of exclusion by facilitating the "defence" of the potentially excluded firm).

5 Conclusion

Recapitulating results

Table 2 summarizes the results:

Contractual environment	**One firm is a potential entrant**	**Both firms are incumbents**
	Socially inefficient exclusion happens in a PCPNE if $\bar{\pi}_1$-π_1 is greater than...	
No discrimination	$V - U_1$	Never
Discrimination and simple exclusive contracts	$\frac{V-U_1}{2}$ (more often than when discrimination is prohibited)	$\frac{V-U_1}{2} + \pi_2$ (but there also is a PCPNE without exclusion)
Discrimination and exclusive contracts with breach penalty	$\frac{V-U_1}{2} + \pi_2$ (less often than when breach penalties are prohibited)	$\frac{V-U_1}{2} + \pi_2$ (but there also is a PCPNE without exclusion)
Same as above but conditional contracts are possible	Never	Never

Even though exclusion is less likely when the "targeted" firm is able to offer contracts early on, at the same time as the potential excluding firm, it is still possible in such a setting, unless the contractual environment is rich enough. Coasian bargaining thus 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 may 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 consumers on a downstream market: all the models presented above assume that firms directly sell to final consumers.

Let us stress that in terms of real-world applicability, this theory of foreclosure (as well related ones such as in RRW and SW) 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 analysis is exactly the same as long as the investment variable involves some increasing returns, in the (very weak) sense that for a given level of investment, the induced increase in demand is reduced if the firm is barred from serving a given set of consumers (for example, a fixed investment allowing a firm to lower its variable costs could fit into this theory). In such a setting, partial consumer foreclosure induces a firm to scale down investment, which reduces the competitive constraint it is able to exert vis-à-vis those consumers who did not sign an exclusive contract - thus enhancing the market power enjoyed by the firm offering exclusive contracts vis-à-vis *all* consumers.

While this paper extends the existing theory and shows that anticompetitive exclusive contracts may arise in more general settings than has been established so far, further research is probably required in two very different directions. The first and more obvious one is empirical: like any theoretical research in Industrial Organization, this work would gain from being complemented with empirical studies. This is all the more true in the case of exclusive contracts, since little in known as to their motivation or their effects in many cases, including those that have been scrutinized by Courts. The second direction is theoretical: in our quest for an institutional setting rich enough to induce the Coasian argument to work, we did not proceed according to a predetermined metric over contractual environments. For example, while it seems straightforward to consider that contracts conditional on many variables are more complex than contracts conditional on fewer variables, there is much less clarity as to whether a game with many moves and countermoves is more or less complex, and more or less plausible, than a game where agents simultaneously choose actions, once and for all. In other words, our claim that "simple" contractual environments allow inefficient exclusion to take place, while "rich" contractual environments do not, is not founded on a rigorous theory of what a simple or a rich environment is. Progress towards a complexity metric could pave the way for more general results about how much complexity is required for Coasian bargaining to take place.

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6 Appendix

Proof of Proposition 1

Consider a hypothetical equilibrium in which exclusion occurs, and let $V*$ denote each consumer's utility level in this hypothetical equilibrium (the no-discrimination clause implies that in equilibrium both consumers enjoy the same utility level). It must be the case that $V* \geq V$. Assume indeed that this is not the case and that $V* < V$. In this case, there necessarily exists an equilibrium in which no consumer accepts the exclusive contract offered by Firm 1 and both consumers enjoy a utility level of V. Indeed, if consumer a rejects the contract, then consumer b's utility from rejecting it as well is V (since rejection by both induces Firm 2 to enter and allows each consumer to be served by both firms). If consumer a takes up the contract, then he will be served by Firm 1 alone and be paid the lump-sum transfer provided for in the exclusive contract offered by Firm 1. He will get the utility level $V*$. If $V* < V$, rejection by both consumers is thus a Pareto-superior equilibrium of the continuation game than acceptance. This implies that in any PCPNE involving exclusion, $V* \geq V$. Since the joint surplus of Firm 1 and consumers is $2(\hat{\pi}_1 + U_1)$, Firm 1's profit is at most equal to $2(\hat{\pi}_1 + U_1 - V)$. For exclusion to be an equilibrium outcome, it must then be the case that $2(\hat{\pi}_1 + U_1 - V) \geq 2\pi_1$, or equivalently $\hat{\pi}_1 + U_1 \geq \pi_1 + V$ Otherwise, Firm 1 could increase its profit to $2\pi_1$ by offering no contract at all.

We show now that the converse is true: if $\hat{\pi}_1 + U_1 > \pi_1 + V$, then exclusion must occur in equilibrium. Under no exclusion, Firm 1's profit is π_1. But Firm 1 could earn greater profits by offering the following contract: offer each consumer an exclusive contract against a lump-sum transfer equal to $V - U_1 + \varepsilon$, with $\varepsilon > 0$. Clearly, accepting such a contract increases each consumer's utility level by ε (if acceptance is pivotal in deterring Firm 2's entry) or by $V - U_1 + \varepsilon$ (if acceptance is not pivotal). Accepting this contract is thus a dominant strategy, and this contract is accepted by both consumers in equilibrium. Firm 1's profit is equal to $\hat{\pi}_1 - (V - U_1) - \varepsilon$, which is strictly greater than π_1 if ε is small enough. Offering an exclusive contract which will be accepted by consumers is thus a dominant strategy for Firm 1. QED.

Proof of Proposition 2

First step: if $U_1 + 2\hat{\pi}_1 > V + 2\pi_1$, then exclusion occurs in all PCPNE. We assume that $U_1 + 2\hat{\pi}_1 > V + 2\pi_1$. In a hypothetical no-exclusion equilibrium, Firm 1's profit would be $2\pi_1$. Now consider the following strategy for Firm 1: offer consumer a an exclusive contract against a payment equal to $V - U_1 + \varepsilon$, where ε is strictly positive and small, and no contract to consumer b. If consumer a accepts this offer, Firm 2 is deterred from entering and consumer a's surplus is thus $U_1 + (V - U_1 + \varepsilon) = V + \varepsilon$, which is greater than the utility level V it would earn if it rejected the offer, triggering Firm 2's entry. But then, Firm 1's profit will be $2\hat{\pi}_1 - (V - U_1 + \varepsilon)$, which is strictly greater than $2\pi_1$ if ε is small enough. Therefore, offering an exclusive contract which is taken up by consumer a allows Firm 1 to increase its profit with respect to a hypothetical equilibrium in which Firm 2 is not excluded. This implies that exclusion occurs in equilibrium. More precisely, one can check that the only PCPNE of this game is such that Firm 1 offers one consumer an exclusive contract against a payment equal to $V - U_1$, which that consumer accepts, thus deterring Firm 2 from entering.

Second step: if $U_1 + 2\hat{\pi}_1 < V + 2\pi_1$, then exclusion does not occur in any PCPNE. We assume that $U_1 + 2\hat{\pi}_1 < V + 2\pi_1$. By offering no exclusive contract, Firm 1 can obtain a profit equal to $2\pi_1$. We consider now a hypothetical PCPNE involving Firm 2's exclusion. First, we claim that in any such PCPNE, at least one consumer's utility level is no smaller than V, and that each consumer's utility level is above U_1. By signing no contract at all, any consumer is certain to be served at least by Firm 1, which yields a surplus equal to U_1. This implies that each consumer's surplus is greater than or equal to U_1. Then, assume that both consumers' equilibrium utility levels are below V. This means that each exclusive contract taken up in equilibrium involves a lump-sum payment strictly smaller than $V - U_1$. But this implies the existence of an equilibrium of the subgame starting in Period 2 (when consumers decide whether they will sign contracts) in which no consumer signs a contract, yielding each consumer a utility level of V (because Firm 2 enters if no consumer signs an exclusive contract with Firm 1). This equilibrium of the continuation subgame starting in Period 2 yields both consumers a strictly greater utility than the hypothetical equilibrium, which is therefore not a PCPNE. Second, the fact that in any PCPNE involving exclusion, one consumer's utility level is greater than or equal to V, while the other consumer's utility level is greater than or equal to U_1 implies that in such an equilibrium, Firm 1's profit is no greater than $2(U_1 + \hat{\pi}_1) - V - U_1$, which is smaller than $2\pi_1$ by assumption. Therefore, Firm 1 could increase its profit by offering no contract at all and earning $2\pi_1$, so that exclusion does not occur in a

PCPNE. QED.

Proof of Proposition 3. First, notice that in any equilibrium with exclusion, each consumer gets a utility level of at least U_1 and at least one of them gets a utility level greater than or equal to V (the proof of this claim is the same as in the proof of Proposition 2). This implies that the maximum profit which Firm 1 can earn by excluding Firm 2 is $2\hat{\pi}_1 - (V - U_1)$. We now show that the maximum profit which Firm 1 can earn in an equilibrium in which Firm 2 is not excluded is equal to $2\pi_1 + 2\pi_2$. In a no-exclusion equilibrium, no consumer signs a contract, so that each consumer's utility level is equal to V. Since Firm 2's equilibrium profit must be nonnegative (otherwise it could do better by deciding to serve no consumer), this implies that Firm 1's profit is smaller than or equal to $2\pi_1 + 2\pi_2$. What remains to be shown is that Firm 1 can offer a contract such that the only PCPNE of the continuation game yields it a profit arbitrarily close to $2\pi_1 + 2\pi_2$. Consider the following strategy: Firm 1 offers consumer a an exclusive contract, together with a lump-sum payment of $V - U_1$ and a breach penalty equal to $2\pi_2 + V - U_1 - \varepsilon$ (with ε very small). If consumer a accepts such a contract, Firm 2 will be ready to him to breach it against a payment comprised between $2\pi_2 - \varepsilon$ and $2\pi_2$, and consumer a will be better off accepting such an offer. Its utility would then be greater than $V + (V - U_1) - (2\pi_2 + V - U_1 - \varepsilon) + (2\pi_2 - \varepsilon) = V$, so that consumer a is better off accepting Firm 1's offer than rejecting it. This proves that Firm 1 can offer a contract inducing Firm 2 to enter and yielding Firm 1 a profit arbitrarily close to $2\pi_1 + 2\pi_2$. As a consequence, if $2\pi_1 + 2\pi_2 > 2\hat{\pi}_1 - (V - U_1)$, then Firm 1's optimal strategy is to offer an exclusive contract together with a breach penalty clause which will induce Firm 2 to enter. In this case, one can easily check that the only PCPNE is such that Firm 1 offers consumer a (or b)an exclusive contract together with a lump-sum payment of $V - U_1$ and a breach penalty equal to $2\pi_2 + V - U_1$, and that Firm 2 enters and offers this consumer to breach the exclusive contract against a payment of $2\pi_2$. Conversely, if $2\pi_1 + 2\pi_2 < 2\hat{\pi}_1 - (V - U_1)$, then Firm 1's optimal strategy is to offer an exclusive contract with no provision for breach (or with prohibitively high breach penalties). QED.

Proof of Proposition 4. Consider the following offer by Firm 1 in Stage 1: Firm 1 offers consumer a an exclusive contract together with a lump-sum payment of $V - U_1 + \varepsilon$ and a breach penalty equal to $2\pi_2 + 2(V - U_1) - \varepsilon$ (with ε very small). Consumer a obviously takes up this contract in Stage

2, since it ensures him a utility level equal to at least $V + \varepsilon$ (in case he decides not to breach it so that its surplus from the relationship with Firm 1 will be U_1). Then, consider Stage 3. Firm 2 cannot induce consumer a to breach the contract by making an unconditional offer. Indeed, Firm 2 is willing to give up at most the entirety of its foreseeable profit, or $2\pi_2$. But if consumer a breaches the exclusive contract against a payment of $2\pi_2$, this results into (i) a gain of $V - U_1$ due to the shift from being served by Firm 1 alone to being served by both firms, (ii) a gain of $2\pi_2$ (Firm 2's bribe for breaching the contract), and (iii) the breach penalty $2\pi_2 + 2(V - U_1) - \varepsilon$, leading to a loss of $(V - U_1) - \varepsilon$. However, Firm 2 can induce consumer a to breach the exclusive contract by simultaneously (i) offering consumer a to breach the contract against a payment $2\pi_2 + (V - U_1) - \eta$ (with $0<\eta < \varepsilon$); (ii) requiring consumer b to pay $V - U_1 - \varepsilon'$ with $\varepsilon' < \eta$; and (iii) stating that the offer to consumer a is conditional on consumer b accepting to make this payment. Clearly, in any PCPNE of the continuation game starting in Stage 4, both consumers decide to accept these offers. Consumer a risks nothing: if consumer b does not accept, then accepting has no consequence for consumer a, who remains bound by its exclusive contract with Firm 1. On the other hand, if consumer b accepts, consumer a ends up with a welfare level equal to $V+\varepsilon + (\varepsilon - \eta)$, which is greater than $V+\varepsilon$ which it would earn if it did not accept Firm 2's offer. Regarding consumer b's incentive to accept Firm 2's requirement for a payment of $V - U_1 - \varepsilon'$, notice that if consumer a takes up Firm 2's conditional offer, then (i) if consumer b rejects Firm 2's requirement, consumer a will remain bound by the exclusive contract signed with Firm 1 (by virtue of the conditional nature of Firm 2's offer), so that Firm 2 will decide to serve no consumer in Stage 6, and consumer b will be subjected to Firm 1's monopoly power and have a welfare level equal to U_1. On the other hand, if consumer b accepts Firm 2's requirement, consumer a will be released from the exclusive contract signed with Firm 1, Firm 2 will thus decide to serve both consumers, and consumer b will enjoy a utility level equal to V-$(V - U_1 - \varepsilon') = U_1 + \varepsilon'$. Thus, both consumers have an interest in accepting Firm 2's offer, inducing Firm 2 to serve both consumers. Firm 2's profit is in turn equal to the profit it would normally earn when serving both consumers, minus its "bribe" to release consumer a from his exclusive contract, plus the payment made by consumer b, i.e. $2\pi_2 - [2\pi_2 + (V - U_1) - \eta] + [V - U_1 - \varepsilon'] = \eta - \varepsilon' > 0$. Thus, faced with the aforementioned contract offered by Firm 1 in Stage 1, consumer a has an incentive to take it up, and Firm 2 can make a positive profit by offering to bribe consumer a into breaching the exclusive contract conditionally on consumer b making a payment to Firm 2. Therefore, in any PCPNE of the continuation game starting in Stage 2, the breach penalty is paid to Firm 1, which thus earns its "duopoly profit" $2\pi_1$ minus the lump-sum transfer $(V - U_1 + \varepsilon)$ paid to consumer a upon signing the exclusive contract, plus the breach penalty $2\pi_2 + 2(V - U_1) - \varepsilon$, or in total $2\pi_1 + 2\pi_2 + (V - U_1) - 2\varepsilon$. Therefore, Firm 1 can earn a profit arbitrarily close to $[2\pi_1 + 2\pi_2 + (V - U_1)]$ while inducing Firm 2 to serve both consumers.

In contrast, the maximum profit which Firm 1 can earn while excluding Firm 2 is $2\hat{\pi}_1 + U_1 - V$, because in any equilibrium with exclusion, each consumer gets a utility level of at least U_1 and at least one of them gets a utility level greater than or equal to V (the proof of this claim is the same as in the proof of Proposition 2). Assumption (3), stating that exclusion is socially inefficient, is equivalent to $2\pi_1 + 2\pi_2 + (V - U_1) > 2\hat{\pi}_1 + V - U_1$, implying that Firm 1's profit-maximizing strategy in Stage 1 involves offering a contract such as the one described above, leading to no exclusion. Therefore, no PCPNE involves exclusion in equilibrium. Finally, one can easily check that the strategies described above, with $\eta = \varepsilon = \varepsilon' = 0$, define a PCPNE. QED.

Proof of Proposition 5.

Step 1. There exists a subgame perfect equilibrium such that (i) the corresponding equilibrium of the subgame starting in period 2 is coalition-proof, (ii) Firm i (for $i = 1$ and $i = 2$) offers both consumers an exclusive contract with a lump-sum transfer $t_{ei} = \hat{\pi}_i - \pi_i + Max[0, (\hat{\pi}_j + U_j) - (\pi_j + V)]$ and a non-exclusive contract with a lump-sum transfer of $t_{ni} = Max[0, (\hat{\pi}_j + U_j) - (\pi_j + V)]$ (with the notation $\{i; j\} = \{1; 2\}$); and (iii) consumers choose to accept both firms' non-exclusive offers. First, these transfers are such that each consumer is better off accepting both non-exclusive offers (which yields a payoff $V + t_{n1} + t_{n2}$) than accepting Firm i's exclusive offer (which yields a payoff $U_i + t_{ei}$), while being indifferent between these two options if $t_{nj} > 0$. Accepting both firms' non-exclusive offers is thus a weakly dominant strategy and thus defines a PCPNE of the continuation game. Second, consider firms' actions in period 1. If the contracts offered by Firm j are as described above, the cheapest way for Firm i to induce a consumer to be served by both firms in equilibrium involves offering a non-exclusive contract with the smallest positive lump-sum transfer required to make the consumer indifferent between accepting both firms' non-exclusive contracts and accepting Firm j's exclusive contract. This minimal lump-sum transfer is equal to $Max\,[0; U_j + t_{ej} - V - t_{nj}] = Max[0,(ƀ_j + U_j) - (\pi_j + V)] = t_{ni}$. Similarly, the cheapest way for Firm i to induce a consumer to purchase from Firm i only in equilibrium involves offering an exclusive contract with the smallest positive lump-sum transfer required to make the consumer indifferent between accepting Firm i's exclusive contract, and either of the two contracts offered by Firm j. This minimal lump-sum transfer is equal to $Max\,[0; U_j + t_{ej} - U_i; V + t_{nj} - U_i] = Max[0; ƀ_j - \pi_j + Max[0, (ƀ_i + U_i) - (\pi_i + V)]; (ƀ_j + U_j) - (\pi_j + V)] \geq t_{ei}$. But, since $ƀ_i - t_{ei} = \pi_i - t_{ni}$, Firm i's maximal profit, given Firm j's offers, can be obtained by offering a non-exclusive contract with a lump-sum payment equal to t_{ni}. Firm i's best response to Firm j's actions is thus such that Firm i offers a non-exclusive contract with a lump-sum payment of t_{ni}, and an exclusive contract with a lump-sum payment smaller than or equal to $Max\,[0; U_j + t_{ej} - U_i; V + t_{nj} - U_i]$. Offering a non-exclusive contract with a lump-sum payment of t_{ni}, and an exclusive contract with a lump-sum payment of t_{ei} is thus a best response to Firm j's actions. This proves that the actions described above define a subgame-perfect equilibrium. This also proves that there exists a PCPNE involving no exclusion, and that in this PCPNE, Firm i's profit is greater than or equal to $2\,(Min[\pi_i, (\pi_1 + \pi_2 + V) - (ƀ_j + U_j)])$. Indeed, in any hypothetical exclusionary subgame perfect equilibrium, one of the firms earns zero, and is thus worse off than in the non-exclusionary equilibrium described above, which implies that there exists at least one non-exclusionary PCPNE. Finally we show that the equilibrium described above is a PCPNE. This is equivalent to showing that there exists no subgame-perfect equilibrium which is a PCPNE of the continuation game starting in period 2 and such that (i) each consumer is served by both firms and (ii) for one firm at least, say firm i, the equilibrium profit is strictly greater than $2\,(Min[\pi_i, (\pi_1 + \pi_2 + V) - (ƀ_j + U_j)])$. Assume first that $(ƀ_j + U_j) \leq (\pi_j + V)$ and that Firm i's equilibrium profit is greater than $2\pi_i$. This means that one of the consumers signs a non-exclusive contract with Firm i involving a strictly positive payment to Firm i, which is impossible since this strategy would be dominated by not signing any contract with Firm i. Assume now that $(ƀ_j + U_j) > (\pi_j + V)$ and that Firm i's equilibrium profit is strictly greater than $2[(\pi_1 + \pi_2 + V) - (ƀ_j + U_j)]$. This means that at least one consumer receives a lump-sum payment from Firm 1 which is strictly lower than $(ƀ_j + U_j) - (\pi_j + V)$. But if this is the case, then this implies that, faced with Firm i's equilibrium non-exclusive offer and a hypothetical exclusive offer proposed by Firm j together with a lump-sum transfer equal to $ƀ_j - \pi_j - \varepsilon$ for small enough ε, this consumer would choose the latter. This implies that, by offering such an exclusive contract, Firm j could increase its profit by at least ε (the reason for this is that in equilibrium the non-exclusive contracts picked by consumers necessarily involve nonnegative transfers from firms to consumers). This contradicts the assumption that both consumers are served by both firms in equilibrium.

Step 2. We assume now that there exists a PCPNE in which one of the consumers (at least) is served by only one firm. Let t_{ei} and t_{ni} denote respectively Firm i's lump-sum transfer associated with the best (from consumers' viewpoint) exclusive and a non-exclusive contract it offers (offering no contract can be interpreted as offering a transfer equal to minus infinity, which will be rejected by consumers in any subgame perfect equilibrium of the continuation game). Assume that consumer a, is served by one firm only, say Firm i. Since both consumers are offered the same contracts, they both get the same utility level U^*. But $U^* \geq Max(V + \pi_j, U_j + ƀ_j)$, because otherwise Firm j would have an interest in offering to each consumer it does not serve in the hypothetical equilibrium a non-exclusive contract together with a lump-sum payment equal to $\pi_j - \varepsilon$, as well as an exclusive contract together with a lump-sum payment equal to $ƀ_j - \varepsilon$, with $\varepsilon > 0$ being very small. Such a contract would be picked by any consumer being offered it (because it would yield a payoff greater than U^*), and this would increase Firm j's profit. Since both consumers are offered the same contracts, Firm i's profit is the same as the one it would earn if both consumers were picking an exclusive contract it offers (otherwise, this means that Firm i could increase its profit by offering only an exclusive contract to both consumers, or only a non-exclusive contract to both consumers). Firm i's equilibrium profit is thus equal to $2(ƀ_i + U_i - U^*) \leq 2Min(ƀ_i + U_i - V - \pi_j, ƀ_i + U_i - U_j - ƀ_j) \leq 2Min(\pi_i, (\pi_1 + \pi_2 + V) - (ƀ_j + U_j))$, which is smaller than or equal to Firm i's profit in some non-exclusionary PCPNE, as shown in Step 1. This implies that the hypothetical exclusive PCPNE is Pareto-dominated, from the point of view of firms, by some non-exclusive PCPNE. This implies that all PCPNE are non-exclusive.

Proof of Proposition 6.

First, it can easily be checked that the PCPNE described in Step 1 of the proof of Proposition 5 is still a PCPNE when discriminatory offers are allowed.

Second, we show that in any PCPNE, Firm 1 serves both consumers. Assume that there exists an equilibrium in which one consumer at least, say consumer a, is not served by Firm 1. This means that in equilibrium consumer a signs an exclusive contract with Firm 2, against some lump-sum payment t_{e2}. But the inequality $U_2 + t_{e2}^a \geq Max[ƀ_1 + U_1; \pi_1 + V]$ must hold, because otherwise Firm 1 could increase its profit by offering consumer a an exclusive contract against a lump-sum transfer equal to $U_2 + t_{e2}^a - U_1 + \varepsilon$ and a non-exclusive contract against a lump-sum transfer equal to $U_2 + t_{e2}^a - V + \varepsilon$, which would be chosen by consumer a while yielding Firm 1 a strictly positive profit if ε is small enough. In equilibrium, Firm 2 necessarily serves consumer b (this is because Firm 2 loses money when serving one consumer only, so that if it serves consumer a it must also serve consumer b). Let us define π_{2b}=$\pi_2 - t_b^2$ if in equilibrium consumer b is served by both firms and Firm 2 pays consumer b a lump-sum transfer t_b^2, and π_{2b}=$ƀ_2 - t_b^2$ if in equilibrium consumer b is served by Firm 2 only and Firm 2 pays consumer b a lump-sum transfer t_b^2. The inequality $U_2 + t_{e2}^a \geq Max[ƀ_1 + U_1; \pi_1 + V]$ implies that Firm 2's equilibrium profit is smaller than $\pi_{2b} + ƀ_2 + U_2 - Max[ƀ_1 + U_1; \pi_1 + V]$. But, as proved above, there also exists an equilibrium which is a PCPNE of the subgame starting in Period 2, such that in period 1 Firm i (for $i = 1$ and $i = 2$) offers consumer a an exclusive contract with a lump-sum transfer $t'_{ei} = ƀ_i - \pi_i + Max[0,(ƀ_j + U_j) - (\pi_j + V)]$ and a non-exclusive contract with a lump-sum transfer of $t'_{ni} = Max[0,(ƀ_j + U_j) - (\pi_j + V)]$ (with the notation $\{i; j\} = \{1; 2\}$); and (iii) consumer a chooses to accept both firms' non-exclusive offers. If both firms changed their offers to consumer a accordingly (while leaving unchanged their offers to consumer b), the outcome would still be an equilibrium, Firm 1's profit would increase by $Min[\pi_1, (\pi_1 + \pi_2 + V) - (ƀ_2 + U_2)]$ and Firm 2's profit would increase by at least $(\pi_1 + \pi_2 + V) - (ƀ_2 + U_2)$. This means that the equilibrium originally considered is not a PCPNE.

Third, in order to prove that there exists a PCPNE in which Firm 2 is excluded if and only if $2ƀ_1 + U_1 > 2\pi_1 + 2\pi_2 + V$, we distinguish two cases.

First case: $ƀ_2 + U_2 < \pi_2 + V$. Step 1. Assume that $2ƀ_1 + U_1 > 2\pi_1 + 2\pi_2 + V$. We show that there exists an equilibrium in which Firm 1 offers consumer a an exclusive contract together with a lump-sum payment equal to $2\pi_2 + V - U_1$, Firm 2 offers consumer a a non-exclusive contract together with a lump-sum payment equal to $2\pi_2$, and consumer a chooses to accept Firm 1's exclusive contract. Clearly, consumer a is indifferent between both contracts and accepting either makes him better off than accepting none. Firm 1 cannot offer less in an exclusive contract (this would cause consumer

a to accept Firm 2's non-exclusive contract and cause Firm 1's profit to fall from $2\widehat{\pi}_1 + U_1 - 2\pi_2 - V$ to $2\pi_1$), and Firm 2 cannot avoid being excluded (offering a more generous non-exclusive contract would cause losses, and the inequality $\widehat{\pi}_2 + U_2 < \pi_2 + V$ implies that providing consumer a with a given utility level is more expensive for Firm 2 using an exclusive than a non-exclusive contract). This proves that the aforementioned actions define an equilibrium, which is also a PCPNE of the subgame starting in period 2 (this is because consumer a is the only agent making a decision in period 2). Finally, Firm 1's profit in this equilibrium, at $2\widehat{\pi}_1 + U_1 - 2\pi_2 - V$, is greater than its level in the only non-exclusive PCPNE (where it is equal to $2\pi_1$ if $\widehat{\pi}_2 + U_2 < \pi_2 + V$). Also, this equilibrium is a PCPNE because Firm 2 would earn zero profit in the out-of-equilibrium event in which consumer a would choose to accept its contract rather than Firm 1's exclusive one. Step 2. We now prove the converse and consider a PCPNE in which Firm 2 is excluded. Two cases can arise, depending on whether one or two consumers sign an exclusive contract with Firm 1 in equilibrium. If two consumers do, let t_{e1}^k ($k = a, b$) denote the equilibrium lump-sum transfer paid by Firm 1 to consumer k. If $t_{e1}^a + t_{e1}^b < 2\pi_2 + 2V - 2U_1$, then Firm 2 can profitably avoid exclusion by offering consumer k a non-exclusive contract together with a lump-sum transfer equal to $t_{e1}^k - V + U_1 + \varepsilon$, with ε small enough. Thus $t_{e1}^a + t_{e1}^b \geq 2\pi_2 + 2V - 2U_1$, implying that Firm 1's profit is smaller than or equal to $2\widehat{\pi}_1 - 2\pi_2 - 2V + 2U_1$, which is strictly smaller than $2\pi_1$ by (3). If only one consumer, say consumer a, signs an exclusive contract with Firm 1 in equilibrium, against a lump-sum transfer t_{e1}^a, then necessarily $t_{e1}^a \geq 2\pi_2 + V - U_1$, because otherwise Firm 2 could profitably avoid exclusion by offering consumer a a non-exclusive contract together with a lump-sum transfer equal to $t_{e1}^k - V + U_1 + \varepsilon$, with ε small enough. Firm 1's profit is thus smaller than or equal to $2\widehat{\pi}_1 - 2\pi_2 - V + U_1$. the fact that the equilibrium considered is a PCPNE implies that Firm 1's equilibrium profit is strictly greater than Firm 1's profit in the only non-exclusionary PCPNE, i.e. greater than $2\pi_1$, which implies that $2\widehat{\pi}_1 - 2\pi_2 - V + U_1 > 2\pi_1$, or equivalently $2\widehat{\pi}_1 + U_1 > 2\pi_1 + 2\pi_2 + V$.

Second case: $\widehat{\pi}_2 + U_2 > \pi_2 + V$. Step 1. Assume that $2\widehat{\pi}_1 + U_1 > 2\pi_1 + 2\pi_2 + V$. We show that there exists a PCPNE in which Firm 1 offers consumer a an exclusive contract together with a lump-sum payment equal to $2(\widehat{\pi}_2 + U_2) - (V + U_1)$, Firm 2 offers consumer a an exclusive contract together with a lump-sum payment equal to $2\widehat{\pi}_2 + U_2 - V$, and in equilibrium consumer a chooses to accept Firm 1's exclusive contract. In order to prove that Firm 2's strategy is a best response, notice that in order to avoid exclusion at lowest possible cost, Firm 2 has to offer consumer a an exclusive contract (this is because the inequality $ƀ_2 + U_2 > \pi_2 + V$ implies that exclusion is jointly optimal for the Firm 2 - consumer a pair) together with a transfer yielding consumer a at least the same utility as it would get by accepting Firm 1's offer, i.e., a transfer equal to $2ƀ_2 + U_2 - V$. But in any subgame-perfect equilibrium such that consumer a signs a contract with Firm 2, consumer b knows that it can get a utility of at least V simply by signing no contract. Thus, the maximum profit Firm 2 can derive from serving consumer b is $ƀ_2 + U_2 - V$, obtained by offering consumer b an exclusive contract against a transfer of $V - U_2$, leaving consumer b with a utility level of at least V. Thus, given Firm 1's offer, Firm 2 cannot obtain a profit greater than $2ƀ_2 - (2ƀ_2 + U_2 - V) + U_2 - V$=0. Firm 2's strategy is thus a best response. Conversely, Firm 1's strategy is a best response to Firm 2's, because the transfer offered to consumer a is the smallest leading consumer a not to choose to accept Firm 2's offer, and Firm 1's ensuing profit is greater than the profit level π_1 which it would earn if it offered no contract at all (or no contract which consumer a would prefer over Firm 2's offer). Finally, in order to prove that these strategies form a PCPNE, it is enough to check that Firm 1's profit is greater than that it would earn in the only non-exclusive PCPNE, i.e. that $2ƀ_1 - [2(ƀ_2 + U_2) - (V + U_1)] > 2\pi_1 - 2[(ƀ_2 + U_2) - (\pi_2 + V)]$, which is equivalent to the assumed inequality, i.e. $2ƀ_1 + U_1 > 2\pi_1 + 2\pi_2 + V$.

Step 2. Conversely, we prove that if Firm 2 is excluded in a PCPNE, then $2ƀ_1 + U_1 > 2\pi_1 + 2\pi_2 + V$. Two cases can arise, depending on whether one or two consumers sign an exclusive contract with Firm 1 in equilibrium. If two consumers do, let t^k_{e1} $(k = a, b)$ denote the equilibrium lump-sum transfer paid by Firm 1 to consumer k. If $t^a_{e1} + t^b_{e1} < 2ƀ_2 + 2U_2 - 2U_1$, then Firm 2 can profitably avoid exclusion by offering consumer k an exclusive contract together with a lump-sum transfer equal to $t^k_{e1} - U_2 + U_1 + \varepsilon$, with ε small enough. Thus $t^a_{e1} + t^b_{e1} \geq 2\pi_2 + 2U_2 - 2U_1$, implying that Firm 1's profit is smaller than or equal to $2(ƀ_1 - ƀ_2 - U_2 + U_1)$, which is strictly smaller than $2[\pi_1 - (ƀ_2 + U_2) + (\pi_2 + V)]$ by (3). Since the right-hand side of this inequality is equal to Firm 1's profit in the non-exclusive PCPNE, it follows that there is no exclusive PCPNE in which both consumers sign an exclusive contract. If only one consumer, say consumer a, signs an exclusive contract with Firm 1 in equilibrium, against a lump-sum transfer t^a_{e1}, then necessarily $t^a_{e1} \geq 2(ƀ_2 + U_2) - (V + U_1)$, because otherwise Firm 2 could profitably avoid exclusion by offering consumer a an exclusive contract together with a lump-sum transfer equal to $t^k_{e1} - U_2 + U_1 + \varepsilon$, and consumer b an exclusive contract together with a lump-sum transfer equal to $V - U_2 + \varepsilon$, with ε small enough. Firm 1's profit is thus smaller than or equal to $2\widehat{\pi}_1 - [2(\widehat{\pi}_2 + U_2) - (V + U_1)]$. The fact that the equilibrium considered is a PCPNE implies that Firm 1's equilibrium profit is strictly greater than Firm 1's profit in the only non-exclusionary PCPNE, i.e. greater than $2\pi_1 - 2[(\widehat{\pi}_2 + U_2) - (\pi_2 + V)]$, which implies that $2\widehat{\pi}_1 + U_1 > 2\pi_1 + 2\pi_2 + V$.