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The demand-boost theory of exclusive dealing*

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Abstract

This article unifies various approaches to the analysis of exclusive dealing that so far have been regarded as distinct. The common element of these approaches is that firms depart from efficient pricing, raising marginal prices above marginal costs. We show that with distorted prices, exclusive dealing can be directly profitable and anticompetitive provided that the dominant firm enjoys a competitive advantage over rivals. The dominant firm gains directly, rather than in the future, or in adjacent markets, thanks to the boost in demand it enjoys when buyers sign exclusive contracts. We discuss the implication of the theory for antitrust policy.

Keywords: Exclusive dealing; Price distortions; Rent extraction; Two-part tariffs; Antitrust; Dominant firm.

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1 Introduction

Exclusive-dealing agreements prohibit a buyer who purchases a firm's product from buying the products of the firm's competitors. These agreements are common in vertical relations and are generally regarded with suspicion by antitrust authorities. However, theory is unsettled and the policy debate is still ongoing.

The contribution of this article is to unify three approaches to the analysis of exclusive dealing that so far have been regarded as competing or, at best, unrelated: the linear pricing model of Mathewson and Winter (1987), the moral hazard model of Bernheim and Whinston (1998, section V), and the adverse selection model of Calzolari and Denicolò (2013, 2015). We demonstrate that, in fact, all these models share a common mechanism and thus represent different versions of the same theory.

The theory can be explained in simple terms as follows. Consider the product market competition among two or more firms that supply differentiated products. Abstracting from more roundabout effects, the upside of exclusive dealing is that it increases the demand for the firm's product. The downside is whatever price reduction may be necessary to entice the buyer to enter into the agreement, compensating him for the loss of the option of buying other products. This creates a price-volume trade off, but one of a special nature.

The trade-off cannot be favorable if the firm prices efficiently, setting marginal prices at cost and extracting the surplus by means of lump-sum payments. In this case, the increase in volumes would not improve profitability, and the firm might have to reduce the fixed payment in order to compensate the buyer for the loss in variety. But when the price-cost gap is strictly positive at the margin, any increase in sales translates into higher profits. If the compensation required by the buyer is not too large, exclusive dealing may then be profitable. Essentially, price distortions create contractual externalities.

We shall refer to this explanation for exclusive dealing as the *demand* *boost* theory, as the key insight is that exclusive dealing creates a boost in demand that may be directly profitable.

As said, profitability requires that marginal prices be distorted upwards. We believe this assumption is mild in both theory and practice. In real life, firms rarely rely only on fixed fees to extract profits. Even when lump-sum payments are used, they are often supplemented with marginal prices in excess of marginal costs.

At the theoretical level, this pattern of pricing is, indeed, optimal if fixed fees are an imperfect means of rent extraction. This may be so for a variety of different reasons. Consider, for instance, the moral hazard model developed in section V of Bernheim and Whinston (1998). Here, Bernheim and Whinston adapt to the analysis of exclusive dealing a framework, originally proposed by Rey and Tirole (1986), in which buyers are risk-averse retailers who face uncertain demand. In this setting, fixed fees expose retailers to the risk of making large payments even if demand turns out to be low. To reduce the risk, upstream firms lower their fixed fees and distort marginal prices upwards.

As another example, consider the model of adverse selection of Calzolari and Denicolò (2013, 2015). In this model, firms do not exactly know the buyers' willingness to pay for their products, as in the pioneering contributions of Mussa and Rosen (1978) and Maskin and Riley (1984). Fixed fees may then create a distortion at the extensive margin by excluding some low-demand buyers. Balancing distortions at the extensive and intensive margins, firms optimally set marginal prices above marginal costs.

These are just two examples. There may be other reasons why firms distort marginal prices upwards. As we show, however, the source of price distortions is not important: the theory applies whenever marginal prices exceed marginal costs, and for whatever reason. This makes the theory robust and broadly applicable.

According to the demand-boost theory, the competitive effects of exclusive dealing are as follows. On the one hand, exclusive dealing deprives consumers of product variety. On the other hand, it changes the nature of competition: with exclusive contracts, firms compete for the whole market rather than for each marginal unit. And while the competition for marginal units is attenuated by product differentiation, that for the entire market is not, as it takes place in utility space, where product differentiation is irrelevant.

The effects of this change in the mode of competition depend on the structure of the market and in particular on the size of the dominant firm's competitive advantage over its rivals. When the competitive advantage is big, exclusive dealing may increase prices, or else reduce them only slightly. In this case, exclusive dealing is profitable for the dominant firm, and consumers may be harmed both in terms of higher prices and reduced variety. Remarkably, these negative effects are immediate and direct. In most of the alternative theories, by contrast, exclusive dealing entails a sacrifice of profits that pays off in other stages of the game, and any possible anticompetitive effects materialize only in the recoupment phase.[1] The difference is critical for antitrust policy.

If however the competitive advantage is small, and the dominant firm's rivals are highly concentrated, exclusive dealing may entail a significant fall in prices. Profits may then fall, as they are caught in a prisoner's dilemma. If the price reduction outweighs the loss of variety, consumers may actually gain. Thus, exclusive dealing may be procompetitive.

When assessing the competitive effects of exclusive dealing, it is therefore important that antitrust authorities and the courts try to gauge the size of the dominant firm's competitive advantage. This is a difficult but not impossible task, as the competitive advantage typically correlates with observable variables, such as for instance the dominant firm's market share. The policy implications of the theory may thus be practical.

[1] The profit sacrifice may vanish in certain cases, but still there is no direct gain. The indirect gain may take a variety of forms, such as entry deterrence (e.g. Rasmusen et al., 1991), the exploitation of a future entrant (e.g. Aghion and Bolton, 1987), the protection of non-contractible investments (e.g. Marvel, 1982), and so on. See Whinston (2008) and Fumagalli, Motta and Calcagno (2018) for excellent surveys of the literature.

The rest of the article proceeds as follows. In the next section, we propose a simple model where firms supply differentiated products and compete in two-part tariffs. Pricing is modeled by means of a reduced form that captures in a stylized way the inefficiencies due to moral hazard, adverse selection, and other possible sources of price distortions. The reduced-form model simply assumes that extracting buyers' rent by means of fixed fees entails a deadweight loss, without specifying the nature of this loss.

We then use this model to compare the equilibria that prevail when exclusive contracts are prohibited or permitted. We start, in section 3, from the case where the dominant firm's rivals are so fragmented that they actually form a competitive fringe. In this case, exclusive dealing is always anticompetitive. Section 4 extends the analysis to the case where the dominant firm faces a single rival. The analysis here shows that exclusive dealing has anticompetitive effects when the dominant firm's competitive advantage is big, procompetitive when it is small.

We finally turn, in section 5, to the foundations of the reduced-form model. We consider both the moral hazard model of Bernheim and Whinston (1998) and the adverse selection model of Calzolari and Denicolò (2013, 2015). For both cases, we show that our reduced form captures in a stylized way the pricing distortions that arise endogenously with market imperfections, being exactly equivalent in some cases and providing a close approximation in others.

Section 6 concludes with a brief discussion of the policy and methodological implications of the analysis. Proofs and supplementary material are relegated to the Appendix and a series of online Appendices.[2]

2 A reduced-form model

In this section, we set up a simple model of competition in two-part tariffs with differentiated products. Initially, we abstract from any market imperfection other than market power and model firms' pricing by means of a

[2] Online appendices are available at Calzolari's home page.

reduced form. As we shall show later, however, the pricing strategies we derive may be re-obtained in more highly structured models with uncertain demand and adverse selection or moral hazard.

Model assumptions. To eschew intertemporal trade-offs, the model is one stage. There are two substitute goods, denoted by $i = 1, 2$. In the duopoly model, they are produced, respectively, by upstream firm 1 and 2; in the competitive fringe model, by firm 1 and a mass of competitive firms. In any case, marginal costs c_i are constant, and we abstract from fixed costs.

Upstream firms sell to retailers or, more generally, downstream firms. Retailers do not interact strategically with each other, so we can focus on the firms' relationships with a single retailer. The gross profit that the retailer can make with q_i units of good i and q_j units of good j is denoted by $u(q_i, q_j)$. We assume that this payoff function is at least twice continuously differentiable, and that the goods are imperfect substitutes: $u_{q_i q_i}(q_i, q_j) \leq u_{q_i q_j}(q_i, q_j) \leq 0$. (Subscripts denote partial derivatives, and the above inequalities are assumed to be strict when quantities are strictly positive.) Furthermore, we assume that $u(q_i, q_j)$ vanishes when $q_1 = q_2 = 0$ (a normalization), has finite satiation points $\bar{q}_i$ implicitly defined by $u_{q_i}(\bar{q}_i, 0) = 0$, and finite choke prices $\bar{p}_i = u_{q_i}(0, 0) > c_i$. Further regularity assumptions will be introduced as needed in the subsequent sections.

Firms may be asymmetric; in particular, upstream firm 1 (which we shall refer to as the dominant firm) may have a competitive advantage over its rival. The competitive advantage may be due to lower costs, higher quality, or a combination of the two. To fix ideas, however, we shall assume that the payoff function $u(q_i, q_j)$ is symmetric and focus on cost asymmetries. Our measure of the dominant firm's competitive advantage will then be the cost gap $c \equiv c_2 - c_1 \geq 0$.[3] Normalizing the unit production cost of good 1 to zero, c becomes the unit cost of producing good 2.

[3] The model is analytically equivalent to one in which costs are symmetric and c is an index of vertical differentiation, with product 1 being of greater quality, and hence in greater demand, than product 2. In this interpretation, the retailer's payoff function would be $u(q_1, q_2) - cq_2$.

Following Rey and Tirole (1986) and Bernheim and Whinston (1998), initially we assume that each upstream firm i offers only one two-part tariff $P_i = F_i + p_i q_i$, where F_i is the fixed fee and p_i is the marginal price.[4] A tariff is denoted by (p_i, F_i). We distinguish between two regimes, depending on whether exclusive contracts are permitted or not. When they are permitted, upstream firm i may offer either an exclusive tariff (denoted by superscript E), which requires $q_j = 0$, or a non-exclusive tariff (denoted by superscript NE), which allows for $q_j > 0$. When exclusive contracts are prohibited, in contrast, the firm's tariff cannot be conditioned on whether the buyer purchases from the rival or not.

Timing is as follows. First, upstream firms choose simultaneously and independently their tariffs. The retailer then chooses which contracts to sign, and the quantities to buy. Finally, payoffs realize.

We shall refer to the case in which the retailer buys from only one firm as *exclusive representation*, and to the case where he buys from both as *common representation*. Exclusive representation may emerge either when firms offer exclusive tariffs, or else when the tariffs are not exclusive but the retailer elects to buy from one firm only.

Distortionary pricing. With constant marginal costs, two-part tariffs in principle permit efficient profit extraction. In fact, with complete information and no market imperfections, firms would set marginal prices at cost and extract the profit by means of fixed fees only. As discussed in the introduction, however, such a pattern of pricing is no longer optimal in the presence of moral hazard, adverse selection, or other market imperfections. In these cases, firms may optimally choose to reduce the fixed fees and raise marginal prices above marginal costs.

For the time being, we capture this effect in a reduced-form way, assuming

[4] The assumption that each firm offers only a two-part tariff may be justified as in Rey and Tirole (1986). In the duopoly model, however, this assumption may create issues of equilibrium existence. To guarantee the existence of an equilibrium we shall therefore allow each firm to offer one tariff that applies in equilibrium and another tariff, which is never chosen by the buyer but serves to prevent deviations from the equilibrium.

that extracting rents by means of fixed fees creates deadweight losses. To be precise, we assume that with a lump-sum payment of F_i, the firm earns F_i but the retailer loses $(1+\mu)F_i$, with $\mu \geq 0$. For consistency with the more highly structured models developed later, we assume that the cost μ appears only when $F_i > 0$. This guarantees that lump-sum subsidies do not entail any benefit and hence will never be used.

In section 5, we shall show that this reduced-form model produces the same qualitative results as fully specified models of moral hazard and adverse selection. In fact, the parameter μ may capture also other imperfections that make utility not perfectly transferable.[5] The reduced-form model is agnostic about the exact source of the inefficiency: it focuses on the consequences rather than the causes of imperfect rent extraction.

Indirect payoff functions. In what follows, we shall use repeatedly indirect and semi-indirect payoff functions.

The retailer's *indirect* payoff function (gross of fixed fees) under common representation is

$$V^{CR}(p_1, p_2) = \max_{q_1 \geq 0, q_2 \geq 0} [u(q_1, q_2) - p_1 q_1 - p_2 q_2].$$

Under exclusive representation, it is simply $V^E(p_i) = \max_{q_i \geq 0}[u(q_i, 0) - p_i q_i] = V^{CR}(p_i, \infty)$.

The *semi-indirect* payoff function instead gives the highest payoff, gross of firm j's fixed fee and any payment to firm i, that the retailer can obtain with q_i units of good i given that he can then buy product j at price p_j:

$$v(q_i, p_j) = \max_{q_j \geq 0} \left[u(q_i, q_j) - p_j q_j\right].$$

[5] For example, if buyers are final consumers, they might underestimate future demand, as in Della Vigna and Malmendier (2004) and a rapidly growing body of related literature. In this case, the true expected gains from trade cannot be extracted by means of fixed fees because the perceived gains are lower than the true ones. As another example, buyers may be retailers or downstream firms that compete in linear prices in the downstream market, as in Ramezzana (2016) and Nocke and Rey (2018). In this case, a positive value of μ might capture the profits lost due to excessive competition among downstream firms facing efficient wholesale marginal prices. Such disruptive competition would instead be attenuated with distorted prices.

Under common representation, i.e. when $q_j > 0$, the function will be denoted by $v^{CR}(q_i, p_j)$. Under exclusive representation, i.e. when $q_j = 0$, the function reduces to

$$v^E(q_i) = u(q_i, 0).$$

Both functions $v^{CR}(q_i, p_j)$ and $v^E(q_i)$ are continuous, increasing up to a point, and concave.[6]

Let $v(q_i)$ denote any generic semi-indirect payoff function. The inverse demand for product i (i.e., the *residual demand*) is found by maximizing $v(q_i) - p_i q_i$, and is therefore $p_i = v_{q_i}(q_i)$. This implies a one-to-one correspondence between p_i and q_i, so marginal prices and quantities can be used interchangeably. We shall often use this fact below without an explicit reference.

3 Competitive fringe

We now analyze the implications of price distortions for exclusive dealing arrangements. We start from the competitive fringe model, which provides the simplest possible framework where the anticompetitive effects of the practice may be analyzed. The procompetitive effects, on the contrary, can arise in our setting only when the dominant firm's rivals are more concentrated and thus will be analyzed in the duopoly model of the next section.

Equilibrium. The competitive fringe always prices at cost, $p_2 = c$ and $F_2 = 0$, without imposing any exclusivity clause. Thus, the reservation payoff

[6] For $v^E(q_i)$, these properties follow immediately from the model's assumptions. For $v^{CR}(q_i, p_j)$, by the envelope theorem we have

$$v^{CR}_{q_i}(q_i, p_j) = u_{q_i}(q_i, q_j^*(q_i, p_j)) > 0,$$

where $q_j^*(q_i, p_j) = \arg\max_{q_j \geq 0} [u(q_i, q_j) - p_j q_j]$, and

$$v^{CR}_{q_i q_i}(q_i, p_j) = u_{q_i q_i}(q_i, q_j^*) - \frac{\left[u_{q_i q_j}(q_i, q_j^*)\right]^2}{u_{q_j q_j}(q_i, q_j^*)} < 0.$$

that the retailer can obtain by dealing only with the competitive fringe is $v^{CR}(0,c)$ (or, equivalently, $V^E(c)$).

The dominant firm maximizes its profit, $\Pi_1(q_1) = p_1 q_1 + F_1$, under the constraint that the retailer obtains at least his reservation payoff:

$$v(q_1) - p_1 q_1 - (1+\mu)F_1 \geq v^{CR}(0,c). \qquad (1)$$

Clearly, the participation constraint (1) must be binding at the optimum; if not, the firm could increase its fixed fee. Thus, keeping in mind that $p_1 = v_{q_1}(q_1)$, the dominant firm's profit may be rewritten as

$$\Pi_1(q_1) = \frac{1}{1+\mu}\left[v(q_1) - v^{CR}(0,c)\right] + \frac{\mu}{1+\mu} v_{q_1}(q_1) q_1. \qquad (2)$$

Expression (2) shows that the dominant firm's profit is a weighted average of its *marginal contribution* $v(q_1) - v^{CR}(0,c)$ and the *linear-pricing profit* $p_1 q_1$, with a relative weight of μ (recall that the marginal cost c_1 has been normalized to zero). The marginal contribution is the bilateral surplus created when the retailer trades with firm 1. Loosely speaking, the first term on the right-hand side of (2) is the profit that can be extracted by means of the fixed fee, the second is the profit extracted by means of a positive price-cost gap at the margin.

For simplicity, we assume that the profit function is strictly quasi-concave for $q_1 \leq \bar{q}_1$. (There is no loss of generality in restricting q_1 to range in the interval $[0, \bar{q}_1]$.) Thus, the solution to the dominant firm's profit maximization problem – and hence the equilibrium of the competitive fringe model – exists and is unique.

The solution has the following properties. First of all, in the limiting case $\mu = 0$, the profit function reduces to the marginal contribution. The optimal marginal price then equals the marginal cost, and the profit is extracted by means of the fixed fee only.

Second, as soon as $\mu > 0$, the firm complements the fixed fee with a positive price-cost margin as a means of profit extraction. This follows from the fact that the marginal contribution is maximized at $p_1 = 0$ whereas the linear-pricing profit is maximized at $p_1 > 0$. By the envelope theorem, starting from $p_1 = 0$, a small price increase has a second-order negative effect on the marginal contribution and a first-order positive effect on the linear-pricing profit. This implies that setting $p_1 > 0$ is profitable whenever $\mu > 0$.

Finally, the fixed fee is never negative.[7] The fixed fee may however vanish, and it will indeed always do so in the limit as $\mu \to \infty$. In this case, the profit is extracted by means of positive price-cost margins only.

Formulas (1) and (2), as well as the properties just mentioned, hold both with common and exclusive representation. The difference between the two cases is captured by the different specification of the semi-indirect payoff function $v(q_1)$: under common representation, this is $v^{CR}(q_1, c)$; under exclusive representation, it is $v^E(q_1)$.

Non-exclusive contracts. When exclusive contracts are prohibited, the semi-indirect payoff function $v(q_1, c) = \max[v^{CR}(q_1, c), v^E(q_1)]$ has two branches, with a kink corresponding to the limit quantity $q_1^{\lim}$ where the demand for product 2 vanishes. The solution to the dominant firm's pricing problem may then lie on either branch of the profit function, or at the kink. Accordingly, the equilibrium may take three forms: common representation, limit pricing, or monopoly:[8]

Proposition 1 *If exclusive dealing is prohibited, the equilibrium in the competitive fringe model is as follows:*

- *(common representation) when $c < c_{\lim}$, the dominant firm's tariff is $p_1^* = v_{q_1}^{CR}(q_1^*, c)$ and $F_1^* = \frac{v^{CR}(q_1^*,c) - v^{CR}(0,c)}{1+\mu}$, where the output level q_1^* is implicitly defined by*

$$v_{q_1}^{CR}(q_1^*, c) + \frac{\mu}{1+\mu} v_{q_1 q_1}^{CR}(q_1^*, c) q_1^* = 0; \tag{3}$$

[7] The reason for this is that if $F_1 < 0$, the profit function would reduce to the marginal contribution, as by assumption lump-sum subsidies do not entail any gain. But the maximization of the marginal contribution entails $p_1 = 0$ and $F_1 > 0$, a contradiction.

[8] To avoid well-known problems of equilibrium existence, we assume that the retailer has lexicographic preferences. That is, he maximizes his net payoff, but faced with alternatives that deliver the same payoff, he prefers common representation over dealing only with the dominant firm, and dealing with the dominant firm over dealing with the fringe (or with firm 2 in the duopoly model).

the fringe's output $q_2^* > 0$ *is implicitly given by the condition* $u_{q_2}(q_1^*, q_2^*) = c$*;*

- *(limit pricing) when* $c_{\lim} \leq c < c_{DRAS}$*, the dominant firm prices at* $p_1^{\lim} = v_{q_1}^{CR}(q_1^{\lim}, c)$ *and* $F_1^{\lim} = \frac{v^E(q_1^{\lim}) - v^{CR}(0,c)}{1+\mu}$*, where the limit quantity* $q_1^{\lim}$ *is implicitly defined by*

$$u_{q_2}(q_1^{\lim}, 0) = c,$$

  and the fringe is foreclosed $(q_2 = 0)$*;*

- *(monopoly) when* $c \geq c_{DRAS}$*, the dominant firm prices at* $p_1^M = v_{q_1}^E(q_1^M)$ *and* $F_1^M = \frac{v^E(q_1^M) - v^{CR}(0,c)}{1+\mu}$*, where the monopoly output level* q_1^M *is implicitly defined by*

$$v_{q_1}^E(q_1^M) + \frac{\mu}{1+\mu} v_{q_1 q_1}^E(q_1^M) q_1^M = 0, \tag{4}$$

  and the fringe is inactive $(q_2 = 0)$*.*

The thresholds $c_{\lim}$ and c_{DRAS} are such that q_1^* and q_1^M, respectively, coincide with $q_1^{\lim}$. Thus, we have $c_{DRAS} = u_{q_2}(q_1^M, 0)$, whereas $c_{\lim}$ may be defined by condition $c_{\lim} = u_{q_2}(q_1^*(c_{\lim}), 0)$, or, equivalently:

$$v_{q_1}^{CR}(q_1^{\lim}(c_{\lim}), c_{\lim}) + \frac{\mu}{1+\mu} v_{q_1 q_1}^{CR}(q_1^{\lim}(c_{\lim}), c_{\lim}) q_1^{\lim}(c_{\lim}) = 0. \tag{5}$$

Note that when $c \geq c_{DRAS}$, the competitive pressure exerted by the fringe is so weak that its only effect is to guarantee the retailer a reservation payoff of $v^{CR}(0, c)$. Since this is the same with and without exclusive dealing, there is nothing to gain by imposing exclusivity clauses. The analysis of exclusive dealing is therefore interesting only when $c < c_{DRAS}$.

Exclusive dealing. If exclusive contracts are permitted, the dominant firm can choose whether to offer an exclusive or a non-exclusive tariff.

If it offers an exclusive tariff, the equilibrium necessarily entails exclusive representation. The fringe, which is less efficient than the dominant firm, is always foreclosed. In expression (2), the relevant function becomes therefore $v^E(q_1)$. The equilibrium may take two forms, depending again on the size of the dominant firm's competitive advantage. When c is large, the dominant firm can set the marginal price at the monopoly level and adjust the fixed fee so as to ensure participation. When c is small, by contrast, the fixed fee vanishes and participation must be guaranteed by reducing the marginal price.

Proposition 2 *In any equilibrium with exclusive contracts, the competitive fringe is foreclosed. If $c > p_1^M$, the dominant firm charges the monopoly price p_1^M and a positive fixed fee $F_1^M = \frac{v^E(q_1^M) - v^{CR}(0,c)}{1+\mu}$. If instead $c \leq p_1^M$, the dominant firm just undercuts the fringe, setting $p_1 = c$ and $F_1 = 0$.*

Since p_1^M is a function of μ, which case applies depends not only on the competitive advantage c but also on the magnitude of the price distortions. In particular, when μ is small, q_1^M is close to the efficient level of output under exclusive representation. And since the dominant firm has a lower cost than the fringe, this implies that $v^E(q_1^M) - v^E_{q_1}(q_1^M)q_1^M > v^{CR}(0,c)$, thus allowing for a strictly positive fixed fee. But when μ gets larger, the monopoly output may become so small that $v^E(q_1^M) - v^E_{q_1}(q_1^M)q_1^M < v^{CR}(0,c)$. In this case, a negative fixed fee would be required to meet the participation constraint, but, as we have seen above, this cannot be optimal. The optimum is then given by $F_1 = 0$ and $p_1 = c$.

Profitability. We now compare the dominant firm's profit in the two regimes. The profitability of exclusive dealing depends on three factors: the magnitude of the price distortions, the dominant firm's competitive advantage, and the degree of product differentiation. We consider each of these factors in turn.

Price distortions. It is easy to confirm that when prices are not distorted ($\mu = 0$), exclusive dealing cannot be profitable and hence will never be adopted. Analytically, when $\mu = 0$ the dominant firm's profit reduces to its marginal contribution $v(q_1) - v^{CR}(0,c)$. Plainly, $v^{CR}(q_1,c) \geq v^E(q_1)$, reflecting the inefficiency of exclusive dealing due to the loss of product variety, and implying that exclusive dealing is never profitable.[9]

Things are different when marginal prices are distorted upwards ($\mu > 0$). In this case, part of the dominant firm's profit is extracted by means of a positive price-cost margin. Exclusive dealing then becomes beneficial in that it boosts the demand for the dominant firm's product. Analytically, this demand-enhancing effect is captured by inequality $v^E_{q_1}(q_1) > v^{CR}_{q_1}(q_1, c)$,[10] which holds because the goods are substitutes.

Can this effect make exclusive dealing profitable? The answer is affirmative as soon as prices are just minimally distorted:

Proposition 3 *For any arbitrarily small $\mu > 0$, there exists a non-empty left neighborhood of c_{DRAS} in which exclusive dealing is profitable.*

Competitive advantage. For any level of the price distortions, another key factor for the profitability of exclusive dealing is the size of the dominant firm's competitive advantage. Proposition 3 already suggests that profitability requires that the competitive advantage is sufficiently large. This is true, in fact, not only when μ is small but more generally.

This pattern will be demonstrated in section 3.4 with a linear demand specification, but the intuition is much more general. As we have seen above, the upside of exclusive dealing is that it boosts the demand for the dominant firm's product. The downside is twofold. First, exclusive dealing reduces product variety and hence the dominant firm's marginal contribution. This decreases the profits that can be extracted by means of the fixed fee. Second, and crucial for the intuition, profit extraction is constrained by the buyer's willingness to sign the exclusive contract, which requires that he obtains at least the reservation payoff $v^{CR}(0, c)$. Since the optimal fixed fee cannot be negative, this condition implies $p^E_1 \leq c$. When the competitive advantage c is small, this upper bound is tight, so there is little to be gained from

[9] This result was first noted and proved analytically by O'Brien and Shaffer (1997) and Bernheim and Whinston (1998).

[10] This inequality follows from the envelope theorem, which implies $v^{CR}_{q_1}(q_1, c) = u_{q_1}(q_1, q_2)$, and the assumption that $u_{q_1 q_2}(q_1, q_2) \leq 0$.

the increase in volumes. If instead c is large, there is more room for taking advantage of the boost in demand, and hence exclusive dealing can be profitable.

On a broader level, the reason why the profitability of exclusive dealing depends on the size of the competitive advantage is that exclusive dealing changes the nature of competition among the firms. Without exclusive contracts, firms compete for each marginal unit; with exclusive contracts, they compete for the entire volume demanded by a buyer. When the products are imperfect substitutes, the competition for marginal units is attenuated by product differentiation. The competition for exclusives, by contrast, is not, as it takes place in utility space where products are effectively homogeneous.

Whether the more intense competition benefits the dominant firm or not depends on the size of its competitive advantage. When c is small, product differentiation shelters the dominant firm against disruptive competition from the fringe. Exclusive dealing removes the protection and is therefore unprofitable. When instead c is large, product differentiation in fact protects the fringe, allowing it to maintain a positive market share even in the face of a substantially more efficient competitor. In this case, wiping out product differentiation allows the dominant firm to seize the competitive fringe's market niche, thereby increasing its profit.[11]

Product substitutability. Exclusive dealing is not profitable when the products are perfect substitutes, or when they are completely independent. In the

[11] These effects are clearest in the limiting case $\mu \to \infty$, where fixed fees are so costly that most of the profit is extracted by distorting the marginal price. In this case, the fact that exclusive dealing reduces the marginal contribution is inconsequential. But the marginal price cannot be greater than c. This immediately implies that when $c = 0$, the exclusive profit vanishes. Under common representation, by contrast, the dominant firm can take advantage of product differentiation to obtain a positive profit even if $c = 0$. Exclusive contracts are therefore unprofitable when $c = 0$, and by continuity this result will still hold when the competitive advantage is sufficiently small. On the other hand, it is easy to see that exclusive dealing is profitable if the dominant firm's competitive advantage is big enough. Most obviously, a sufficient condition for this is $c \geq p_1^M$. In this case, the upper bound on the exclusive price is not binding, and therefore the comparison between the exclusive and non-exclusive profits is entirely driven by the demand-enhancing effect. But condition $c \geq p_1^M$ is in fact far from necessary; as we shall see below, exclusive dealing can be profitable even if the exclusive price is constrained by the fringe's competitive pressure and hence must be set at c.

former case, the dominant firm must set $p_1 = c$ and $F_1 = 0$ both with and without exclusive contracts, and the fringe is foreclosed in both cases. When instead the products are completely independent, or just poor substitutes, the dominant firm enjoys a near monopoly even under common representation. Engaging in competition for the entire market can then only decrease its profit.

It is therefore for intermediate degrees of substitutability that exclusive dealing can be profitable.[12] In the linear demand example considered below, the profit gain indeed first increases and then decreases with the degree of product differentiation.

Welfare effects. When exclusive contracts are profitable, how do they affect the retailer and the final consumers? In the competitive fringe model, the dominant firm always extracts any rent in excess of the retailer's reservation payoff. Thus, the retailer always obtains exactly $v^{CR}(0, c)$, both with and without exclusive contracts.

To assess the impact of exclusive dealing on final consumers, however, a more relevant criterion may be the retailer's payoff *gross of the fixed fee*, as fixed fees are a fixed cost which as such may not be passed on to consumer prices. Using this criterion, it is easy to see that final consumers are always harmed by exclusive dealing. Under common representation, the retailer can always procure good 2 at marginal price c, and good 1 at a marginal price that never exceeds p_1^M. With exclusive dealing, instead, the retailer procures only good 1, at a marginal price of either c or p_1^M. Therefore, exclusive dealing generally reduces product variety without entailing any benefit in terms of wholesale marginal prices.[13]

In fact, when $c_{DRAS} > c > c_{\lim}$, exclusive dealing increases the dominant

[12] Things are different with increasing marginal costs, which, as is well known, may generate economic effects similar to those of product differentiation. This implies, in particular, that with increasing marginal costs exclusive dealing may be profitable even when the products are homogeneous. See, for instance, Calzolari and Denicolò (2020), which focuses on the case where firms face capacity constraints (an extreme form of increasing marginal costs).

[13] In terms of the indirect payoff functions, the above argument may be summarized as follows: $V^{CR}(p_1^{NE}, c) \geq V^{CR}(p_1^M, c) > V^E(c) \geq V^E(p_1^E)$.

firm's marginal price, from $p_1^{\lim}$ to p_1^M. This reflects the fact that exclusive dealing is a more efficient tool for foreclosing the fringe than limit pricing. In this case, final consumers are harmed in terms of higher prices (product variety being lost in all cases). For lower values of c, they may be harmed both in terms of higher prices and lower variety. And even when c is so small that the dominant firm's price decreases, the reduction is limited and cannot outweigh the loss of product variety.

Linear demand. To illustrate the effects discussed above, we work out the equilibrium for the simple case of a quadratic payoff function:

$$u(q_1, q_2) = (q_1 + q_2) - \frac{1}{2}\left(q_1^2 + q_2^2\right) - \gamma q_1 q_2, \tag{6}$$

which implies linear demand functions. Specifically, the demand for product 1 is

$$q_1^E = 1 - p_1$$

under exclusive representation, and

$$q_1^{CR} = \frac{1 - p_1 - \gamma(1 - p_2)}{1 - \gamma^2}$$

under common representation.

With no loss of generality, both the intercept and the slope of the exclusive demand curve have been normalized to one. The remaining parameter, γ, captures the degree of substitutability between the goods. It ranges from 0 (independent goods) to 1 (perfect substitutes).

It is straightforward to calculate the non-exclusive marginal price chosen by the dominant firm in a common representation equilibrium:

$$p_1^{NE} = \frac{\mu}{1 + 2\mu}\left[1 - (1 - c)\gamma\right],$$

and the associated fixed fee:

$$F_1^{NE} = \frac{(1 + \mu)\left[1 - (1 - c)\gamma\right]^2}{2(1 - \gamma^2)(1 + 2\mu)^2}.$$

One can verify that $p_1^{NE} \to 0$ as $\mu \to 0$, and $F_1^{NE} \to 0$ as $\mu \to \infty$. The above tariff however applies only as long as c is lower than

$$c_{\lim} = \frac{(1 - \gamma)[1 + \mu(2 + \gamma)]}{1 + \mu(2 - \gamma^2)},$$

a condition that guarantees that both quantities are strictly positive. When $c \geq c_{\lim}$, we have a limit pricing equilibrium with

$$p_1^{\lim} = 1 - \frac{1-c}{\gamma}$$

and

$$F_1^{\lim} = \frac{(1-\gamma^2)(1-c)^2}{2(1+\mu)\gamma^2}.$$

With exclusive contracts, the optimal marginal price is

$$p_1^E = \min\left[c, \frac{\mu}{1+2\mu}\right].$$

That is, the dominant firm either charges the monopoly price $p_1^M(\mu) = \frac{\mu}{1+2\mu}$ or undercuts the fringe – whichever leads to the lower marginal price. The corresponding fixed fee is

$$F_1^E = \max\left[0, \frac{\left(c - \frac{\mu}{1+2\mu}\right)\left(2 - c - \frac{\mu}{1+2\mu}\right)}{2(1+\mu)}\right].$$

[Figure 1 about here.

Caption of figure 1: Exclusive dealing is unprofitable for $c < c_{PROF}$ (the dark grey region), profitable for $c_{PROF} < c < c_{DRAS}$ (the light grey region), and irrelevant for $c \geq c_{DRAS}$.]

Comparing profits under exclusive dealing and common representation, we have:

Proposition 4 *With the quadratic payoff function* (6)*, for any value of* μ *there exist a lower and an upper threshold,* c_{PROF} *and* c_{DRAS}*, such that exclusive dealing is unprofitable for* $c < c_{PROF}$*, profitable for* $c_{PROF} < c < c_{DRAS}$*, and irrelevant for* $c \geq c_{DRAS}$*. Both* c_{DRAS} *and* c_{PROF} *converge to* $1-\gamma$ *as* $\mu \to 0$*, the limiting case in which exclusive dealing is never profitable.*

The curves c_{PROF} and c_{DRAS} are depicted in Figure 1.[14] The dominant firm engages in exclusive dealing in the region between these two curves. Exclusive dealing therefore tends to prevail when the dominant firm's competitive advantage is strong and the degree of product substitutability is large. An increase in μ, which widens price distortions, shifts the c_{PROF} curve down and the c_{DRAS} curve up. Thus, the stronger the price distortions, the larger the region where exclusive dealing will be observed.

[Figure 2 about here
Caption of figure 2: The dominant firm's percentage profit gain from exclusive dealing is inverted-U shaped in the degree of product substitutability γ. The percentage loss in consumers' welfare, by contrast, is overall decreasing in γ. The dashed vertical line on the right corresponds to the critical value of γ above which limit pricing arises. The figure has been drawn for $\mu = 6$ and $c = \frac{1}{3}$. The online Appendix shows how the figure changes as these parameters vary.]

Figure 2 illustrates the size of the profit gain, in percentage terms, as a function of the degree of product differentiation. Consistently with the above discussion, the profit gain is in fact negative when the products are poor substitutes and vanishes when the products are perfectly homogeneous. However, it is positive when the degree of product substitutability exceeds a critical threshold, being largest for intermediate degrees of product differentiation.

Figure 2 depicts also the welfare loss of final consumers, as measured by the percentage fall in the retailer's payoff gross of the fixed fees. (As discussed above, this variable may be taken as an index of the anticompetitive effects of exclusive dealing.) The welfare loss is largest when the products are poor substitutes and tends to decrease as γ increases. Like the profit gain, the welfare loss vanishes when the products are homogeneous: in this case, exclusive dealing is effectively neutral.

[14] The explicit formulas are cumbersome and are relegated to online Appendix 1.

4 Duopoly

To highlight the possible procompetitive effects of exclusive dealing, we now turn to a model where the dominant firm faces a single rival. With differentiated products, the rival will possess some market power, so in the common representation equilibrium prices are higher than in the competitive fringe model. This implies that exclusive dealing may now cause bigger price reductions. Whether this may offset the loss of product variety, is the issue we address in this section.

Non-exclusive contracts. We start from the benchmark case where exclusive contracts are prohibited. The analysis is now complicated by issues of equilibrium existence: under duopoly, a pure strategy equilibrium with common representation generally fails to exist when each firm offers only one two-part tariff.

The reason for this is as follows. In any candidate equilibrium with common representation, each firm i must set its fixed fee in such a way that the retailer's payoff equals his outside option. The outside option is the largest payoff that the retailer could get by refusing i's contract and dealing with firm j only. Denoting the payoff under common representation by κ^{CR} and that under exclusive representation with firm 1 and 2 by κ_1^E and κ_2^E, respectively, the preceding argument implies that $\kappa^{CR} = \kappa_1^E = \kappa_2^E$. Thus, in any candidate equilibrium, the retailer must be indifferent between dealing with both firms or with only either one. Furthermore, as we have seen above, when $\mu > 0$ firms must distort marginal prices upwards in any candidate equilibrium.

All of this implies that each firm i has a profitable deviation from any candidate equilibrium with common representation. The deviation consists of reducing its marginal price p_i by a positive but arbitrarily small amount. This price reduction increases κ_i^E more than κ^{CR},[15] implying that after the deviation the retailer will prefer to deal exclusively with the deviating firm

[15] By the envelope theorem, the effect of a small change in price on the retailer's payoff is equal to his demand, and we already know that for any given marginal price $q_i^E > q_i^{CR}$.

i. But this implies that the deviating firm's volumes increase by a discrete amount. And since the price-cost margin is positive, the price reduction, which can be arbitrarily small, must be profitable.[16]

This existence problem is a consequence of the assumption that each firm offers a single tariff. The problem disappears if firms are allowed to offer, along with the tariffs that are accepted in equilibrium, other tariffs that are destined not to be accepted but serve to prevent deviations to exclusivity.[17] In this section, we therefore assume that each firm offers one *actual* tariff, at which trade takes place, and one *barrage* tariff, which prevents deviations to exclusive representation.

This solves the problem of existence, as we shall confirm momentarily, but may create a multiplicity of equilibria. The multiplicity is caused by the fact that the barrage tariffs, which are destined not to be accepted, may be varied arbitrarily, at least to some extent. However, only the equilibrium fixed fees are indeterminate: the equilibrium marginal prices (and hence the equilibrium quantities) are pinned down uniquely. To the extent that fixed fees are not passed on to consumer prices, the multiplicity is therefore irrelevant for the welfare results.

At any rate, here we focus on the equilibrium where the actual fixed fees are largest – i.e., the equilibrium that is payoff dominant for the firms. Exclusive dealing is least likely to be profitable against this benchmark, which is therefore as conservative as possible. Moreover, the payoff-dominant equilibrium is "risk free," as it can be supported by barrage tariffs that, if accepted, would result in exactly the same profit as the actual equilibrium tariffs. In the other equilibria, the barrage tariffs are less profitable than the actual ones, exposing the firms to some strategic risk.

[16] This argument was first articulated by Inderst (2010).

[17] The equilibrium existence problem is related to the failure of the revelation principle with multiple principals (see e.g. McAfee, 1993), which implies that with complete information a simple take-it-or-leave-it offer does not suffice to characterize the equilibrium set. The idea that additional contracts must then be offered has been explored, among others, by Chiesa and Denicolò (2009), Rey and Whinston (2013), Ramezzana (2016) and Nocke and Rey (2018) in different settings.

Marginal prices. The marginal prices in a common representation equilibrium are determined as follows. Remember that $v^{CR}(q_i, p_j)$ is the indirect payoff function when the retailer can purchase product j at price p_j. As usual, the participation constraint must be binding and thus it implies

$$v^{CR}(q_i, p_j) - p_i q_i - (1 + \mu)(F_i + F_j) = \kappa_j^E,$$

where κ_j^E is the retailer's outside option. (Crucially, κ_j^E is now determined by firm j's barrage tariff. This implies that a small reduction in the actual marginal price p_j does not affect κ_j^E and thus does not trigger a switch to exclusive representation.) We can then solve for F_i and substitute into firm i's profit function to get

$$\Pi_i(q_i, p_j) = \frac{1}{1 + \mu} \left[v^{CR}(q_i, p_j) - c_i q_i - \kappa_j^E\right] + \frac{\mu}{1 + \mu} \pi_i(q_i, p_j) - F_j,$$

where $\pi_i(q_i, p_j) = (p_i - c_i)q_i$.

The profit-maximizing marginal price is $p_i = v_{q_i}^{CR}(q_i^*, p_j)$, where q_i^* maximizes $\Pi_i(q_i, p_j)$. Since in a common representation equilibrium the solution must be interior, it is given by the first-order condition

$$v_{q_i}^{CR}(q_i^*, p_j) + \frac{\mu}{1 + \mu} v_{q_i q_i}^{CR}(q_i^*, p_j) q_i = c_i. \tag{7}$$

The solution depends on p_j but not on F_j nor on κ_j^E, so we can write firm i's best response as $p_i = BR_i(p_j)$. In equilibrium, the marginal prices must be a fixed point of these best responses. We shall denote the fixed point by (p_1^*, p_2^*).[18] As usual, the marginal prices fully pin down the equilibrium quantities.

Like in the competitive fringe model, this common representation equilibrium is obtained when the dominant firm's competitive advantage is not too large ($c < c_{\lim}$, where $c_{\lim}$ is still given by (5)). If instead c is larger ($c_{DRAS} > c \geq c_{\lim}$), there is a limit pricing equilibrium where the dominant firm sets its marginal price at $p_1^{\lim}$. Firm 2 is foreclosed and hence prices

[18]Existence of the fixed point may be guaranteed by standard regularity conditions. Uniqueness is not necessary for our results but is implicitly assumed for ease of exposition.

at cost, setting $p_2 = c$ and $F_2 = 0$. The limit pricing equilibrium is therefore identical to that of the competitive fringe model and appears in the same range of parameter values. Like in the competitive fringe model, the dominant firm can engage in monopoly pricing if $c \geq c_{DRAS}$.

Fixed fees. While the limit-pricing equilibrium does not require barrage offers and is therefore unique,[19] the common representation outcome must be sustained by suitable barrage tariffs that prevent deviations to exclusive representation. These barrage tariffs are designed in such a way that should the retailer choose one such tariff, out of equilibrium, he would then prefer not to deal with the other firm. Thus, these tariffs generally involve low marginal prices and large fixed fees.

The equilibrium actual marginal prices (p_1^*, p_2^*), and hence the equilibrium quantities, do not depend on the barrage tariffs but the actual fixed fees do. As noted above, this creates a multiplicity of equilibria as the barrage tariffs, which are not taken in equilibrium, are to some extent arbitrary.

The following proposition characterizes the equilibrium that is payoff dominant for the upstream firms.

Proposition 5 *When each firm can offer one actual tariff and one barrage tariff, if $c < c_{\lim}$ there exists a common representation equilibrium where firms' profits are largest. The equilibrium actual tariffs are (p_i^*, F_i^*), where the marginal prices p_i^* are given by the intersection of the best responses* (7) *and the fixed fees F_i^* are implicitly determined by the conditions*

$$\begin{aligned} V^{CR}(p_1^*, p_2^*) - (1+\mu)(F_1^* + F_2^*) &= \kappa^* &(8)\\ p_1^* q_1^{CR}(p_1^*, p_2^*) + F_1^* &= \tilde{p}_1(\kappa^*) q_1^E(\tilde{p}_1(\kappa^*)) + \tilde{F}_1(\kappa^*) &(9)\\ (p_2^* - c)\, q_2^{CR}(p_1^*, p_2^*) + F_2^* &= [\tilde{p}_2(\kappa^*) - c]\, q_2^E(\tilde{p}_2(\kappa^*)) + \tilde{F}_2(\kappa^*) &(10)\end{aligned}$$

where $(\tilde{p}_i(\kappa), \tilde{F}_i(\kappa))$ is the solution to the following problem:

$$\begin{aligned} &\max_{p_i, F_i \geq 0} [(p_i - c_i) q_i^E(p_i) + F_i] \\ &s.t.\ V^E(p_i) - (1+\mu) F_i \geq \kappa \\ &V^{CR}(p_i, p_j^*) - (1+\mu)(F_i + F_j^*) \leq V^E(p_i) - (1+\mu) F_i. \end{aligned} \quad (11)$$

[19] The limit-pricing equilibrium already entails exclusive representation, so the dominant firm has no profitable deviation to exclusivity. Firm 2, in its turn, cannot do any better than standing ready to supply its product at cost.

The equilibrium barrage tariffs guarantee to the retailer a payoff of κ^* *under exclusive representation; for example, they could be* $\left(c, \frac{V^E(c)-\kappa^*}{1+\mu}\right)$ *for both firms.*

Intuitively, each of the two firms' barrage tariff pins down the retailer's payoff at κ^*. As a result, the retailer's payoff cannot be decreased unilaterally by any one of the firms. For any given κ^* and F_j^*, condition (8) then implies that firm i cannot increase its actual fixed fee F_i^*, as this would lead the retailer to switch to firm j's barrage tariff. Since the marginal prices must be (p_1^*, p_2^*), this implies that there are no profitable deviations to a different common representation outcome.

Conditions (9) and (10) guarantee that there are no deviations to exclusive representation either. The most profitable such deviation is the solution to problem (11),[20] but conditions (9)-(10) ensure that even the best deviation to exclusivity is no more profitable than the equilibrium actual tariff.

Notice that the barrage tariffs $\left(c, \frac{V^E(c)-\kappa^*}{1+\mu}\right)$ could in fact be replaced by $(\tilde{p}_i(\kappa^*), \tilde{F}_i(\kappa^*))$. Since the first constraint in problem (11) is always binding, these latter tariffs also guarantee a payoff of κ^* to the retailer. Now, conditions (9)-(10) ensure that the profit that firm i would make if tariff $(\tilde{p}_i(\kappa^*), \tilde{F}_i(\kappa^*))$ were accepted is exactly the same as its equilibrium profit, confirming that upstream firms need not be exposed to any risk when offering barrage tariffs.

This property, however, holds true only for the equilibrium that is payoff dominant for the firms. From the above discussion, it should be clear that other equilibria may exist, where the left-hand sides of (9), (10), or both, strictly exceed their respective right-hand sides. This would *a fortiori* ensure that there are no profitable deviations to exclusive representation,

[20] The first constraint in problem (11) says that the contract must be accepted by the retailer. Plainly, at the optimum this constraint must bind, so the retailer is just indifferent between taking the deviation tariff or sticking to the actual equilibrium ones. The second constraint requires that the deviation does indeed lead to exclusive representation – otherwise, we already know it could not be profitable. A third constraint is that the retailer must not prefer to take both firm i's deviation tariff and firm j's barrage tariff. However, it is easy to check that this further constraint never binds at the optimum and thus is redundant.

guaranteeing that we have an equilibrium. But in these equilibria, the fixed fees would be smaller. Besides, the barrage contracts that support these equilibria would be less profitable than the equilibrium actual tariffs. Offering these barrage tariffs would then inevitably entail some strategic risk.

Exclusive dealing. Against the (conservative) benchmark characterized by Proposition 5, suppose now that exclusive contracts are permitted. We consider first the case in which exclusive contracts are accepted in equilibrium, so that the equilibrium outcome is one of exclusive representation[21]. This is arguably the most relevant case for policy purposes, as antitrust cases are typically brought when exclusive dealing prevails in practice.

Such an exclusive representation equilibrium always exists when firms can offer exclusive tariffs. Furthermore, the exclusive representation equilibrium is unique and is exactly the same as in the competitive fringe model (Proposition 2). This follows from two simple remarks. First, when one firm offers an exclusive tariff, it is always a best response for the rival to offer an exclusive tariff as well. That is, there is nothing to gain by unilaterally offering a non-exclusive tariff. Second, under exclusive representation firms compete in *utility space*, where their products are effectively homogeneous. The standard Bertrand logic then implies that the dominant firm must win the competition for exclusives by undercutting its rival. The weaker firm, which is foreclosed, must stand ready to supply its product at competitive terms, $p_2 = c$ and $F_2 = 0$. The dominant firm then either charges the monopoly price p_1^M or else just undercuts the rival – whichever leads to the lower marginal price.

Comparison. Even though the exclusive representation equilibrium is exactly the same as in the competitive fringe model, the common representation benchmark is now less competitive. Therefore, while the economic effects at work are qualitatively the same, their magnitude is different, and therefore

[21] In subsection 4.4 below, we shall consider the possibility that exclusive tariffs are offered but are not accepted. Even if the resulting equilibria exhibit common representation, exclusive contracts are still not neutral.

the impact of exclusive dealing may change.

Obviously, the dominant firm's rival cannot gain from exclusive dealing, which invariably leads to its foreclosure. Perhaps less obviously, not only the retailer never loses from exclusive dealing, as in the competitive fringe model, but now he can actually gain. This follows from the fact that under exclusive dealing he gets $v^{CR}(0, c) = V^E(c)$, whereas under common representation his payoff is pinned down by the barrage contracts, which are less competitive than $p_2 = c$ and $F_2 = 0$ but, if accepted, also deny the retailer the benefits of product variety.

Whether the dominant firm gains or not from exclusive dealing depends again on the size of its competitive advantage. But now, the dominant firm may not be able to avoid an exclusive representation outcome even if it is not profitable. Indeed, if the rival offers only an exclusive tariff, the dominant firm cannot unilaterally escape from the cutthroat competition engendered by exclusive contracts. That is, firms may be caught in a prisoner's dilemma where each of them offers only an exclusive tariff even if this leads to lower prices and makes all of them worse off.

Another difference with the competitive fringe model is that when c is small, exclusive dealing may now benefit the final consumers. Of course exclusive representation entails a loss of variety, but this may now be more than offset by the lower prices. To show this, let us again proxy the welfare of final consumers by the retailer's payoff gross of the fixed fees, as discussed above. Consider the limiting case of symmetric firms with linear pricing, which is obtained for $c \to 0$ and $\mu \to \infty$. In this limiting case, the result follows from Beard and Stern (2008), who show that consumer surplus is higher when only one product is available but is priced at cost (as in the exclusive representation equilibrium) than when both products are available but firms exploit their market power by charging positive mark-ups (as in the common representation equilibrium).[22] By continuity, the result will continue to hold for c positive but small enough, provided that price distortions are

[22] Beard and Stern (2008) actually prove the result for the case of independent products, but the result extends to the case of imperfect substitutes.

sufficiently large.

Linear demand. The above results may be clearly demonstrated in the case of linear demand derived from the quadratic payoff function (6). In this case, the best response curves $p_i = BR_i(p_j)$ are linearly increasing, with a slope lower than one. This guarantees the existence of a unique pair of common representation marginal prices, which can be calculated as:

$$p_1^* = \frac{\mu(1-\gamma)}{1+\mu(2-\gamma)} + c\frac{\gamma\mu(1+\mu)}{(1+2\mu)^2 - \mu^2\gamma^2}$$
$$p_2^* = \frac{\mu(1-\gamma)}{1+\mu(2-\gamma)} + c\frac{(1+\mu)(1+2\mu)}{(1+2\mu)^2 - \mu^2\gamma^2}.$$

The actual fixed fees in the payoff-dominant equilibrium are too cumbersome to be reported here. They are reported in online Appendix 2, together with the barrage tariffs that sustain the equilibrium.

Comparing profits and consumers' welfare under exclusive dealing and common representation is then just a matter of calculation. We have:

Proposition 6 *With the quadratic payoff function* (6)*, for any value of* μ *there exist thresholds* c_{PROF}*,* c_{WELF} *and* c_{DRAS}*, such that exclusive dealing is: (i) unprofitable for* $c < c_{PROF}$ *and profitable for* $c_{PROF} < c < c_{DRAS}$*; (ii) welfare improving for* $c < c_{WELF}$ *and welfare decreasing for* $c_{WELF} < c < c_{DRAS}$*; (iii) irrelevant for* $c \geq c_{DRAS}$*. All of the thresholds converge to* $1-\gamma$ *as* $\mu \to 0$*.*

The explicit formulas for the thresholds are also relegated to online Appendix 2. The Appendix shows that an increase in μ widens price distortions and shifts the curves c_{PROF} and c_{WELF} down, and the curve c_{DRAS} up. Therefore, the stronger the price distortions, the larger the region where exclusive dealing is profitable and anticompetitive.

[Figure 3 about here.

Caption of figure 3: Exclusive dealing is an equilibrium for $c < c_{DRAS}$ (the grey region). It is unprofitable for both firms when $c < c_{PROF}$ (firms are caught here in a prisoner's dilemma), and profitable for the dominant firm when $c > c_{PROF}$. Above the c_{WELF} curve, exclusive dealing harms final consumers; below, it benefits them.]

A look at Figure 3 shows that the two thresholds c_{PROF} and c_{WELF} do not coincide. In particular, there exists a region where exclusive dealing is both profitable and welfare improving. However, this region is small and vanishes when μ is low. In most of the region where exclusive dealing is welfare improving, it is not profitable for the dominant firm. As discussed above, in this case firms are effectively caught in a prisoner's dilemma. This suggests that the procompetitive effects of exclusive dealing are essentially due to a lack of coordination among the firms.

Exclusive dealing as an out-of-equilibrium threat. The analysis above has shown that exclusive dealing is anticompetitive when c is large, procompetitive when c is small. However, these different effects may not seem both equally plausible. The anticompetitive effects arise when exclusive dealing is profitable for the dominant firm and weakens its competitor. In this case, competition produces winners and losers, and winners have little incentive to alter the outcome. The procompetitive effects, in contrast, arise because of a lack of coordination among the firms: both lose from the cutthroat competition created by exclusive contracts.

A skeptic might argue that such disruptive competition must in time tend to correct itself. For example, Mathewson and Winter (1987) posit that firms can commit, in a first stage of the game, to a type of contract. With this assumption, exclusive dealing would be observed only if it is profitable for the dominant firm, and hence, essentially, only if it is anticompetitive.

However, commitments are not easy to justify in one-shot pricing games, and coordination problems may not be that easy to solve. Nevertheless, some coordination may be possible even ruling out commitments. Specifically, suppose again that both firms offer two tariffs. When exclusive contracts are permitted, however, one tariff may be now exclusive and the other non-exclusive.[23]

Under this assumption, the exclusive representation equilibrium analyzed above continues to exist,[24] but common representation equilibria may now also appear. Essentially, in a common representation equilibrium, the exclusive tariffs are offered but are not accepted and thus serve the role of barrage tariffs: that is, they prevent deviations to exclusive representation.

This subsection analyzes the equilibria that emerge in this case. To preview the results, there are no substantial changes when exclusive dealing is profitable and anticompetitive. The procompetitive effects of exclusive dealing, by contrast, are less pronounced than in the previous analysis. However, they do not disappear, especially if the products are good substitutes.

Linear demand. Since firms offer tariffs that are destined not to be accepted, we have once again a multiplicity of equilibria. For consistency, we keep focusing on the equilibrium that is payoff dominant for the upstream firms. For ease of exposition, we focus on the case of linear demand functions generated by the quadratic payoff (6). The detailed analysis is relegated to online Appendix 3; here, we briefly report the main results.

To begin with, exclusive contracts are never neutral, in a twofold sense. First, for a range of parameter values, no common representation equilibrium exists, so the only equilibrium is the one with exclusive representation. Essentially, the dominant firm can unilaterally enforce exclusive representation, and it will do so when this is profitable.

Second, even when a common representation equilibrium does exist, as soon as $\mu > 0$, the equilibrium outcome is different from the one obtained when exclusive contracts are prohibited. The reason for this is that the deviations to exclusive representation may be more attractive than in the case where exclusive contracts are prohibited. Indeed, the deviating firm no

[23]This assumption captures also the common practice of *exclusivity discounts*, which could not be observed if firms offered one tariff only. An exclusivity discount indeed requires the combination of two tariffs: the reference (non-exclusive) tariff and a tariff with reduced prices that applies if the buyer does not purchase from competitors.

[24]If the non-exclusive tariffs are exorbitant, neither firm has a profitable deviation.

longer needs to design the deviation tariff in such a way that the retailer finds it optimal not to buy from the rival: it can just impose exclusivity by contract. Technically, the second constraint in problem (11), which always binds when exclusive contracts are prohibited, no longer applies when the deviation is to an exclusive contract. Since the temptation to deviate is stronger, upstream firms must leave to the retailer a bigger rent, reducing the tariffs they charge in equilibrium.[25] As a result, the equilibrium is more competitive than when exclusive contracts are prohibited.

For a range of parameter values, however, this effect impacts only the fixed fees and does not change the marginal prices, which remain p_i^*. In this case, exclusive contracts are *quasi-neutral* in that they do not affect the final consumers, at least to the extent that final prices depend only on wholesale marginal prices. This case arises, in particular, when the products are relatively poor substitutes.

When the products are closer substitutes, however, the effects of out-of-equilibrium exclusive contracts are more pervasive. The deviation to exclusive representation now becomes very attractive, as the business stealing effect is more pronounced. To prevent the deviation, the actual equilibrium tariff must then be reduced more strongly. But since lump-sum subsidies are never optimal, for a range of parameter values the only way to prevent the deviation is to reduce the marginal prices below p_i^*. In this case, exclusive contracts have a procompetitive effect even if they are not taken in equilibrium.

The comparison of the payoff-dominant equilibria with and without exclusive contracts, which is detailed in online Appendix 3, can be summarized as follows:

Proposition 7 *With the quadratic payoff function* (6), *for any value of* μ

[25] This follows from the fact that leaving some extra rent to the retailer is generally more costly under exclusive representation than under common representation. For example, decreasing F_i^* by ΔF_i^* lowers the left-hand side of (9) (resp., (10)) by the same amount. However, κ^* increases by $(1+\mu)\Delta F_i^*$. As a result, the right-hand side of (9) (resp., (10)) decreases by *at least* ΔF_i, and in fact by more than ΔF_i when the second constraint in problem (11) binds.

there exist two thresholds, γ_{QN} and c_{ED}. Common representation equilibria exist for $c \leq c_{ED}$, whereas only the exclusive representation equilibrium exists when $c > c_{ED}$. When common representation equilibria exist, if the products are poor substitutes ($\gamma \leq \gamma_{QN}$) there exists a common representation equilibrium where exclusive contracts are quasi-neutral; if instead the products are close substitutes ($\gamma > \gamma_{QN}$), in all common representation equilibria the marginal prices are lower than p_1^* and p_2^*. As μ tends to zero, both c_{ED} and γ_{QN} collapse to $1 - \gamma$.

The expressions for c_{ED} and γ_{QN}, as well as the new expressions for c_{PROF} and c_{WELF}, are reported in online Appendix 3. The curves are depicted in Figure 4.

[Figure 4 about here.

Caption of figure 4: With coordination, common representation occurs for $c \leq c_{ED}$ whereas only exclusive dealing equilibria exist for $c > c_{ED}$. Exclusive dealing benefits final consumers for $c < c_{WELF}$ and harms them for $c > c_{WELF}$. Exclusive dealing is profitable for the dominant firm for $c > c_{PROF}$ and unprofitable for $c < c_{PROF}$ (firms are caught in a prisoner's dilemma here). To the left of the γ_{QN} curve, the decrease in profit is caused by a reduction in the fixed fees only; to the right, marginal prices are also reduced.]

Summary of results. Summarizing, a general picture emerges from the analysis of the last two sections. First of all, exclusive contracts are of scarce relevance when the products are poor substitutes. In this case, exclusive dealing rarely arises in the competitive fringe model, while under duopoly the firms may manage to coordinate on an equilibrium in which exclusive contracts are not taken and do not affect marginal prices.

Second, when the products are perfect substitutes, exclusive dealing is neutral. Product 2 is supplied at cost, and the dominant firm just undercuts the rival(s), both with and without exclusive contracts.

Exclusive dealing is more relevant when the products are good, but not perfect, substitutes. In this case, the effects of exclusive dealing depend on the size of the dominant firm's competitive advantage c. When c is large, exclusive dealing is profitable for the dominant firm, which will therefore engage in the practice irrespective of whether rivals are fragmented or concentrated. Under both market structures, the outcome is likely to be anticompetitive.

When instead c is small, exclusive dealing is not profitable. In the competitive fringe model, this implies that exclusive dealing arrangements will not be observed. Under duopoly, by contrast, firms may get trapped in a prisoner's dilemma where they all lose whereas final consumers gain, and exclusive contracts are therefore procompetitive. With more contractual flexibility, firms may instead coordinate on common representation equilibria where profit losses are lower. However, the possibility of offering exclusive contracts still exerts negative effects on equilibrium prices and profits.

5 Endogenous price distortions

So far we have simply assumed that fixed fees entail deadweight losses, without modeling the precise reason why this is so. In this section, we analyze a fully fledged model of price competition with uncertain demand that provides micro-foundations for the reduced form model. The analysis shows that the moral hazard model of Bernheim and Whinston (1998) and the adverse selection model of Calzolari and Denicolò (2013, 2015) represent, in fact, different versions of the same theory. The same is true for the model of linear pricing originally studied by Mathewson and Winter (1987). In all of these models, the key factor is the upwards distortion in the marginal prices.

Model assumptions. The model is identical to that presented in section 2, except that demand is now stochastic. We capture demand uncertainty by assuming that the retailer's gross profit is now $U(Q_1, Q_2, \theta)$, where Q_i is the quantity of good i and the stochastic variable θ represents the state of demand. It is distributed over the support $(\underline{\theta}, \bar{\theta})$ according to a distribution function $G(\theta)$ with positive, finite density $g(\theta) > 0$.

Following Bernheim and Whinston (1998, sect. V), demand uncertainty is assumed to be multiplicative. This requires that $U(Q_1, Q_2, \theta)$ be homogeneous of degree one, so one can write $U(Q_1, Q_2, \theta) = \theta u(q_1, q_2)$, where $q_i \equiv \frac{Q_i}{\theta}$ and $u(q_1, q_2) \equiv U\left(\frac{Q_1}{\theta}, \frac{Q_2}{\theta}, 1\right)$. With no further loss of generality, the average value of θ is normalized to 1: $\int_{\underline{\theta}}^{\bar{\theta}} \theta g(\theta) d\theta = 1$. The function $u(q_1, q_2)$ can then be thought of as the retailer's average payoff. The deterministic model analyzed so far can be re-obtained assuming a degenerate distribution function $G(\theta)$ where all the probability mass is concentrated at $\theta = 1$.

With these assumptions, one can further specify the model as one of moral hazard (as Bernheim and Whinston do) or adverse selection, depending on the informational assumptions made. In all cases, upstream firms are assumed to be risk neutral and to maximize expected profits

$$\Pi_i = \int_{\underline{\theta}}^{\bar{\theta}} \theta(p_i - c_i) q_i g(\theta) d\theta + F_i. \tag{12}$$

Moral hazard. Bernheim and Whinston (1998) posit that the state of demand θ is unknown to all players at the contracting stage but is revealed to the retailer before actual quantities are chosen. The retailer therefore chooses which contracts to sign before observing θ, and the quantities Q_1 and Q_2 after. The retailer is risk averse and θ is not contractible (only quantities are), so we have a problem of moral hazard.

Bernheim and Whinston propose this model in order to provide rigorous theoretical foundations for the view that exclusive dealing may be an efficient contractual device. They highlight this possibility by looking at the extreme case in which the products are perfect substitutes. In this case, when exclusive dealing is prohibited, firms price competitively, setting marginal prices at cost, and fixed fees at zero. The rent left to the buyer is however uncertain, as it depends on the state of demand θ. With a Constant Absolute Risk Aversion (CARA) utility function, as Bernheim and Whinston assume, it would be efficient to insure the retailer against demand shocks. In principle, this could be done by setting marginal prices above marginal costs and fixed fees below zero (i.e., lump-sum subsidies). In the absence of exclusivity clauses, however, such lump-sum subsidies cannot be offered, as the retailer could pocket the subsidy offered by one firm and purchase the product from the other. Exclusive dealing prevents this opportunistic behavior, and thus can improve efficiency in the provision of insurance.

Risk aversion however implies that upstream firms distort marginal prices upwards even when the products are imperfect substitutes and hence firms have some market power. This creates others, less benign reasons for offering exclusive contracts, which we have analyzed in the reduced-form model.[26] In order to abstract from Bernheim and Whinston's pro-efficiency effect and highlight the other consequences of the upwards distortion in marginal prices, we replace their CARA utility function with a piecewise linear one, with a kink at the origin. With this specification, the retailer is risk neutral both in the region of monetary gains and in the region of monetary losses but dislikes losses more than he likes gains. This rules out the possibility that lump-sum subsidies may be optimal,[27] eliminating the effect discussed by Bernheim and Whinston (1998). Still, exclusive contracts are not neutral.

To show this, normalize to one the slope of the utility function in the region of gains, and denote its slope in the region of losses by $1 + \lambda$, so that the parameter $\lambda \geq 0$ measures the degree of risk (loss) aversion. The retailer's *ex ante* expected payoff then is

$$(1+\lambda)\int_{\underline{\theta}}^{\hat{\theta}} \Pi_R(\theta)g(\theta)d\theta + \int_{\hat{\theta}}^{\bar{\theta}} \Pi_R(\theta)g(\theta)d\theta, \tag{13}$$

where $\Pi_R(\theta)$ denotes the retailer's *ex post* payoff, net of any payment to the firms, as a function of the state of demand θ. The cut-off $\hat{\theta}$ corresponds to

[26] Bernheim and Whinston do not uncover these effects as they restrict attention to the two extreme cases of perfect substitutes or independent products, where exclusive dealing has no impact on the intensity of competition.

[27] Risk aversion still creates a demand for insurance that upstream firms meet by decreasing their fixed fees. However, as soon as the fixed fees vanish, the retailer is guaranteed to stay in the region of gains, where he is effectively risk neutral and thus demands no more insurance. (Retailer's fixed costs could be easily accommodated by suitably adjusting the position of the kink in the utility function.)

$\Pi_R(\hat{\theta}) = 0$; if $\Pi_R(\theta)$ is always positive, or negative, then (13) applies with $\hat{\theta} = \underline{\theta}$, or $\hat{\theta} = \bar{\theta}$. Note that in spite of its behavioral flavor, equation (13) is fully consistent with expected utility theory. To avoid uninteresting cases in which the retailer always ends up in the region of gains, and hence is effectively risk neutral, in the analysis of this model we shall set $\underline{\theta} = 0$.

To fix ideas, let us focus on the competitive fringe model. (With minimal changes, the analysis applies also to the case of duopoly.) Since the competitive fringe always prices at cost, $p_2 = c$ and $F_2 = 0$, the retailer's reservation payoff, which is the expected utility that he can obtain by dealing with the fringe only, is $v^{CR}(0, c)$.[28] To guarantee retailer's participation, the dominant firm must then meet the following constraint:

$$\begin{gathered}(1+\lambda) \int_0^{\hat{\theta}} \{\theta\,[v(q_1) - v_{q_1}(q_1)q_1] - F_1\}\, g(\theta)d\theta + \\ + \int_{\hat{\theta}}^{\bar{\theta}} \{\theta\,[v(q_1) - v_{q_1}(q_1)q_1] - F_1\}\, g(\theta)d\theta \geq v^{CR}(0, c),\end{gathered}$$

where the cut-off $\hat{\theta}$ is

$$\hat{\theta} = \frac{F_1}{v(q_1) - v_{q_1}(q_1)q_1}$$

if $\frac{F_1}{v(q_1) - v_{q_1}(q_1)q_1} \in (0, \bar{\theta})$; otherwise, $\hat{\theta}$ is either 0 or $\bar{\theta}$.

Since the participation constraint must bind in equilibrium, solving for F_1, substituting back into (12). and rearranging, one gets

$$\Pi(q_1) = (1-\alpha)\left[v(q_1) - (1-\chi)v^{CR}(0, c)\right] + \alpha v_{q_1}(q_1)q_1, \tag{14}$$

where $\alpha = 1 - \frac{1+\lambda\Theta(\hat{\theta})}{1+\lambda G(\hat{\theta})}$, $\Theta(\hat{\theta}) \equiv \int_0^{\hat{\theta}} \theta g(\theta)d\theta$, and $\chi = \frac{\lambda\Theta(\hat{\theta})}{1+\lambda\Theta(\hat{\theta})}$.

Expression (14) is clearly reminiscent of (2) in that the dominant firm's profit is still a weighted average of its "marginal contribution" and the linear-pricing profit. However, there are two differences. First, the relative weight α is now endogenous. Second, the marginal contribution is $v(q_1) - (1 - \chi)v^{CR}(0, c)$ as the outside option $v^{CR}(0, c)$ is adjusted to account for risk aversion. The adjustment factor collapses to one when $\lambda = 0$ (the retailer is risk neutral) or $\hat{\theta} = 0$ (the retailer is always in the region of gains): in these cases, no adjustment is needed.

[28] Since $F_2 = 0$, a retailer who buys only from the fringe is guaranteed to always be in the region of gains. Therefore, his expected utility equals his expected payoff.

In spite of these differences, the variable α plays the same role as μ in the reduced form model. In the limiting case $\alpha = 0$, which is obtained under risk neutrality ($\lambda = 0$), the optimal marginal price p_1 equals the marginal cost, and the profit is extracted by means of the fixed fee only. When instead $\alpha = 1$, i.e. under infinite risk aversion ($\lambda \to \infty$), the fixed fee vanishes, and the profit is extracted by means of positive price-cost margins only. For intermediate degrees of risk aversion, the firm complements fixed fees with positive price-cost margins as a means of profit extraction, exactly as in the reduced-form model.

Proposition 8 *For any finite $\lambda > 0$, both the optimal fixed fee and the optimal price-cost margin are positive: $F_1 > 0$ and $p_1 > 0$.*

The upwards distortion in the marginal price was noted by Rey and Tirole (1986) and Bernheim and Whinston (1998); a similar result can also be found in Png and Wang (2010).[29] The intuition is that relying exclusively on the fixed fee as a means of rent extraction exposes the retailer to the risk of making large payments even if demand turns out to be low. To reduce the risk, the upstream firm lowers its fixed fee and distorts its marginal price upwards.

The endogeneity of the weight α complicates the analysis, but for the quadratic payoff function (6) the moral hazard model can be solved explicitly, as we do in online Appendix 4. The analysis shows that the qualitative results are identical to those of the reduced-form model.

Adverse selection. In the adverse selection specification of the model, the retailer knows the state of demand θ at the contracting stage whereas upstream firms do not. The retailer then chooses both which contracts to sign and the volumes to purchase knowing θ, and thus he maximizes $\Pi_R(\theta)$ pointwise. As a result, his attitude towards risk is now irrelevant.

[29] To be precise, Png and Wang show that the result holds as long as the total and the marginal payoffs are positively correlated. The assumption of multiplicative uncertainty guarantees that this is always true in our model.

The resulting model is similar to that analyzed by Calzolari and Denicolò (2013, 2015), with two main differences. First, they allow firms to offer *menus* of two-part tariffs, which gives plenty of scope for price discrimination. Their detailed analysis of the optimal screening of buyers may suggest that exclusive dealing should be viewed, in an adverse selection framework, mainly as a means to better price discriminate. But in fact, in their framework exclusive dealing serves essentially to boost the demand for the dominant firm's product; price discrimination is a secondary factor. Our focus on two-part tariffs, which reduces the scope for price discrimination as far as this is possible in this class of models, helps clarify this point.

Second, they assume that uncertainty is so high that for low realizations of demand the retailer does not buy in equilibrium. Here instead we consider also the case of limited uncertainty, where the retailer always buys. This allows us to clarify that even minimal price distortions may suffice to generate the effects of interest. (Price distortions are small precisely when uncertainty is limited.)

To proceed, let us start precisely from the case where $\underline{\theta}$ is sufficiently close to $\bar{\theta}$ that the market is covered, meaning that it is optimal to have the retailer sign the dominant firm's contract in all states of demand. In this case, the participation constraint is:

$$\underline{\theta}\left[v(q_1) - v_{q_1}(q_1)q_1\right] - F_1 = \underline{\theta}v^{CR}(0, c).$$

Solving for F_1 and substituting into (12) one gets

$$\Pi(q_1) = \underline{\theta}\left[v(q_1) - v^{CR}(0, c)\right] + (1 - \underline{\theta})v_{q_1}(q_1)q_1. \tag{15}$$

The profit is again a weighted average of the marginal contribution and the linear-pricing profit. The weights are constant, exactly as in the reduced-form model. In particular, the reduced-form model is re-obtained for $\mu = \frac{1-\underline{\theta}}{\underline{\theta}}$.

The case of an uncovered market can be treated in a similar way. An expression similar to (15) is obtained, but the weight are now endogenous, as in the moral hazard model.[30]

[30] Denote by $\hat{\theta}$ the marginal retailer, i.e. the lowest state of demand for which the retailer

Both with covered and uncovered market, when uncertainty vanishes, i.e. for $\underline{\theta} = \bar{\theta}(= 1)$, the profit reduces to the marginal contribution, so the rent is extracted by means of the fixed fee only. But as soon as there is some uncertainty, $\underline{\theta} < 1 < \bar{\theta}$, the weight of the linear-pricing profit becomes positive. As a result, the marginal price is distorted upwards, and the fixed fee is correspondingly reduced.

Proposition 9 *For any $\underline{\theta} < \bar{\theta}$, in the adverse selection model the optimal fixed fee is non-negative and the optimal price-cost margin is positive: $F_1 \geq 0$ and $p_1 > 0$.*

The distortion in the marginal price is a familiar property of models of adverse selection. Intuitively, a firm that relies exclusively on the fixed fee maximizes the surplus extracted from the retailer when demand is lowest ($\theta = \underline{\theta}$), but leaves him too much rent in higher demand states. Distorting marginal prices upwards (and hence quantities downwards) reduces the rent that is left to infra-marginal retailers.

6 Conclusion

In this article, we have analyzed exclusive dealing when firms compete in two-part tariffs. We have focused on product market competition, abstracting from any possible effect on entry, exit, investments, or other strategic choices. Crucially, we have allowed for market imperfections that make it optimal for firms to distort marginal prices upwards.

purchases a positive amount of good 1; it is implicitly defined by the condition:

$$\hat{\theta}\left[v(q_1) - v_{q_1}(q_1)q_1\right] - F_1 = \hat{\theta}v^{CR}(0, c).$$

Solving for F and substituting into (12) one now gets

$$\Pi(q_1) = \beta\left[v(q_1) - v^{CR}(0, c)\right] + \gamma v_{q_1}(q_1)q_1,$$

where $\beta = \hat{\theta}\left[1 - G(\hat{\theta})\right]$ and $\gamma = \int_{\hat{\theta}}^{\bar{\theta}} \theta g(\theta)d\theta - \beta$. If $\hat{\theta} = \underline{\theta}$, we re-obtain formula (15). When instead $\hat{\theta} > \underline{\theta}$, the weights β and γ add up to less than one. This reflects the profit lost because the retailer is inefficiently excluded in low states of demand. The weights are again endogenous, as in the moral hazard model. Proposition 9 applies irrespective of whether the market is covered or uncovered.

In this framework, the effects of exclusive dealing depend on the size of the dominant firm's competitive advantage. When it is weak, exclusive dealing reduces profits and increases consumers' welfare; when it is strong, exclusive dealing is profitable for the dominant firm and harms both rivals and final consumers.

The analysis has both policy and methodological implications. In terms of policy, it provides a theory of harm that antitrust authorities can apply in the analysis of exclusive dealing cases. The mechanism through which exclusive dealing produces anticompetitive effects is simply that it boosts the demand for the dominant firm's product and steals the rivals' business. Consumers may be harmed in terms of higher prices, reduced variety, or both.

Importantly, all of these effects are direct. Most alternative theories, by contrast, are based on the notion that exclusive dealing can be profitable only indirectly, by weakening rivals and allowing the dominant firm to gain in the future, or in adjacent markets. These theories of harm follow the same profit sacrifice/recoupment logic as is commonly adopted in cases of predation. Hence, they imply that policy should weight the immediate social benefits from the allegedly anticompetitive practice against the future costs. The latter, however, may be difficult to assess as they may not have materialized yet.

Our theory of harm does not require speculating on future social costs. However, agencies and the courts must keep in mind the possibility that exclusive dealing may benefit consumers by intensifying the competition among the firms. This possibility arises when the dominant firm's competitive advantage over its rivals is small. Assessing whether this is so may be difficult but not impossible, as the size of the competitive advantage correlates with observable variables, such as for instance profits or market shares.

In terms of methodology, the article provides tools for the analysis of optimal pricing when trade is non-anonymous, which is normally the case in vertical relations. In principle, with non-anonymous trade, sellers who possess market power could extract their profit efficiently by means of fixed fees. But then many problems that are commonly perceived as real, such as for instance double marginalization, or royalty stacking in the licensing of complementary patents, would disappear. To analyze these problems, economists often restrict firms to linear pricing, which is clearly *ad hoc.* The reduced-form approach presented in this article offers a more rigorous and yet analytically tractable alternative, which may prove useful in the analysis of other problems in the economics of vertical relations.

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APPENDIX

Proof of Proposition 1. When exclusive contracts are prohibited, the semi-indirect payoff function $v(q_1, c) = \max[v^{CR}(q_1, c), v^E(q_1)]$ has two branches, with a kink in between. The profit function (2) clearly inherits the same property. The kink in both functions occurs at $q_1 = q_1^{\lim}$, where $q_1^{\lim}$ is the lowest q_1 such that $\arg\max_{q_2 \geq 0} [u(q_1, q_2) - cq_2] = 0$ and thus is implicitly defined by the condition that $u_{q_2}(q_1^{\lim}, 0) = c$. If this equation does not have a solution, define $q_1^{\lim}(c) = \infty$. However, for c large enough a finite solution exists by the assumptions of a finite choke price and strict substitutability.

The solution to the dominant firm's pricing problem may then lie on either branch of the profit function, or at the kink. The common representation equilibrium arises when the maximum is attained to the left of the kink, where $v = v^{CR}(q_1, c)$. The maximum is then implicitly defined by condition (3).

This is an equilibrium when $q_1^* < q_1^{\lim}$. Note that $c_{\lim}$ is by definition a value of c that makes q_1^* equal to $q_1^{\lim}$ (see condition (5)). Existence of $c_{\lim}$ follows from the continuity of the left-hand side of (5) and the observation that $q_1^* \geq q_1^{\lim} = 0$ for $c = \bar{p}_2$ and $q_1^* \leq \bar{q}_1 \leq q_1^{\lim}$ for $c = 0$. Since $q_1 = q_1^{\lim}$ implies $q_2 = 0$, by the strict quasi-concavity of the profit function, $c_{\lim}$ is unique. It then follows immediately that inequality $q_1^* < q_1^{\lim}$ is equivalent to $c < c_{\lim}$. In this region, we have therefore the common representation equilibrium.

The monopoly equilibrium arises instead when the maximum of (2) is attained to the right of the kink, where $v = v^E(q_i)$. The maximum is now implicitly defined by (4). This solution applies when c is sufficiently large that $q_1^M \geq q_1^{\lim}$. Since $q_1^{\lim}$ is decreasing in c whereas q_1^M does not depend on c, this condition is equivalent to $c \geq c_{DRAS} \equiv u_{q_2}(q_1^M, 0)$.

For intermediate values of the competitive advantage, i.e. $c_{\lim} \leq c < c_{DRAS}$, we have $q_1^* \geq q_1^{\lim} \geq q_1^M$. By the strict quasi-concavity of the profit function, it follows that the function is increasing to the left of the kink and decreasing to its right, so the optimum is achieved exactly at the kink: $q_1 = q_1^{\lim}$. ■

Proof of Proposition 2. The dominant firm maximizes its profit

$$\Pi_1(q_1) = \frac{1}{1+\mu}\left[v^E(q_1) - v^{CR}(0,c)\right] + \frac{\mu}{1+\mu} v^E_{q_1}(q_1)q_1.$$

This expression, however, holds only as long as $F_1 \geq 0$. By assumption, the deadweight loss μ disappears when $F_1 < 0$; in other words, lump-sum subsidies do not entail any benefit. Clearly, condition $F_1 \geq 0$ is equivalent to $v^E(q_1) - v^E_{q_1}(q_1)q_1 - v^{CR}(0,c) \geq 0$. When this inequality is reversed, the profit function becomes $\Pi_1(q_1) = v^E(q_1) - v^{CR}(0,c)$.

When $c \geq p_1^M(\mu)$, we have $v^E(q_1^M) - v^E_{q_1}(q_1^M)q_1^M \geq v^{CR}(0,c)$. The fixed fee is then non negative, and hence the optimum is achieved at the monopoly output q_1^M.

If instead $c < p_1^M(\mu)$, we have $v^E(q_1^M) - v^E_{q_1}(q_1^M)q_1^M < v^{CR}(0,c)$, which implies that at the monopoly output the fixed fee would be negative. But this is not possible, as we have shown in the main text. It follows that the dominant firm must set $p_1 = c$ and $F_1 = 0$. ■

Proof of Proposition 3. First of all, note that exclusive dealing is always profitable when $c^{\lim} \leq c < c_{DRAS}$. The reason for this is that in this region the semi-indirect payoff function is $v^E(q_1)$ both with and without exclusive dealing clauses. With non exclusive contracts, however, the price is bounded above by $p_1^{\lim}$, whereas under exclusive dealing it is not. Plainly, the unconstrained solution must be strictly better than the constrained one.

It remains to show that the interval $c_{DRAS} > c \geq c^{\lim}$ is non-empty as soon as $\mu > 0$. From the definitions it follows that inequality $c_{DRAS} > c^{\lim}$ is equivalent to $q_1^{\lim} > q_1^M$. So we must show that for $c < c_{DRAS}$, inequality $q_1^{\lim} \geq q_1^M$ is strict as soon as $\mu > 0$.

To show this, note that condition (4) may be rewritten as

$$u_{q_1}(q_1^M, 0) + \frac{\mu}{1+\mu}\left[u_{q_1 q_1}(q_1^M, 0)\right] q_1^M = 0,$$

whereas condition (3), evaluated at $q_1^* = q_1^{\lim}$ and using the properties of the semi-indirect payoff function (footnote 6), becomes

$$u_{q_1}(q_1^{\lim},0)+\frac{\mu}{1+\mu}\left[u_{q_1q_1}(q_1^{\lim},0)-\frac{u_{q_1q_2}(q_1^{\lim},0)\ \ u_{q_2q_1}(q_1^{\lim},0)}{u_{q_2q_2}(q_1^{\lim},0)}\right]q_1^{\lim}=0.$$

It follows that for $\mu=0$, we have $q_1^M=q_1^{\lim}$, as only the first term on the left-hand sides of the two equation counts, and that term is identical. However, as soon as $\mu>0$ the second term on the left-hand sides matters. Since this term is greater in the second equation than in the first, by the strict concavity of the retailer's payoff function, we must have $q_1^{\lim}>q_1^M$. This completes the proof of the proposition. ■

Proof of Proposition 4. See online Appendix 1. ■

Proof of Proposition 5. First of all, notice that if there exists a value of F such that

$$\begin{aligned}&p_1^*q_1^{CR}(p_1^*,p_2^*)+(p_2^*-c)\,q_2^{CR}(p_1^*,p_2^*)+F=\\&\tilde{p}_1(\kappa)q_1^E(\tilde{p}_1(\kappa))+[\tilde{p}_2(\kappa)-c]\,q_2^E(\tilde{p}_2(\kappa))+\tilde{F}_1(\kappa)+\tilde{F}_2(\kappa)\end{aligned}\tag{A1}$$

for

$$\kappa=v(p_1^*,p_2^*)-(1+\mu)F$$

then there exists a triple (κ^*,F_1^*,F_2^*) that solves system (8)-(10). The reason for this is that equation (9) depends only on F_1^* and (10) only on F_2^*, so it is always possible to split the aggregate fixed fee F into two parts F_1^* and F_2^* such that both (9) and (10) separately but simultaneously hold.

To prove the existence of a solution to (A1), consider first the case in which the fixed fees are such that, at the equilibrium actual tariffs, the retailer is indifferent between dealing with both firms or with only either one. That is

$$v(p_1^*,p_2^*)-(1+\mu)(\bar{F}_1+\bar{F}_2)=v^E(p_1^*)-(1+\mu)\bar{F}_1=v^E(p_2^*)-(1+\mu)\bar{F}_2.$$

Then we know that both firms have a profitable deviation to exclusive representation, which is to reduce p_i^* slightly without changing F_i. As argued in the main text, this is more profitable than tariff $(p_i^*,\bar{F}_i)$ as it induces the retailer to increase the purchases of product i by a discrete amount. This implies that when $\bar{F} = \bar{F}_1 + \bar{F}_2$ and $\underline{\kappa} = v(p_1^*, p_2^*) - (1+\mu)(\bar{F}_1 + \bar{F}_2)$, the left-hand side of (A1) is strictly lower than the right-hand side.

Next, let us decrease F, and hence increase $\kappa = v(p_1^*, p_2^*) - (1+\mu)F$, down to the point where $\kappa = v^E(0)$ (if $v(p_1^*, p_2^*) \geq v^E(0)$) or to $F = 0$ (if $v(p_1^*, p_2^*) < v^E(0)$). In the former case, the right-hand side of (A1) vanishes and thus is strictly lower than the left-hand side. In the latter case, the second constraint in problem (11) implies that $\tilde{p}_i$ must be set at $p_i^{\lim}(p_j^*)$, which is defined as $u_{q_i}(q_i^{\lim}(p_j^*), 0)$ where $q_i^{\lim}(p_j^*)$ is implicitly given by the condition $u_{q_j}(q_i^{\lim}(p_j^*), 0) = p_j^*$. But for both firms, the profit associated with this limit price must be lower than the common representation profit, as the latter is maximized at p_i^* (given p_j^*) and the profit function is by assumption strictly quasi-concave. Thus, when $F = 0$ the right-hand side of (A1) must be strictly lower than the left-hand side.

By the mean value theorem we can then conclude that there exists a value of F such that (A1) holds, and hence that there exists a triple (κ^*, F_1^*, F_2^*) that solves system (12)-(14).

It remains to show that the actual tariffs (p_i^*, F_i^*) and the barrage tariffs $\left(0, \frac{V^E(0)-\kappa^*}{1+\mu}\right)$ are a payoff dominant equilibrium when $c < c_{\lim}$. The proof follows the logic sketched in the main text. We must show that the retailer takes the actual tariffs rather than the barrage tariffs, and that no firm has any profitable deviation.

That the retailer takes the actual tariffs is guaranteed by our tie-breaking rule (see footnote 8).

As for the upstream firms, there are two types of possible deviations: deviations that still lead to a common representation outcome, and deviations that lead to an exclusive representation outcome. By construction, the most profitable deviation that would lead to exclusive representation is less profitable than the equilibrium actual tariff, so there are no deviation to exclusive representation. As for deviations to a different common representation outcome, the analysis in the main text shows that any marginal price different from p_i^* would lead to lower profits, given p_j^*; furthermore, the fixed fee F_i^* cannot be increased for otherwise the retailer would switch to the barrage tariff offered by firm j.

Lastly, we must show that there exists no other equilibrium where the upstream firms' profits are larger. Since the marginal prices are pinned down uniquely, other common representation equilibria may differ only in the level of the fixed fees. So, suppose both firms increase both their actual and barrage fixed fees by ΔF (a coordinated increase is necessary as otherwise the retailer would switch to exclusive representation). The left-hand side of (9) (resp., (10)) would then increase by ΔF. As a result, κ^* would increase by $(1+\mu)\Delta F_i^*$. But then the right-hand side of (9) (resp., (10)) would increase by more than ΔF, because of the second constraint in problem (11).

This completes the proof of the proposition. ■

Proof of Proposition 6. See online Appendix 2. ■

Proof of Proposition 7. See online Appendix 3. ■

Proof of Proposition 8. To show that $F_1 > 0$, it suffices to note that $v(q_1) - q_1 v_{q_1}(q_1)$ is always positive by the concavity of $v(q_1)$. Therefore, $F_1 \leq 0$ would imply $\hat{\theta} = 0$. But then the profit would become $v(q_1) - v^{CR}(0, c)$, which is maximized at $p_1 = 0$. Clearly, though, $p_1 = 0$ and $F_1 \leq 0$ cannot be the optimal tariff.

To show that $p_1 > 0$, suppose to the contrary that $p_1 = 0$. Consider then a small increase $dp_1 > 0$ in p_1 and a corresponding decrease $q_1(0) \times dp_1$ in F_1, where $q_1(p_1)$ is the inverse of $p_1 = v_{q_1}(q_1)$. In other words, the fixed payment F_1 decreases by the same amount by which the average variable payment $p_1 q_1$ increases. With this change in the price schedule, the firm's average profit by construction does not change. Since the total surplus $v(q_1)$ is maximized at $p_1 = 0$, a small change in p_1 has a second order effect on it. Therefore, the retailer's average profit, which is the difference between the average total surplus and the average profit of the dominant firm, does not change. However, the retailer's profit has become less uncertain, so the participation constraint is now slack. This means that the fixed fee may actually be reduced by less than $q_1(0) \times dp_1$, which makes the increase in the marginal price profitable. ■

Proof of Proposition 9. To show that $F_1 \geq 0$, suppose to the contrary that $F_1 < 0$. In this case, participation is guaranteed for all types θ. Now, consider type $\bar{\theta}$. Take a small decrease $dp_1 < 0$ in p_1 and a corresponding increase in F_1 that leaves the profit extracted from retailer $\bar{\theta}$ unaffected. Since the profit extracted *via* the price cost margin is lower for types $\theta < \bar{\theta}$ than for type $\bar{\theta}$, this change increases the firm's total profit. This shows that $F_1 < 0$ cannot be optimal.

To prove the second part of the proposition, we proceed as in the proof of Proposition 8. Thus, suppose to the contrary that $p_1 = 0$ and consider a small increase $dp_1 > 0$ in p_1 and a corresponding decrease in F_1 equal to $dF_1 = -\underline{\theta} \times q_1(0) \times dp_1$. By construction, this change does not affect participation, as the retailer's payoff is unaffected when $\theta = \underline{\theta}$. Furthermore, the change has a second-order impact on the first term of the profit function, but the impact on the second term (which is positive) is first order. This means that the increase in the marginal price is profitable.

The proof can be easily adapted to the case of an uncovered market, by replacing $\underline{\theta}$ with the marginal retailer $\hat{\theta}$ defined in footnote 30. By construction, the change in the tariff does not affect the marginal retailer $\hat{\theta}$, and hence the weights β and γ in the profit function in footnote 30. The proof can then proceed exactly as in the case of a covered market. ■