

# Predatory Exclusive Dealing\*

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## Abstract

While the previous literature on exclusive dealing has been concerned with the question of how exclusive dealing can raise static profits, this paper analyzes the question of how exclusive dealing can be used to predate in a dynamic context. It is shown that exclusive dealing may arise even if it reduces static profits. Exclusivity provisions may not only allow excluding efficient competitors, but indeed are often a cheaper exclusionary tool than predatory pricing. This is the case either if the prey's access to finance is not too limited, or if the predator has sufficiently strong market power vis-à-vis the prey.

**JEL classification:** K21, L11, L12, L41, L42

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# 1 Introduction

The Chicago School's critique of antitrust action against exclusive dealing is based on the argument that, under the assumptions of those models, exclusive dealing is not profitable for firms in the absence of efficiencies like the protection of prior investments (see, for instance, Bork, 1978). From this it was concluded that exclusive dealing must be beneficial for welfare because it is only profitable for firms if there is an efficiency rationale.<sup>1</sup>

The subsequent literature has shown, however, that exclusive dealing may be anticompetitive if the implicit assumptions of the Chicago School are relaxed. Much of this literature has focused on the exclusion of potential entrants. Exclusive dealing is often profitable in this case because potential entrants are assumed not to be in the position of making counteroffers at the time the exclusive contract is accepted (they are not in the market yet). Under certain circumstances incumbents may therefore exploit contracting externalities to prevent entry (see Aghion and Bolton, 1987, Rasmussen et al., 1991, Innes and Sexton, 1994, Segal and Whinston, 2000b, Fumagalli and Motta, 2006, Simpson and Wickelgren, 2007, and Abito and Wright, 2008). The identified circumstances under which exclusive dealing can anticompetitively exclude rival incumbents are more restricted (see Mathewson and Winter, 1987, O'Brien and Shaffer, 1997, and, in particular, Bernheim and Whinston, 1998).<sup>2</sup>

What is common in all of the above models is that product market competition takes place in a one-period game. The economic literature has therefore been concerned with the question of under which circumstances exclusive dealing may increase the static profits of a firm. Many recent antitrust procedures against exclusive dealing, however, have been concerned with another poten-

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<sup>1</sup>See Marvel (1982), Segal and Whinston (2000a), and De Meza and Selvaggi (2009) for efficiency justifications of exclusive dealing.

<sup>2</sup>Spector (2007) provides a synthesis of the different strands of the literature.

tial motivation to engage in exclusionary conduct: predatory exclusion of active rivals. Strong incumbent companies are sometimes accused of accepting lower profits in one period to exclude an incumbent competitor and recouping those losses in subsequent periods where monopoly rents can be earned.<sup>3</sup>

Indeed, U.S. antitrust enforcement currently seems to consider only this second type of exclusive dealing as anticompetitive while typically not intervening against exclusive dealing of the sort discussed in the literature (which raises, rather than reduces current profits). One test that is considered in the U.S. is the profit-sacrifice or no-economic-sense test (see Salop, 2006). This test checks whether an exclusive contract was consistent with (static) profit maximization. If it is found that profits were sacrificed (and hence exclusive dealing made no economic sense from a static perspective), exclusive dealing is prohibited because it must have been predatory. If no profits were sacrificed, exclusive dealing may be allowed, in line with the Chicago School argument.<sup>4</sup>

To our knowledge, predatory exclusive dealing has so far not been analyzed formally in the economic literature. This paper tries to fill this gap by investigating the ability of firms to use exclusive dealing in order to predate. Our model of predation loosely follows Bolton and Scharfstein (1990), who first formalized the long-purse story of predation, according to which agency problems in financial contracting may allow predatory pricing to exclude rivals.<sup>5</sup> By allowing for exclusivity clauses in a model of predation, we show that exclusive dealing may arise in equilibrium even in circumstances where it cannot be profitable for a one-period profit

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<sup>3</sup>For a discussion of cases where exclusionary practices have been used by incumbents against rivals see for instance Spector (2007).

<sup>4</sup>See Patterson (2003) for a discussion of antitrust cases where the profit-sacrifice test was applied.

<sup>5</sup>In some sense, our paper takes the opposite perspective of Bolton and Scharfstein (1990). While their paper is detailed in its modeling of the financial market, it is crude in the way it treats the product market. In particular, the price formation on the product market is not derived endogenously from a model of competition. Our paper, on the other hand, is detailed in the modeling of the product market while being crude in the treatment of the financial market. In particular, the financing constraints from the financial market are not derived endogenously from a model of asymmetric information, but are assumed to be exogenous.

maximization strategy.

Predatory exclusive dealing may not only be a possible strategy for dominant incumbents to exclude rivals; indeed, it is often a cheaper way of predating than predatory pricing. As shown below, this is the case if the prey's access to capital is not too limited, making ordinary price predation expensive. It also turns out that, the more market power the predator has with respect to the prey, the more likely it is that exclusive dealing is preferable for the predator compared to predatory pricing.

Besides predatory pricing, other strategies of exclusion in a dynamic setup have been considered in the literature, under which firms trade off lower current profits for larger future profits. Carlton and Waldman (2002) describe how bundling can be used in a predatory way in evolving network industries. Ordoover and Shaffer (2007) show that rebate schemes can be used to exclude rival incumbents.

The paper is organized as follows. Section 2 sets up the model. Section 3 characterizes the equilibria of a static game of exclusion, while Section 4 analyzes the equilibria of a dynamic game and presents the main results of the paper. Section 5 extends the model to a situation where firms can offer non-linear pricing schemes and Section 6 concludes.

## **2 The model**

The model combines the intuitions of Bolton and Scharfstein (1990) and Bernheim and Whinston (1998). Bolton and Scharfstein analyze a dynamic game of price competition in which exit may occur, but do not allow for exclusive dealing clauses. Bernheim and Whinston (1998), on the other hand, allow for exclusivity provisions, but consider only a static pricing game.

In our model, there are two upstream firms 1 and 2, each with fixed costs  $F$  and marginal cost  $c$ , who compete in two periods  $\tau = 1, 2$ . In each period, firms first simultaneously announce whether they insist on exclusivity or not, as in Mathewson and Winter (1987). Afterwards they simultaneously set prices  $p_1$  and  $p_2$ .<sup>6</sup>

The products are purchased by a large number of identical downstream buyers who have preferences over the two goods which are given by Hotelling demand functions. Specifically, each purchaser wants to buy a fixed number of units in each period (normalized to 1) which he splits between firm 1 and firm 2. Each (marginal) unit  $x \in [0, 1]$  gives purchasers utility  $u_1 - tx$  if bought from firm 1 and utility  $u_2 - t(1 - x)$  if bought from firm 2, where  $t$  as usual denotes the degree of product differentiation between goods 1 and 2.<sup>7</sup> As  $u_1$  and  $u_2$  may differ, we allow for vertical product differentiation in addition to the horizontal differentiation already inherent in the Hotelling model. Without loss of generality, let  $u_1 \geq u_2$  and denote  $\Delta u := u_1 - u_2 \geq 0$  as the *degree of dominance* of firm 1.<sup>8,9</sup> As usual in the Hotelling model, we will assume that  $u_i$  and  $u_2$  are sufficiently large to ensure full market market coverage in equilibrium (specifically,  $u_i \geq c + 2t$  for  $i = 1, 2$ ). Moreover, let  $\Delta u < t$ , which implies that it is socially efficient that at least some units of firm 2 are sold (if it is active).

The timing of the dynamic game is as follows. The game starts when both firms have sunk their fixed costs in period 1. Firms then play the stage game described above, consumers make

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<sup>6</sup>In order to allow for the possibility of exclusion, we assume that firms cannot offer long term contracts but set prices in each period, as is common in models of predation. Note that firms' pricing strategies are restricted to linear schemes in this section. In Section 5, we extend the analysis to non-linear pricing (two-part tariffs).

<sup>7</sup>Note the relation of this model to the standard Hotelling model. While in the latter there is a continuum of heterogenous consumers with unit demand, here purchasers are identical but have demand functions that are identical to aggregate Hotelling demand. One possible interpretation of our model is that purchasers are perfectly discriminating retail monopolists whose *customers* have Hotelling preferences over firms 1 and 2.

<sup>8</sup>The legal definition of dominance has typically been interpreted by economists as being equivalent to a high degree of market power or a low elasticity of demand. In our model  $\Delta u$  is indeed positively related to firm 1's profits and negatively related to its elasticity of demand.

<sup>9</sup>It would also be possible to introduce differentiated marginal cost parameters. However, this affects possible equilibria in the same way as differentiated utility parameters. In order to save on notation, we therefore omit this type of differentiation. The results can be easily reinterpreted to account for cost differentials.

their orders and first period profits are realized. If the firms expect non-negative profits in period 2 and have sufficient funds to finance their ongoing operation, they remain in the market, and the stage game is repeated in the second period. If one firm exits the market after period 1 (a possibility that will be specified further below), this firm will not have to incur fixed costs for period 2, and the other firm will be able to charge monopoly prices. Second period profits are discounted by some common discount factor  $\delta$ , which we normalize to 1 for convenience.

In line with Bolton and Scharfstein (1990), let one firm be the predator with sufficient access to capital and the other firm be the prey, which is financially constrained. Due to the assumption that  $u_1 \geq u_2$ , firm 1 is the stronger firm in terms of market share in a standard one-period Hotelling game. It therefore makes sense to let firm 1 (the "dominant" firm) be the predator and firm 2 the prey.<sup>10</sup> We will assume that firm 2 does not obtain continued financing by its investors if its profit  $\pi_2$  falls below some threshold  $\bar{\pi}_2$  in the first period stage game. For instance, this constraint could represent Bolton and Scharfstein's (1990) argument that the weaker firm's financiers face a problem of asymmetric information. If first period profits turn out to be low, this may either reflect the fact that firm 2 is falling prey to a predator, or that firm 2 is less efficient than firm 1 and therefore cannot survive in the marketplace. As investors cannot distinguish the origin of the losses, they decide to withdraw their funding if profits are below  $\bar{\pi}_2$ .

Firm 2 can always guarantee a profit of  $-F$  by not producing anything in period 1. A possibility for predation can therefore only arise if  $\bar{\pi}_2 \geq -F$ , which we will assume to be the case. In the other direction, it seems reasonable that the firm will not be shut down if it makes profits. We

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<sup>10</sup>In principle, however, it would be easy to extend our model to the case where the smaller firm has better access to finance. That said, predatory exclusion would become significantly less likely in the model, because the first period costs of excluding a rival increase in the rival's market share. We therefore adopt the structure in the text, which appears empirically more relevant.

therefore have  $\bar{\pi}_2 \in [-F, 0]$ , which we parameterize with

$$\bar{\pi}_2 = -\alpha F, \tag{1}$$

where the parameter  $\alpha \in [0, 1]$  represents the leniency of firm 2's banks. A value of  $\alpha = 0$  means the banks are quite tough. Even if firm 2 breaks even, banks will shut it down. A value of  $\alpha = 1$  on the other hand, means the banks are very soft. Only if firm 2 makes no sales at all it will be shut down; more moderate losses will be tolerated.

We are now ready to solve the game by backward induction starting in period 2. This is essentially the case of static exclusive dealing as analyzed in the previous literature.

### 3 Exclusion in a static game

There are two possible subgames that start in period 2. Either both firms are still active or firm 2 has been cut off from its funding after period 1 due to insufficient profits. If only firm 1 is active, it is easy to see that it charges the monopoly price  $p_1^M = u_1 - t$ , leading to demand  $x^M = 1$ , profit  $\pi_1^M = u_1 - t - c - F$  and purchasers' rent  $U^M = \frac{1}{2}t$ . Whether the firm announces exclusivity or not is irrelevant: there is no competition anyway.

Next consider the case where both firms are still active in period 2. If nobody has announced an exclusivity requirement, the firms play the pricing game with Hotelling preferences, which we denote as *regular pricing* for later reference. Given  $p_1$  and  $p_2$ , each buyer purchases

$$x = \frac{1}{2} + \frac{p_2 - p_1 + \Delta u}{2t} \tag{2}$$

units of good 1 and  $1 - x$  units of good 2. The best response functions of firms 1 and 2 are therefore

$$p_1(p_2) = \frac{1}{2}(c + t + p_2 + \Delta u) \text{ and } p_2(p_1) = \frac{1}{2}(c + t + p_1 - \Delta u). \quad (3)$$

This leads to a Nash equilibrium with

$$p_1^* = c + t + \frac{\Delta u}{3} \text{ and } p_2^* = c + t - \frac{\Delta u}{3},$$

so that  $x^* = \frac{1}{2} + \frac{\Delta u}{6t}$ ,  $\pi_1^* = \frac{1}{2t} \left(t + \frac{\Delta u}{3}\right)^2 - F$ ,  $\pi_2^* = \frac{1}{2t} \left(t - \frac{\Delta u}{3}\right)^2 - F$ , and the purchasers' rent is  $U^* = \frac{1}{2}(u_1 + u_2) - c - \frac{5}{4}t + \frac{(\Delta u)^2}{36t}$ . For later reference, note that firm 2's one-period profits are non-negative if and only if

$$F \leq \frac{1}{2t} \left(t - \frac{\Delta u}{3}\right)^2. \quad (4)$$

If one of the firms has announced an exclusivity requirement, downstream purchasers have to decide whether to exclusively buy from firm 1 or from firm 2. Sourcing from firm 1 generates a higher utility for purchasers if and only if

$$p_1 \leq p_2 + \Delta u.$$

The only undominated Nash equilibrium in this subgame involves consumers choosing the dominant firm ( $x^{ED} = 1$ ) and firms choosing prices

$$p_1^{ED} = c + \Delta u \text{ and } p_2^{ED} = c.$$

The proof for this equilibrium is analogous to the standard Bertrand game with differentiated



cost, where  $\Delta u$  corresponds to the cost differential. There is cut-throat competition, except for the cost advantage (here: utility advantage) of one of the firms. Therefore, it is costly to bribe purchasers into exclusivity.<sup>11</sup> The resulting equilibrium profits are  $\pi_1^{ED} = \Delta u - F$  and  $\pi_2^{ED} = -F$ , and the purchasers' rent is  $U^{ED} = u_2 - c - \frac{1}{2}t$ .

As  $\pi_2^{ED} < \pi_2^*$  for all parameter values, it is a dominant strategy for firm 2 not to require exclusivity. Since firm 1 is the stronger competitor, firm 2 can only lose any fight for exclusivity. For firm 1, however, exclusive dealing may or may not be profitable. Comparing  $\pi_1^{ED}$  and  $\pi_1^*$ , one finds that exclusive dealing is not profitable for firm 1 if and only if

$$\Delta u \leq 3(2 - \sqrt{3})t. \quad (5)$$

Since  $3(2 - \sqrt{3})t \in (0, t)$ , this is a reiteration of Mathewson and Winter's (1987) result that exclusive dealing may occur in static games. In our model, exclusion in a one-period subgame arises if horizontal product differentiation is small ( $t$  is small) but vertical product differentiation is large ( $\Delta u$  is large).<sup>12</sup> For our purposes, this is just a reference point for later comparison. We will therefore now turn to the analysis of the first period to characterize the scope of predatory exclusive dealing.

## 4 Exclusion in a dynamic game

The previous section has shown that there are two circumstances under which exit of firm 2 can occur after period 1 even if firm 1 strictly maximizes one-period profits without sacrificing current

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<sup>11</sup> As in the Bertrand game with differentiated cost, there exist additional Nash equilibria, which, however, involve the play of weakly dominated strategies by firm 2. Here, and in what follows, we will focus on undominated equilibria.

<sup>12</sup> A cost advantage of firm 1 vis-à-vis firm 2 has an effect equivalent to vertical product differentiation.

rents to induce exit of firm 2. First, if condition (5) does not hold, firm 1 would opt for exclusivity in period 1 even if it (wrongly) expected firm 2 to stay in the market. As a consequence, firm 2's profits fall below  $-\alpha F$ , and it must close down. Second, if condition (4) does not hold, the competition under regular pricing is so intense that firm 2 cannot cover its fixed costs of operation. In that case, firm 2 will voluntarily exit after period 1. Staying put would only inflict additional losses in period 2.

These two outcomes can be described as *exclusion by effect* because the implied strategies by firm 1 do not have the *object* of cutting firm 2 off from its funding. This is only the unintended *effect* of a strategy that maximizes one-period profits.<sup>13</sup> The analysis of the overall game for these two cases is trivial. In period 1, both firms play the strategy that is optimal in a static game; firm 2 exits and firm 1 earns monopoly rents in period 2. Hence, we will now turn to the more interesting situation where conditions (4) and (5) hold, in which case exclusion is not profitable absent the intent to remove a competitor from the market. If exclusion occurs in this setting, then it is *predation by object*; that is, the willful sacrifice of current profits to earn future monopoly rents.<sup>14</sup>

If future monopoly profits are sufficiently high, some form of predation might be desirable for firm 1.<sup>15</sup> In order to decrease firm 2's profits below the cutoff threshold  $-\alpha F$ , firm 1 may either propose an exclusive contract (*predatory exclusive dealing*) or it may forego exclusivity requirements but decrease its retail price below the level that is optimal from the viewpoint of

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<sup>13</sup>Notice that in principle, exclusive dealing may nevertheless cause damage to consumers. For instance, even in the case where consumers benefit in period 1 because firm 1 has to bribe them into exclusivity by offering favorable conditions, they will incur future losses by facing a monopolist in period 2. That is, the question whether exit occurred due to exclusive dealing (condition (5) does not hold) or whether it is a consequence of normal competitive pressure (condition (4) does not hold) may make a difference for antitrust assessment.

<sup>14</sup>In practice, the goal of predation may not always be virtual exit of the competitor. The predator may alternatively try to marginalize the prey by pushing it into a niche segment of the market or by making sure that the prey does not obtain the financial resources to compete in the high-quality product spectrum.

<sup>15</sup>Note that in our model (as in Bolton and Scharfstein, 1990) it can never be optimal for firm 2 to try to predate on firm 1. This follows from our assumption that firm 2 faces a financial constraint, while firm 1 does not. Therefore, firm 1 will always be present in the second period, irrespective of what happens in period 1.

static profit maximization (*predatory pricing*). The exclusive dealing strategy was outlined in the previous section. We therefore turn to predatory pricing now.

Given  $p_1$ , firm 2's optimal response  $p_2(p_1)$  is given by (3). Plugging this into firm 2's profit function yields

$$\pi_2(p_1) = \frac{(p_1 - c + t - \Delta u)^2}{8t} - F.$$

Setting this expression equal to  $-\alpha F$  and rearranging gives the largest  $p_1$  consistent with exclusion of firm 2, which is

$$p_1^P = c - t + \Delta u + \sqrt{8t(1 - \alpha)F}.$$

As a result, the optimal price of firm 2 is given by

$$p_2^P = c + \sqrt{2t(1 - \alpha)F}.$$

This leads to  $x^P = 1 - \sqrt{\frac{(1 - \alpha)F}{2t}}$ ,  $\pi_1^P = \left(1 - \sqrt{\frac{(1 - \alpha)F}{2t}}\right) (\Delta u - t + \sqrt{8t(1 - \alpha)F}) - F$ ,  $\pi_2^P = -\alpha F$ , and  $U^P = \frac{1}{2}t$ .

To determine the first period outcome, there are therefore three potential equilibrium candidates: predatory pricing (leading to profits of  $\pi_1^P + \pi_1^M$  for firm 1), predatory exclusive dealing (leading to profits of  $\pi_1^{ED} + \pi_1^M$  for firm 1) and regular pricing (leading to profits of  $2\pi_1^*$  for firm 1). The following proposition shows that all three outcomes can arise as equilibria of the dynamic game depending on the parameter values. So indeed it may be optimal for firm 1 to use an exclusive dealing contract to predate. However, it may also be the case that predatory pricing is a more profitable strategy for firm 1 or that neither of the two predatory strategies is profitable.<sup>16</sup>

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<sup>16</sup>All proofs are contained in the appendix.

**Proposition 1** *Suppose that firms 1 and 2 compete in a dynamic pricing game. Then predatory exclusion may occur in period 1 if monopoly profits in period 2 are sufficiently large. Depending on the parameters, exclusion either takes the form of predatory exclusive dealing or of predatory pricing. Exclusive dealing may occur even in a situation where exclusivity provisions cannot increase one-period profits.*

Given that both predatory pricing and predatory exclusive dealing can arise in equilibrium, the question is under which circumstances one or the other is preferable for firm 1. Proposition 2 provides a first answer.

**Proposition 2** *Suppose that future monopoly profits are sufficiently large for some form of predatory exclusion to arise in period 1. Then, predatory exclusive dealing is more likely to occur if the financing constraint of the prey is soft ( $\alpha$  is large), while predatory pricing is more likely to occur if the financing constraint of the prey is strict ( $\alpha$  is small).*

This result reflects the main advantages and disadvantages of the two instruments. The big disadvantage of predatory pricing is that it forces firm 1 to decrease prices not only for marginal units (those that it intends to capture from firm 2 to force the latter's profits down), but also for intramarginal units. Predation is a costly exercise: the predator wants to enhance his reach, but this forces him to decrease prices. Exclusive dealing is less harmful in that respect. While it captures sales that would otherwise go to firm 2, it is easier to obtain profits on intramarginal units: At the equilibrium price under exclusive dealing, purchasers would prefer to source both from firm 1 and firm 2. However, the exclusivity clause prohibits that. Because no purchaser can obtain any units from firm 2, the choice is to purchase either all sales from firm 1 or none. Since

consumers do not want to forgo firm 1 consumption (especially if  $\Delta u$  is large), firm 1 can save some of the rents on intramarginal units.

However, exclusive dealing is not without cost relative to predatory pricing. The big disadvantage of exclusive dealing is its scope. Exclusivity forces consumers to give up *all* of the consumer surplus that they would enjoy from sourcing some units from firm 2. This makes it costly to convince consumers to accept an exclusivity clause, especially if firm 1's advantage  $\Delta u$  over firm 2 is only moderate. Predatory pricing does not suffer from this disadvantage. In fact, it can be tailored to the degree of market exclusion that is necessary to induce exit of the prey. Indeed, if a small reduction of prices is sufficient to push firm 2 into losses because the financing constraints of firm 2 are tight, then bribing consumers into exclusivity would be far too expensive. Hence, predatory pricing is more attractive if banks are tough, while exclusive dealing is more attractive if banks are soft.

The following proposition relates the foregoing discussion to the degree of dominance of the predator.

**Proposition 3** *Suppose that future monopoly profits are sufficiently large for some form of predatory exclusion to arise in period 1. Then, predatory exclusive dealing is more likely to occur if the degree of dominance  $\Delta u$  of the large firm is large, while predatory pricing is more likely to occur if the the degree of dominance  $\Delta u$  of the large firm is small.*

In light of the previous discussion, the intuition behind Proposition 3 is clear. If the predator is more dominant, then it would gain a large market share even if it did not predate. Bribing purchasers into accepting exclusion is less costly because the buyers do not regret losing access to firm 2's products as much as would otherwise be the case. The cost of predatory pricing, on the

other hand, is relatively large in this scenario. Recall that its disadvantage is that prices are also reduced for intramarginal units. Since a dominant firm has many of those, it is more reluctant to use this instrument.

Finally, we will relate the question of when predatory exclusive dealing occurs to a measure of firm 1's optimal predatory price. Proposition 4 shows that a sharp distinction can be drawn to indicate under which circumstances exclusivity is profitable.

**Proposition 4** *Suppose that future monopoly profits are sufficiently large for some form of predation to arise in period 1. Then, predatory exclusive dealing will always be chosen if predatory pricing would involve below-cost predation ( $p_1^P \leq c$ ).*

Proposition 4 shows that firm 1 always prefers predatory exclusive dealing if predatory pricing is so costly that firm 1 has to lower its price below marginal costs to predate ( $p_1^P \leq c$ ).<sup>17</sup> This is an interesting observation given the ongoing debate concerning whether or not above-cost predation should be prosecuted by antitrust law enforcement.<sup>18</sup>

The prospect of predatory exclusion substantially alters the policy implications of exclusive dealing. For instance, Krattenmaker and Salop (1986) argue, based on models of exclusion in a static setting, that exclusionary practices should be prohibited only if they allow firms to raise prices. Matthewson and Winter (1987) support this standard and argue that the famous prohibition decision in *Standard Fashion* does not pass the test because exclusivity led to significant (short-term) price decreases for purchasers who accepted exclusivity. However, as the following

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<sup>17</sup>With differentiated cost, below-cost predation can theoretically arise in our model. However, only if the predator is *less* cost efficient than the prey is this the case. If the predator has lower marginal costs than the prey, then below-cost predation can also be ruled out for differentiated cost parameters.

<sup>18</sup>For a discussion of above-cost predation see Edlin (2002) and Elhauge (2003), who disagree on the merits of such interventions.

proposition shows, predatory exclusive dealing *always* leads to price decreases as firm 1 has to convince consumers to give up sourcing from firm 2. The proposed antitrust standard would therefore imply per se legality of predatory exclusion, a recommendation that one may question.

**Proposition 5** *If predatory exclusive dealing arises, then it leads to a price decrease relative to regular pricing in the first period, ( $p_1^{ED} < p_1^*$ ), but to price increases thereafter, ( $p_1^M > p_1^*$ ).*

We will finish this section with some results on the welfare effects of predatory exclusive dealing. These are summarized in the following proposition.

**Proposition 6** *Compared to regular pricing, (i) predatory exclusive dealing reduces social welfare if and only if the fixed costs of operation are sufficiently small ( $F$  is small) and (ii) predatory exclusive dealing reduces consumer surplus if and only if consumers' utility of purchasing the dominant firm's product is sufficiently large ( $u_1$  is large).*

As Proposition 6 shows, the welfare effects of exclusive dealing are ambiguous. On the one hand, predatory exclusive dealing causes a distortion in product variety (there is no consumption of firm 2's products which are foreclosed from the market). It is important to note, however, that regular pricing also leads to distorted product variety, even though there is no full exclusion: While under exclusive dealing purchasers obtain too many of firm 1's products (1 instead of  $\frac{1}{2} + \frac{\Delta u}{2t}$ ), they obtain *too few* under regular pricing ( $\frac{1}{2} + \frac{\Delta u}{6t}$  instead of  $\frac{1}{2} + \frac{\Delta u}{2t}$ ) as firm 1 exerts its market power by restricting quantity. Moreover, predation saves on future fixed costs (along the lines of Mankiw and Whinston's [1986] argument of excessive entry). This explains the general ambiguity.

Regarding consumer surplus, there is an additional trade-off. While predatory exclusive dealing leads to lower prices in period 1, it leads to higher prices in period 2. The latter effect dominates

in the model whenever  $u_1$  is sufficiently large. In that case the second period monopoly price  $p_1^M = u_1 - t$  is large and more than offsets the short-term exclusionary gains for consumers.

## 5 Non-linear pricing

We will now analyze an extension of our basic model that allows for non-linear pricing as in O'Brien and Shaffer (1997). Consider a game that is equivalent to our previous set-up except that firms can now set two-part tariffs. Therefore, each firm  $i$  chooses prices  $(L_i, p_i)$ , where  $L_i$  denotes a lump-sum charge and  $p_i$  denotes a per-unit charge.

As before, we will first identify equilibria in the period 2 subgames. Suppose exclusivity has not been announced by any firm. If buyers purchase from both firms,

$$x = \frac{1}{2} + \frac{p_2 - p_1 + \Delta u}{2t}$$

as before. But now there are two incentive constraints that ensure that it is optimal to purchase from both firm 1 and firm 2. The utility of purchasing from both must be larger than purchasing from either firm alone. Comparing the respective consumer surpluses for firm 1 ( $u(1, 2) \geq u(2)$ ) yields

$$L_1 \leq \frac{1}{t} \left( \frac{p_2 - p_1 + \Delta u + t}{2} \right)^2. \quad (6)$$

Similarly, we have

$$L_2 \leq \frac{1}{t} \left( \frac{p_1 - p_2 - \Delta u + t}{2} \right)^2 \quad (7)$$

for firm 2. Both constraints must bind in equilibrium (otherwise, a firm could increase its profits by raising the fixed fee).



Therefore, firm 1 chooses  $p_1$  to maximize

$$\pi_1 = \left( \frac{1}{2} + \frac{p_2 - p_1 + \Delta u}{2t} \right) (p_1 - c) + \frac{1}{t} \left( \frac{p_2 - p_1 + \Delta u + t}{2} \right)^2 - F$$

where  $L_1$  has been substituted from (6). This gives  $p_1^* = c$ . Likewise,  $p_2^* = c$ . Hence,  $x^* = \frac{1}{2} + \frac{\Delta u}{2t}$ ,

$$L_1^* = \frac{1}{t} \left( \frac{t + \Delta u}{2} \right)^2 \quad \text{and} \quad L_2^* = \frac{1}{t} \left( \frac{t - \Delta u}{2} \right)^2$$

which leads to  $\pi_1^* = \frac{1}{t} \left( \frac{t + \Delta u}{2} \right)^2 - F$  and  $\pi_2^* = \frac{1}{t} \left( \frac{t - \Delta u}{2} \right)^2 - F$ . Note that  $\pi_2^* \geq 0$  if and only if

$$\Delta u \leq t - 2\sqrt{tF} \tag{8}$$

which we will again assume to hold. Otherwise exit of firm 2 would automatically occur after period 1.

Next we will investigate the subgame where one of the firms has announced an exclusivity requirement. In this case, buyers will purchase the measure one units from either firm 1 or firm 2. As the volume is fixed, the structure of the payment (fixed or variable) is irrelevant; only the total level matters. Hence, without loss of generality, we can set  $p_1^{ED} = p_2^{ED} = c$ .

Buyers will purchase from firm 1 if and only if

$$L_1 \leq L_2 + \Delta u.$$

With the previous Bertrand argument, this leads to equilibrium fees of

$$L_1^{ED} = \Delta u \quad \text{and} \quad L_2^{ED} = 0.$$

Firm 2 will always be excluded in this subgame, i.e.  $x^{ED} = 1$ . Therefore,  $\pi_1^{ED} = \Delta u - F$  and  $\pi_2^{ED} = -F$ .

It is easy to see that  $\pi_2^{ED} \leq \pi_2^*$ . Therefore, firm 2 will never announce exclusivity in period 1. Exclusive dealing will be more profitable for firm 1 ( $\pi_1^{ED} > \pi_1^*$ ) if and only if

$$(\Delta u - t)^2 < 0,$$

which cannot be the case. Hence, exclusive dealing will never be used, and regular pricing is the relevant subgame in the subgame perfect Nash equilibrium of the overall game. This result contrasts with the result of Section 3: *If firms can employ two-part tariffs exclusion can never be profitable in a one-period game.* This is in line with O'Brien and Shaffer (1997) and Bernheim and Whinston (1998), who show that Mathewson and Winter's (1987) result is reversed if non-linear pricing schemes are taken into account. Essentially, these results restore the logic of Bork (1978) that firms cannot increase their profits through exclusivity provisions.

But while exclusive dealing is not profitable in a static environment, it may still be the case that it is a useful instrument to predate on competitors. This would rationalize the view held by some observers that exclusive dealing should only be questioned by competition authorities if it can be shown to be predatory.

Assume period 2 profits are sufficiently large for some form of predatory exclusion to be optimal. Exclusive dealing is one possible strategy to predate. The equilibrium of this subgame was described above. Next consider price predation. As  $p_2 = c$  is optimal for firm 2 irrespective of firm 1's choice of price schedule, its optimal fixed fee depending on  $p_1$  can be inferred from (7)

as

$$L_2 = \frac{1}{t} \left( \frac{p_1 - c - \Delta u + t}{2} \right)^2.$$

This yields profits of

$$\pi_2 = \frac{1}{t} \left( \frac{p_1 - c - \Delta u + t}{2} \right)^2 - F.$$

In order to predate, these profits have to be pushed down to  $-\alpha F$ . This occurs if

$$p_1^P = c + \Delta u - t + 2\sqrt{t(1-\alpha)F}. \quad (9)$$

Therefore

$$L_1^P = t - 2\sqrt{t(1-\alpha)F} + (1-\alpha)F,$$

$x^P = 1 - \sqrt{\frac{(1-\alpha)F}{t}}$ , and  $\pi_1^P = \Delta u - F + \sqrt{\frac{(1-\alpha)F}{t}}(t - \Delta u) - (1-\alpha)F$ . Comparing  $\pi_1^{ED}$  and  $\pi_1^P$  then yields the following proposition.

**Proposition 7** *Suppose that firms 1 and 2 compete in a dynamic pricing game with two-part tariffs. Then, neither of the two firms will impose an exclusivity requirement on purchasers.*

In other words, there is a one-to-one relationship between the environment that allows exclusion to be profitable in a one-period setup and the environment that allows exclusion to be profitable in a dynamic setting. In the logic of Bernheim and Whinston (1998), exclusive dealing can only be profitable in the absence of efficiency motives if there are contracting externalities. As shown in Sections 3 and 4, one such imperfection is the case where firms are restricted in setting non-linear tariffs.<sup>19</sup> While Proposition 7 (and the previous results by O'Brien and Shaffer, 1997,

<sup>19</sup>The argument readily extends to the case where firms can use two-part tariffs, but can only increase fixed fees up to some limit  $\bar{L}$ , perhaps for fear of antitrust prosecution of price discrimination. It is easy to show that predatory exclusive dealing is profitable for firm 1 provided that  $\bar{L}$  is not too large.

and Bernheim and Whinston, 1998) calls for caution in marking exclusivity provisions as anti-competitive, there are at least two important reasons why the situation depicted in the previous sections, where predatory exclusive dealing could arise, are relevant in practice.

First, the assumption of two-part tariffs with full knowledge of the demand curves of individual purchasers is clearly extreme. Perfect price discrimination of the sort assumed in this section, which allows full extraction on residual demand curves, is typically not observed in the real world. However, once marginal cost pricing on incremental units cannot be maintained (say, because firms do not know purchasers' individual demands with certainty), we again enter a world with contracting externalities. As Spector (2007) notes, nonlinear pricing together with asymmetric information resembles linear pricing. We are therefore back in the scenario of Proposition 7; that is, predatory exclusive dealing may occur.

Second, even if firms possess the large informational requirements leading to Proposition 6, they may still prefer exclusive dealing over predatory pricing because it is less easily detectable as a predatory strategy. This is shown in the following proposition.

**Proposition 8** *Suppose that firms 1 and 2 compete in a dynamic pricing game with two-part tariffs. Then predatory pricing always involves below-cost predation ( $p_1^P < c$ ), while predatory exclusive dealing can always be carried out with above-cost predation ( $p_1^{ED} \geq c$ ).*

As a result, competition authorities may be able to infer predatory pricing from cost observations if firms use non-linear pricing schemes. Predatory exclusive dealing, on the other hand, can always be carried out with incremental prices above cost. Thus, it is likely to be more difficult for a competition authority to actually prove that the predator has sacrificed profits by offering exclusive contracts.

In summary, we believe that the result of Proposition 7 should be seen as pointing to the necessary conditions for predatory exclusive dealing to arise, rather than ruling it out as a matter of principle. In the limiting case of full information and perfect non-linear pricing, predatory exclusive dealing will not arise. However, in a less than perfect world, the intuition of the main body of our paper again provides the relevant framework of analysis.

## 6 Conclusion

This paper has introduced exclusivity clauses into a model of predation along the lines of Bolton and Scharfstein (1990). As a result, two distinct forms of predatory exclusion arose in equilibrium, which are also observed in practice: predatory pricing and predatory exclusive dealing. Exclusive dealing can be a profitable strategy to exclude rivals with financing constraints, even in circumstances where exclusive contracts can never be profitable from the perspective of static profits. The more market power a predator has on the product market, the more likely it is that predatory exclusive dealing is a more profitable exclusionary strategy than predatory pricing.

The previous literature on exclusive dealing has concluded that the exclusion of existing competitors (as opposed to abstract potential entrants) can only have anticompetitive effects under particular conditions - for instance, if there are contracting externalities from related markets (see Bernheim and Whinston, 1998, and Whinston, 2006). This paper, in contrast, has argued that the scope for anticompetitive exclusive dealing is much larger. While exclusive dealing may often not be profitable in a static context, it may provide a cheap and effective instrument of predation.

Our model (and the related work by Mathewson and Winter, 1987, O'Brien and Shaffer, 1997, and Bernheim and Whinston, 1998) has assumed that downstream purchasers are either final consumers or local monopolists, who do not compete with each other. It would be interesting to

extend the present analysis to downstream competition. Fumagalli and Motta (2006) and Simpson and Wickelgren (2007) have shown that the effect of downstream competition on the potential for exclusion is ambiguous for the case of potential entrants. Extending their work to the exclusion of competing incumbents seems to be a promising direction for future research.

## 7 Appendix

### Proposition 1:

**Proof.** Suppose that  $u_1$  is large (which implies that period 2 monopoly profits  $\pi_1^M$  are large). We will prove that in this case, firm 1 will always find it optimal either to engage in predatory pricing or to impose exclusivity. Consider first the situation where firm 1 has not imposed exclusivity before the pricing game in period 1. In this case two equilibrium candidates remain. For firm 1, the predatory pricing outcome is more profitable if and only if

$$\pi_1^P + \delta\pi_1^M \geq 2\pi_1^*. \quad (10)$$

Substituting the appropriate values from the text in (10) and rearranging yields

$$\left(1 - \sqrt{\frac{(1-\alpha)F}{2t}}\right) \left(\Delta u - t + \sqrt{8t(1-\alpha)F}\right) + u_1 - t - c \geq \frac{1}{t} \left(t + \frac{\Delta u}{3}\right)^2. \quad (11)$$

Holding  $\Delta u$  constant, (11) must clearly hold for sufficiently large  $u_1$ . I.e., if the prospect of future monopoly profits is sufficiently large, firm 1 will find it optimal to predate in the absence of exclusive dealing.

In this situation, however, it may be more profitable for firm 1 to impose an exclusivity requirement in the first place. This is the case if and only if

$$\pi_1^{ED} + \pi_1^M \geq \pi_1^P + \pi_1^M. \quad (12)$$

Substituting the appropriate values from the text in (12) and rearranging yields

$$\Delta u \geq \left( \sqrt{\frac{2t}{(1-\alpha)F}} - 1 \right) \left( -t + \sqrt{8t(1-\alpha)F} \right). \quad (13)$$

What needs to be shown is that (13) may or may not hold, depending on the value of parameters (within the parameter restrictions of the model). To show that exclusivity may be profitable, let  $\alpha \rightarrow 1$ . In this case the right-hand-side of (13) converges to  $-\infty$ , and so (13) clearly holds. Next, to show that exclusivity may not hold, let  $\Delta u = 0$ ,  $\alpha = 0$ , and  $F = t/2$ .<sup>20</sup> In this case (13) is equivalent to

$$0 \geq t \quad (14)$$

which cannot hold. Hence, in this case it is preferable for firm 1 not to impose exclusivity and to predate in the pricing game. I.e., for sufficiently large  $u_1$ , firm 1 will either engage in predatory exclusive dealing or predatory pricing, depending on parameter values. ■

**Proposition 2:**

**Proof.** Note that in (12), the only term that is a function of  $\alpha$  is  $\pi_1^P$ . To prove that predatory pricing becomes relatively less profitable compared to exclusive dealing as  $\alpha$  increases, we therefore have to show

$$\frac{\partial \pi_1^P}{\partial \alpha} = -\sqrt{\frac{2tF}{1-\alpha}} + (\Delta u - t) \sqrt{\frac{F}{8(1-\alpha)t}} + 2F < 0$$

which is equivalent to

$$\frac{1}{4}(\Delta u - t) + \sqrt{2(1-\alpha)tF} - t < 0. \quad (15)$$

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<sup>20</sup>Note that these parameter values are consistent with the restrictions imposed by the model setup. In particular, they are consistent with inequality (4).



We know the first term in (15) to be negative.  $\sqrt{2(1-\alpha)tF} - t \leq 0$  if and only if

$$t \geq 2(1-\alpha)F. \quad (16)$$

This is most difficult to fulfill in case  $\alpha = 0$ , in which case (16) reduces to

$$F \leq \frac{t}{2}. \quad (17)$$

(17) however must hold given (4), so we can indeed conclude that (15) holds, which proves the proposition. ■

**Proposition 3:**

**Proof.** From (13) it immediately follows that, ceteris paribus, exclusive dealing becomes relatively more attractive if  $\Delta u$  increases. ■

**Proposition 4:**

**Proof.** Suppose  $p_1^P \leq c$ . In that case it must be that firm 1's first period profits under predatory pricing  $\pi_1^P < -F$  (firm 1 not only has to come up for fixed costs, but incurs additional losses on every sold unit due to below cost pricing). However, we know from Section 3 that firm 1's first period profit under exclusive dealing is equal to  $\pi_1^{ED} = \Delta u - F$ . Hence, we have  $\pi_1^{ED} = \Delta u - F \geq -F > \pi_1^P$ , which proves the proposition. ■

**Proposition 5:**

**Proof.** First, we will show that  $p_1^{ED} < p_1^*$ . Substituting the appropriate values from Section 3 and rearranging yields

$$\Delta u < \frac{3}{2}(c + t + F). \quad (18)$$

We know from Section 2 that the left-hand side of (18) is smaller than  $t$ . As the right-hand side is larger than  $t$ , (18) must hold which proves the first part of the proposition. Second, we will show that  $p_1^M > p_1^*$ . Substituting the appropriate values from Section 3 and rearranging yields

$$u_2 > t - F. \quad (19)$$

We know from Section 2 that the left-hand side of (19) is larger than  $c + 2t$ . As this value exceeds the right-hand side of (19), (19) must indeed hold, which proves the proposition. ■

**Proposition 6:**

**Proof.** In case of exclusive dealing, first period welfare is equal to  $W^{ED} = u_2 - c - \frac{1}{2}t + \Delta u - 2F$ . Second period (monopoly) welfare is equal to  $W^M = u_1 - \frac{1}{2}t - c - F$ . Adding the two gives a two-period welfare of

$$W^{ED} + W^M = u_1 + u_2 - 2c + \Delta u - t - 3F. \quad (20)$$

One period welfare under regular pricing, by contrast, is equal to  $W^* = \frac{1}{2}(u_1 + u_2) - c - \frac{1}{4}t + \frac{5}{36} \frac{(\Delta u)^2}{t} - 2F$ , which means that two-period welfare is equal to

$$2W^* = u_1 + u_2 - 2c - \frac{1}{2}t + \frac{5}{18} \frac{(\Delta u)^2}{t} - 4F. \quad (21)$$

Comparing (20) and (21) and rearranging shows that exclusive dealing reduces welfare if and only if

$$F \leq \frac{1}{2}t + \frac{5}{18} \frac{(\Delta u)^2}{t} - \Delta u. \quad (22)$$

Comparing this threshold for  $F$  with the threshold of admissible values of  $F$  defined by (4) shows that the former is stricter than the latter. Hence, for small values of  $F$  welfare is decreased as a

result of exclusive dealing, while for larger (but still admissible) values of  $F$  it is increased.

Next consider consumer surplus. In case of exclusive dealing first period consumer surplus is equal to  $U^{ED} = u_2 - c - \frac{1}{2}t$ . Second period (monopoly) consumer surplus is equal to  $U^M = \frac{1}{2}t$ . Adding the two gives

$$U^{ED} + U^M = u_2 - c. \quad (23)$$

One period consumer surplus under regular pricing, by contrast, is equal to  $U^* = \frac{1}{2}(u_1 + u_2) - c - \frac{5}{4}t + \frac{1}{36} \frac{(\Delta u)^2}{t}$ , which means that two-period consumer surplus is equal to

$$2U^* = u_1 + u_2 - 2c - \frac{5}{2}t + \frac{1}{18} \frac{(\Delta u)^2}{t}. \quad (24)$$

Comparing (23) and (24) and rearranging shows that exclusive dealing reduces consumer surplus if and only if

$$u_1 - c - \frac{5}{2}t + \frac{1}{18} \frac{(\Delta u)^2}{t} \geq 0.$$

Hence, for large values of  $u_1$  consumer surplus is reduced by exclusive dealing, while for smaller (but still admissible) values of  $u_1$  it is increased. ■

**Proposition 7:**

**Proof.** Comparing  $\pi_{ED}^1$  and  $\pi_P^1$  and rearranging yields that exclusive dealing is more profitable if and only if

$$\Delta u > t - \sqrt{t(1 - \alpha)F}. \quad (25)$$

The right hand side of (18) is larger than the right hand side of (8), therefore (18) cannot hold.

Hence, Predatory pricing must yield higher profits than predatory exclusive dealing. ■

**Proposition 8:**

**Proof.** From (9),  $p_1^P < c$  if and only if

$$\Delta u < t - 2\sqrt{t(1-\alpha)F}. \quad (26)$$

The right hand side of (26) is larger than the right hand side of (8), therefore (26) always holds.

Moreover, as pointed out in Section 5, the incremental price  $p_1^{ED} = c$  is part of an equilibrium in the exclusive dealing subgame; that is,  $p_1^{ED} < c$  can always be avoided. ■

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