Anticompetitive Exclusion in Related Markets

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Abstract

This paper shows how monopolization of a given market through exclusive contracts can affect the profitability of monopolization of another market in a model with two incumbent firms, each producing a distinct substitute or complementary good and each facing a distinct potential entrant. Externalities between incumbents operate through a "scale effect" and a "profit extraction effect." With linear demand, when both potential entrants have intermediate levels of entry costs there exist multiple equilibria. In particular, when the goods are strong complements there exists an equilibrium with monopolization in both markets and an equilibrium with entry in both markets. When the goods are substitutes or weak complements there exist two asymmetric equilibria, each with a different incumbent monopolizing its market while the other does not. The equilibrium is instead unique when at least one of the two potential entrants has very high or very low entry costs. I discuss implications for antitrust enforcement in markets for complementary inputs and for national antitrust policy-making in the presence of international trade in substitute goods.

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1 Introduction

This paper studies the interaction between anticompetitive exclusion in two markets that are related through demand, with particular emphasis on the question of whether monopolization of either market by an incumbent firm increases or decreases the likelihood of monopolization of the other market by another incumbent firm. Its main finding is that, with linear demand and when the potential entrants in both markets have intermediate levels of entry costs, there exist multiple equilibria. In particular, when the goods are strong complements in demand, monopolization of either market increases the profitability of monopolization of the other market. This strategic complementarity leads to two equilibria: one in which both incumbent firms monopolize their market and another in which neither does. When the goods are instead substitutes or weak complements in demand, monopolization of either market reduces the profitability of monopolization of the other market. This makes the actions at the disposal of the two incumbents strategic substitutes and leads to two asymmetric equilibria in each of which a different incumbent monopolizes its market while the other does not. The existence of these different types of multiple equilibria suggests a role for policy, which I discuss further below.

My model builds on previous work by Rasmusen, Ramseyer and Wiley (1991) and Segal and Whinston (2000a) ("RRW-SW" henceforth) who have analyzed the conditions under which anticompetitive exclusion can occur in the equilibrium of a market for a single good. Most of that literature originated as a response to the Chicago School's contention that anticompetitive exclusive contracts would never be signed in equilibrium, since, by causing a deadweight loss, such contracts would always make at least one of the parties worse off. Based on this premise, the Chicago School concluded that when exclusive contracts are observed in reality they should be presumed to be procompetitive (i.e. to give rise to efficiencies that offset any harm from loss of competition) and should thus treated as per se legal.[1] Subsequent contributions have, however, demonstrated that this contention is incorrect when the parties to an exclusive contract can shift the welfare loss caused by monopolization onto other parties.[2] This is, for example, the case when there are multiple buyers and an incumbent can deny viable scale to potential competitors by signing up only a fraction of those buyers to exclusive contracts. As demonstrated by RRW-SW, in those situations an incumbent may be able to profit from exclusion by compensating only a fraction of buyers and earning monopoly profits on all buyers. In essence, the incumbent exploits the existence of negative externalities between buyers: when the incumbent offers a buyer an exclusive contract that fully

[1]For influential expositions of this view, see Posner (1976) and Bork (1978).

[2]See Whinston (2006) and Kaplow and Shapiro (2007) for excellent surveys of this literature.

compensates that buyer for the loss of future competition, that buyer considers only its private benefits and disregards the fact that, by contributing to preventing entry, it allows the monopolist to extract higher prices from other buyers.[3]

In this paper I study the additional externalities that two incumbents that produce distinct substitute or complementary goods impose on each other if they each unilaterally attempt to monopolize their own market. These cross-market externalities may arise in a number of situations. For example, monopolization of the market for a given input can increase or reduce the profitability of monopolization of a related market for a complementary input by another incumbent. Or, considering the case of international trade in substitute goods, monopolization of a given industry in a given country may increase or reduce the profitability of monopolization of a similar industry in another country. The model presented in this paper provides a framework for analyzing this type of situations by applying the RRW-SW model of anticompetitive exclusion to an economy with two incumbents each producing one of two substitute or complementary goods. Each incumbent has already sunk any fixed entry costs and is threatened by a distinct potential entrant that has lower marginal cost but has yet to pay a fixed entry cost. The incumbent can deny the potential entrant viable scale, and thus prevent it from entering, by signing up a sufficiently large number of buyers to exclusive contracts.[4] When deciding whether to offer exclusive contracts, each incumbent takes the contracts offered by the other incumbent (if any) as given. Subsequently, if the incumbent is successful in preserving its market power by preventing entry in its market, it sets prices à la Bertrand, taking the price in the other market as given. I use this framework to study how monopolization of one of the two markets affects the profitability of monopolization of the other market. For the case of linear demand, I fully characterize the multi-market equilibria in which monopolization or entry in the two markets are determined jointly.

To make the discussion of the mechanisms in my model more concrete, consider the Segal and Whinston (2000a) condition for exclusion in market i when the incumbent makes simultaneous and differentiated contract offers. Denote by $N_i \pi_i^*$ the total profit that the incumbent in market i can earn from exclusion (where N_i is the total number of buyers in the market and π_i^* is the profit earned by the monopolist from each of these

[3] Note that in my model, as in Segal and Whinston (2000a), the externalities between buyers do not arise from coordination failures, since I focus on coalition-proof equilibria in which buyers are allowed to communicate with (but not to make side-payments to) one another before accepting exclusive contracts, but are instead due to the use of "divide-and-conquer" strategies by the incumbents.

[4] The model in this paper, like the RRW-SW model, assumes that the excluded firm cannot make counter-offers to buyers before buyers sign exclusive contracts with the incumbent firm. As demonstrated by Spector (2011), for certain parameter values exclusion can still be an equilibrium even when all firms can make offers before any contract is signed, provided that contracts are not sufficiently complex (e.g. provided that contracts cannot specify break-up fees.)

buyers) and by $N_i^* x_i^*$ the total cost of exclusion (where N_i^* is the minimum number of buyers that the incumbent needs to sign up in order to deny the entrant viable scale and x_i^* is the compensation that it needs to pay to each of these buyers.) The incumbent in market i excludes the potential entrant if and only if $N_i \pi_i^* \geq N_i^* x_i^*$, which can be re-written as

$$n_i^* \equiv \frac{N_i^*}{N} \leq \frac{\pi_i^*}{x_i^*}. \tag{1}$$

This condition says that exclusion in market i is an equilibrium only if the share of buyers that the incumbent needs to sign up to exclude the potential entrant, n_i^*, is small relative to the incumbent's ability to extract profits from buyers without causing large surplus losses (and thus without having to pay large compensations), which is captured by the ratio π_i^*/x_i^*. When the demand for good i depends on the price of a substitute or complementary good j, as is the case in the multi-market model presented in this paper, both sides of condition (1) depend on the competitive conditions in the market for good j. In particular, monopolization of market j imposes two distinct externalities, related to the two sides of (1), on the incumbent in market i.

"Scale effect": The increase in the price of good j, p_j, affects the volume that the potential entrant in market i can sell to each free (i.e. non-exclusive) buyer if it enters. The sign of this effect depends on whether the goods are substitute or complements. If the goods are substitutes an increase in p_j increases the volume that the potential entrant in market i can sell to each free buyer if it enters and has thus the effect of increasing the share n_i^* of buyers that the incumbent in market i needs to sign up in order to exclude the potential entrant. All else equal, this makes exclusion in market i more costly and thus less likely. If the goods are instead complements an increase in p_j reduces the volume that the potential entrant in market i can sell to each free buyer and has thus the effect of reducing n_i^*, which makes exclusion in market i less costly and thus more likely.

"Profit extraction effect": Monopolization of market j may also affect the profitability of monopolization of market i by affecting the ability of the incumbent in market i to extract profits from buyers without causing large surplus losses (and thus without having to pay large compensations), which is captured by the ratio π_i^*/x_i^*. Assessing the effects of monopolization in market j on π_i^*/x_i^* is, however, not straightforward, because both the numerator and the denominator of this ratio move in the same direction. When the goods are substitutes, a move from competition to monopoly in market j increases both the profits that incumbent

i can earn and the compensation that incumbent i must pay in order to sign up buyers to exclusive contracts for good i. The compensation required for exclusivity increases because, when p_j is higher, buyers find it harder to mitigate the effects of exclusive contracts on good i by increasing their purchases of good j. Analogously, when goods are complements, monopolization of market j reduces both the profits earned and the compensation paid by the incumbent in market i. The overall effect on π_i^*/x_i^* is thus ambiguous in both cases and depends on the particular functional form of the demand curves for the two goods. Therefore, in order to obtain more concrete results, at various points in the paper I assume that demand can be represented by a linear system.

Using linear demand to resolve the ambiguities related to the "profit extraction" effect, I demonstrate that if both potential entrants in the two markets have intermediate levels of entry costs, there exist multiple equilibria. In particular, when the goods display a strong degree of complementarity, the entry-deterrence game played by the incumbents is super-modular, in that exclusion by either incumbent makes exclusion by the other incumbent more profitable, and there exist two pure-strategy equilibria: one in which both incumbents exclude and one in which neither does. The incumbents prefer the equilibrium with exclusion in both markets, while social welfare is higher in the equilibrium with entry in both markets. When instead the goods are substitutes or weak complements, the monopolization decisions of the two incumbents are strategic substitutes, in that monopolization by either incumbent makes monopolization by the other incumbent less profitable. Strategic substitutability leads to two asymmetric pure-strategy equilibria: one in which incumbent i monopolizes its market, while incumbent j does not, and another in which incumbent j monopolizes its market, while incumbent i does not. This gives each incumbent incentives to commit to monopolization early on, when possible. Finally, when at least one of the two potential entrants has very higher or very low entry costs, the equilibrium is unique, with monopolization or entry in either or both markets, depending on parameter values.

As discussed in further detail in the concluding section, this model can be applied to a number of real world situations in which interactions between markets are important and may have interesting implications for antitrust policy. For example, when the production of a final good or service requires a number of complementary inputs, monopolization of the market for one of those inputs tends to reduce output in the entire downstream sector and thus to reduce the derived demand for the other complementary inputs. This contraction in derived demand makes it easier for the incumbent producers of the other inputs to exclude potential entrants, thus making it more likely that also those inputs will fall prey to monopolization. In situations like this, it is thus important for antitrust authorities to be aware of this possibility and, all else equal, to pursue antitrust enforcement more aggressively. This model, and especially its version for substitute goods, can also be used to study interactions between national antitrust policies in an international context. When an industry in a given country exports a significant share of its output, the government of that country may have fewer incentives to prevent monopolization of that industry than it would have in the absence of international trade. This is because, in the presence of exports, by acquiring or preserving market power an incumbent domestic firm can earn significant profits at the expense of foreign buyers, and this effect can be so large as to offset the welfare loss caused by monopolization of the domestic market. The results in this paper suggest that, when one considers the overall equilibrium in both countries, the gains to each country from this "beggar-thy-neighbour" policy may be greater than one would expect. The fact the monopolization decisions in the two countries are strategic substitutes, may give, under certain conditions, national governments incentives to commit to laxer antitrust enforcement in the hope of selecting the equilibrium that is more desirable for their country.

This paper is related to a number of contributions in the economics literature. As discussed above, my model of exclusive dealing is an extension of models by Rasmusen, Ramseyer and Wiley (1991), and especially by Segal and Whinston (2000a).[5] The issues addressed in this paper are also related to those studied by the literature on entry deterrence in a single market with multiple incumbents and/or potential entrants. This includes, among others, Bernheim (1984), Gilbert and Vives (1986) and Waldman (1991).[6] Finally, the analysis of multi-market equilibria in Section 4, especially as it concerns the case of complements, is related to the analysis of super-modular games in Milgrom and Roberts (1990), Vives (1990) and Cooper (1999).

[5] In order to preserve tractability, in the model presented in this paper buyers are final consumers. In reality, however, exclusive deals are often signed by retailers or downstream producers that compete with one another. As demonstrated by Simpson and Wickelgren (2007), Abito and Wright (2008), and Wright (2009), when buyers are downstream firms an additional externality (related to the pass-through of higher prices from downstream firms to final buyers) comes into play and a number of counterintuitive results can follow, such as a the existence of a positive relationship between the intensity of downstream competition and the likelihood of upstream exclusion (see also Fumagalli and Motta (2006) for different conclusions).

[6] That literature, however, differs from the approach adopted in this paper in important respects. First, that literature considers a single market in which all the incumbents and potential entrants produce a homogeneous good, so that entry would lower the profits of all incumbents. As such, that literature cannot study the case of entry in distinct markets for complementary goods, in which entry would instead lower the profits of the incumbent in the market in which it occurs, but increase the profits of the incumbents in the markets for the other complementary goods. Second, in that literature incumbents deter entry by committing to aggressive post-entry strategies (e.g. by investing in excess capacity), with buyers playing a passive role. In the present paper, instead, exclusion can be achieved through contracts that specify adequate compensation of buyers.

The remainder of the paper is organized as follows. The next section sets out a two-market model of anticompetitive exclusion. Section 3 characterizes the equilibrium in one of the two markets, taking the price of the good produced in the other market as given, and analyzes the effects of changes in that price on the equilibrium in the first market. Section 4 characterizes the full-fledged equilibrium of the two-market model, in which monopolization/entry outcomes in the two markets are determined jointly, paying particular attention to the super-modularity or sub-modularity of the monopolization decisions of the two incumbents and thus to the multiplicity or uniqueness of the resulting multi-market equilibria. Many of the results derived in Sections 3 and 4 are based on a linear demand system. Section 5 discusses potential extensions and policy implications and concludes. All proofs are in the Appendix.

2 A Model with Bertrand Competition

There are N buyers with identical preferences over two differentiated (substitute or complementary) goods, A and B, and a homogeneous good y. The homogeneous good is produced under constant returns to scale with an input-output coefficient of one using the same input as the differentiated goods and its only role in the model is to serve as numéraire.

2.1 Preferences and demand

Preferences can be represented by the following quasilinear utility function

$$\widetilde{U} = U(q_A, q_B) + y, \tag{2}$$

where q_A and q_B denote the quantities of the differentiated goods and y the quantity of the homogeneous good. I assume that, for $i, j \in \{A, B\}$, $i \neq j$, $\partial U/\partial q_i > 0$ and $\partial U^2/\partial {q_i}^2 < 0$ (which together imply that demand is downward sloping in own price) and consider both the case in which the two differentiated goods are substitutes ($\partial U^2/\partial q_i \partial q_j < 0$) and the case in which they are complements ($\partial U^2/\partial q_i \partial q_j > 0$). It is also convenient to assume that preferences are symmetric so that the demand function for the two differentiated goods is the same for the same levels of own and competitor's prices. In particular, for a given function $D(\cdot, \cdot)$, each buyer's demand for the two differentiated goods can be written as $q_i = D(p_i, p_j)$ and $q_j = D(p_j, p_i)$, with $\partial q_i/\partial p_j > 0$ for all i and j when the goods are substitute and $\partial q_i/\partial p_j < 0$ when they are complements. The total demand for good i is thus $Q_i = ND(p_i, p_j)$. The indirect utility associated with (2) for a buyer facing prices p_A and p_B is denoted by $\widetilde{V} = V(p_A, p_B) + y^*$, where

y^* is any income left to the buyer after he has paid for the differentiated goods and received any lump-sum transfer from the incumbents. In order to obtain more concrete results, in Section 3 I introduce a linear demand system with desirable properties.

2.2 Technology and entry

Each of the two differentiated goods can be produced by an incumbent firm or a potential entrant. Both incumbent firms have already sunk any fixed entry cost and have constant marginal cost equal to c. The potential entrant in each market i has lower marginal cost but needs to sink a fixed cost K_i in order to enter. In particular, the marginal cost of the potential entrant in market i is equal to $(1-a_i)c$, with $a_i \in (0,1)$ denoting the potential entrant's cost advantage over the incumbent.[7] For simplicity, I assume that the cost advantage a_i and/or the elasticity of demand are not too large, so that if the potential entrant enters and engages in (homogeneous) Bertrand competition with the incumbent it always chooses a price equal to the cost of the incumbent, c. A sufficient condition for this to be the case is given in Assumption 1.[8]

Assumption 1 $\epsilon_i(c, p_j) < 1/a_i$, *where* $\epsilon_i(c, p_j)$ *is the elasticity of demand when the price of good* i *is* c *and the price of good* j *is* p_j*.*

I also assume that the potential entrant's fixed cost is such that entry is unprofitable if the potential entrant can sell only to one buyer and profitable in both markets in the absence of the incumbent's exclusionary strategy. The first assumption makes exclusion possible in equilibrium, since the incumbent does not need to sign up and compensate every single buyer in order to exclude the potential entrant. The second assumption simply rules out uninteresting cases in which entry is blockaded, i.e. would not occur even in the absence of exclusionary conduct. A sufficient condition for the first assumption to be satisfied is $a_i c\bar{q} < K_i$, where $\bar{q} = \lim_{p_j \to \infty} D(c, p_j)$ while a necessary and sufficient condition for the second assumption to be satisfied is $ND(c, c,)a_i c \geq K_i$. These restrictions on the fixed cost are summarized in Assumption 2 below and are satisfied for appropriately large values of N and K_i.

[7] Note that, while I assume that the marginal cost c of the incumbents is the same in the two markets, I allow the potential entrants' fixed entry cost, K_i, and marginal cost advantage, a_i, to be specific to each market. Since, as will be discussed in further detail below, equilibrium pricing depends only on c and is not affected by K_i or a_i, this assumption allows for different equilibirum probabilities of entry or monopolization in the two markets, without sacrificing the tractability advantages of symmetry when both potential entrants enter or neither does.

[8] The calculations showing why this is a sufficient condition for the entrant to choose a price equal to the incumbent marginal cost are reported in the Appendix.

Assumption 2 $\overline{D} < (K_i/a_i c) \leq ND(c,c)$, *where* $\overline{D} = \lim_{p_j \to \infty} D(c, p_j)$.

For future convenience it is helpful to define

$$k_i \equiv \frac{K_i}{N a_i c}, \tag{3}$$

which can be interpreted as an index of the cost of entry that increases with the level of fixed cost K_i and decreases with the size of the market N and with the potential entrant's marginal cost advantage $a_i c$.

2.3 Sequence of events and contracting

Given these assumptions about demand and technology, events unfold in the following five stages

1. *Entry costs.* Each potential entrant draws a realization k_i of the entry cost from a common distribution function with cumulative density $G(\cdot)$. These realizations are observed by all the players in the model.

2. *Exclusive contract offers by incumbents.* The incumbent firms simultaneously offer exclusive contracts to buyers. I allow incumbents to offer different contracts and payments to different buyers (and in particular, not to offer contracts with positive payments to a subset of buyers). As I demonstrate further below, if each incumbent i can identify the set of buyers to which the other incumbent makes offers, in equilibrium both incumbents make offers to the same set of buyers.[9] The contracts offered by incumbent i require buyers to purchase good i exclusively from incumbent i in exchange for an upfront payment x_i.[10] Following the rest of

[9] The assumption that each incumbent can identify the set of buyers to which the other incumbent makes offers is a realistic one when buyers (as in most circumstances) have different observable characteristics (such as size, strategic importance, etc.) that make them better or worse candidates for exclusive arrangements. See, for example, the discussion in Whinston (2006), p. 147.

[10] I assume that the exclusivity requirement applies only to the good sold by the incumbent offering the contract, i.e. a buyer signing an exclusive contract with incumbent i commits to buying good i exclusively from incumbent i (and thus not to deal with the potential entrant in market i) but remains free to buy good j (and to sign an exclusive contract with incumbent j) if it so wishes. Alternatively, one could assume that each incumbent i can demand absolute exclusivity by requiring buyers not to purchase good j either. If goods i and j were complements, the latter would, however, never be optimal. If instead the goods were subsitute, absolute exclusivity could be an optimal contract only if incumbent i had the ability and incentives to affect the market structure also in market j (by making entry in that market more difficult). If this is not the case, the incumbent does not have an incentive to generate an additional distortion for which it has to compensate the buyer but from which it does not benefit.

the literature on the topic, I assume that the final price of the good, p_i, is non-contractible ex-ante. Therefore, if the incumbent excludes the potential entrant, it will ex-post set p_i at the optimal level compatible with its market power and cause a deadwight loss.

3. *Contract acceptance or rejection decisions by buyers.* Buyers observe the entire set of contracts offered by the two incumbents and decide whether to accept or decline those contracts.[11] When deciding whether to accept or decline contracts buyers can coordinate their decisions, but not compensate one another with side-payments. The purpose of this assumption is to rule out trivial equilibria that are not coalition-proof.[12]

4. *Entry decisions by potential entrants.* The potential entrant in each market observes how many buyers each incumbent has signed up to exclusive contracts and decides whether to enter the market or not. I assume that the potential entrants in the two markets cannot coordinate their entry decisions. This appears to be a reasonable assumption, given that it would be difficult for the two potential entrants to identify each other before actual entry takes place.[13]

5. *Bertrand competition between active producers.* Active producers set their prices taking the prices of other producers as given (Bertrand competition.) In particular, if entry has occurred in market i, then there are two potential producers of good i, and, given its cost advantage, the entrant serves the entire market at a price equal to c (by virtue of Assumption 1). If instead entry has not occurred in market i, then the incumbent producer in that market has market power and, given the price p_j of the good produced in the other market, sets its price according to the reaction function $p_i = R_i(p_j)$.

Section 3 uses the framework outlined above to derive conditions for exclusionary equilibria in one of the two markets, taking as given the market structure and prices in the other market. Section 4 then characterizes equilibria in the two markets when these equilibria are determined jointly.

[11] For expositional simplicity I assume that when a buyer is indifferent between accepting and rejecting an exclusive contract, the buyer accepts the contract.

[12] See Segal and Whinston (2000a) and, more generally, Bernheim, Peleg, and Whinston (1987).

[13] However, in Section 4 I also briefly discuss the case in which the potential entrants can coordinate and show that entry coordination is important for the properties of the equilibria only with complementary goods, whereas it never takes place, and is thus irrelevant, with substitute goods.

3 Exogenous price changes in a related market

In this section I derive the conditions under which exclusion in market i is an equilibrium for a given price p_j in the other market and study how changes in p_j affect the probability of exclusion in market i. This partial equilibrium analysis is a useful introduction to the more complete analysis of the joint determination of the equilibrium in both markets in Section 4. Before deriving equilibrium conditions explicitly in Proposition 1, it is useful to derive and discuss a few building blocks for the analysis to follow.

As discussed above, in any continuation game in which no entry has occurred in market i the incumbent in that market sets its price according to the reaction function $p_i = R_i(p_j)$ and earn total profits equal to $N\pi_i^*(p_j)$, where $\pi_i^*(p_j)$ is the maximum profit earned by incumbent i from each buyer when the price in market j is p_j.

Another important variable of the model is the minimum number of free (i.e. non-exclusive) buyers to which the potential entrant must be able to sell for entry to be profitable in stage four of the game. The potential entrant has lower marginal cost than the incumbent and thus, in the Bertrand competition that follows its entry in market i it would set a price equal to c, earn a unit profit margin equal to $a_i c$, and sell a number of units equal to $D(c, p_j)$ to each of the $(N - N_i^*)$ free buyers, where N_i^* is the number of buyers that have signed exclusive contracts with incumbent i. The potential entrant in market i enters only if its expected gross profits cover its fixed entry cost K_i, which is the case if $a_i c(N - N_i^*)D(c, p_j) \geq K_i$. Rearranging terms, and ignoring integer constraints, entry in market i occurs therefore only if the share of buyers that have signed exclusive contracts is less than $n_i^*(p_j)$, where

$$n_i^*(p_j) = 1 - \frac{k_i}{D(c, p_j)}, \tag{4}$$

where k_i has been defined in (3) and the notation $n_i^*(p_j)$ reminds the reader that the minimum number of buyers necessary for entry in market i depends on the price in market j, which we take as given in this section and determine endogenously in the next section.

Finally, the incumbent in market i has to pay buyers a compensation $x_i^*(p_j)$ to persuade them to sign exclusive contracts when the price in market j is p_j. The equilibrium value of this payment is derived in Proposition 1 below and is equal to the additional income that a buyer needs in order to achieve the same level of utility at the new prices as it had at the old prices. The compensation paid by incumbent i is thus equal to the compensating variation for a buyer that experiences an increase in the price of p_i from

c to $R_i(p_j)$ and is given by $x_i^*(p_j) = V(c, p_j) - V(R_i(p_j), p_j)$.

With these building blocks in hand, I can establish the following proposition, which is merely a simplified restatement of Proposition 1 in Segal and Whinston (2000a) for a market facing given prices and market structure in a related market.

Proposition 1 *Assume that the incumbent in market i makes simultaneous and differentiated offers of exclusive contracts to buyers. For a given price p_j in market j there is a unique coalition-proof equilibrium with the following form*

1. *If*

$$\frac{\pi_i^*(p_j)}{x_i^*(p_j)} < n_i^*(p_j), \tag{5}$$

where $n_i^*(p_j)$ is given by (4), the incumbent in market i does not sign up any buyer to exclusive contracts and pays no compensation. The potential entrant in market i enters and the equilibrium price of good i is c.

2. *If*

$$\frac{\pi_i^*(p_j)}{x_i^*(p_j)} \geq n_i^*(p_j) \tag{6}$$

the incumbent signs up a share $n_i^*(p_j)$ of buyers to exclusive contracts and pays each of them a compensation

$$x_i^*(p_j) = V(c, p_j) - V(R_i(p_j), p_j) \tag{7}$$

The remaining $[1 - n_i^*(p_j)]N$ buyers are offered no compensation. The potential entrant in market i does not enter the market and the equilibrium price of good i is $p_i = R_i(p_j)$.

It is helpful to introduce here a convenient way to reformulate the condition for exclusion in (6) that I use throughout the paper. This condition specifies the threshold level of the entry cost k_i drawn by the potential entrant in market i below which incumbent i accommodates entry and above which it monopolizes the market. Note that, conditional on the entry decision of the potential entrant in stage four of the game, the price set by the incumbent in stage five and thus its profit and the compensation that it has to offer buyers in stage two do not depend on the entry cost k_i. The entry cost k_i enters only the expression (4) for the share of buyers $n^*(p_j)$ that the incumbent needs to sign up to exclude the potential entrant. Inspection of (4) shows that it does so linearly, since the quantity sold by the entrant, if positive, does not depend on the fixed cost either. Therefore, by substituting (4) into (6) and rearranging terms, I can establish the following corollary to Proposition 1.

Corollary 1 *For given p_j exclusion in market i is a coalition-proof equilibrium if and only if*

$$k_i \geq \tilde{k}_i(p_j) \equiv \left[1 - \frac{\pi_i^*(p_j)}{x_i^*(p_j)}\right] D(c, p_j). \tag{8}$$

Corollary 1 implies that the probability of exclusion in market i is $1-G\left(\tilde{k}(p_j)\right)$. Note that the probability of exclusion decreases with the scale that the domestic entrant can achieve if it enters, i.e. with $D(c, p_j)$ and with the deadweight loss caused by monopolization, i.e. with the proportion of the buyer surplus loss associated with monopoly pricing that is not appropriated by the monopolist as profits (i.e. with $[1 - \pi_i^*(p_j)/x_i^*(p_j)]$.)[14] Changes in p_j affect the probability of exclusion in market i through both of these channels, which, as discussed in the introduction, I call "scale effect" and "profit extraction effect".

"Scale effect": Changes in p_j affect directly the volume of sales $ND(c, p_j)$ that the potential entrant in market i can achieve if it enters. In particular, when the goods are substitutes an increase in p_j causes the demand for good i to increase, making entry in market i easier (and thus more costly to deter); while when the goods are complements the opposite is true.

"Profit extraction effect": When the goods are substitutes, a rise in p_j increases both the profits π_i^* and the compensation x_i^*. The increase in π_i^* is due to reduced competition, while the increase in x_i^* is due to the fact that when p_j is higher, buyers in market i have to substitute towards a more expensive alternative when incumbent i monopolizes the market and raises the price of good i (or maintains that price at a level that is higher than it would be if entry occurred).[15] In light of this, and of the fact that there are no general results on the relationship between the deadweight loss caused by a firm with market power and the elasticity or shape of the demand curve for its good, the overall effect of a rise in p_j on the ratio π_i^*/x_i^* is ambiguous.[16] This ambiguity characterizes also the case of complementary goods, since a rise in p_j decreases both the the profits that incumbent i can earn and the compensation that it must pay to each buyer that it signs up to exclusive contracts.

[14] Note that if $\pi_i^*(p_j) = x_i^*(p_j)$, i.e. if there is no deadweight loss (e.g. because of perfect price discrimination or perfectly inelastic demand), the incumbent excludes with probability one.

[15] Formally, using Roy's identity in (7) one obtains $\partial x_i^*/\partial p_j = [q_j(p_j, R(p_j)) - q_j(p_j, c)] + q_i(R_i(p_j), p_j)\partial R_i(p_j)/\partial p_j > 0$.

[16] See, for example, the discussion in Tirole (1988).

In order to resolve the ambiguity associated with the profit extraction effect, below I consider a linear demand system that allows me to derive unambiguous results, because with linear demand π_i^*/x_i^* is constant with respect to p_j.

Exogenous changes in p_j with linear demand

Assume that buyer preferences can be represented by the following Shubik and Levitan (1980) quadratic utility function

$$U = v(q_A + q_B) - \frac{1}{1+\lambda}\left(q_A^2 + q_B^2 + \frac{\lambda}{2}(q_A + q_B)^2\right) + y, \tag{9}$$

which yields the following linear demand system

$$q_i = \frac{1}{4}\left[2v - (2+\lambda)p_i + \lambda p_j\right], \tag{10}$$

$$y = I - p_i q_i - p_j q_j, \tag{11}$$

where $i \neq j$, $v > 0$ and I is sufficiently large to guarantee that $y > 0$. The parameter λ measures the extent of substitutability or complementarity between the two differentiated goods, with goods being substitutes for $\lambda > 0$ and complements for $-4/3 < \lambda < 0$ (where the restriction that $\lambda > -4/3$ is necessary to ensure stability of the Bertrand duopoly game with complements).

This linear demand system has two particularly desirable properties for our purposes. First, as with any other linear demand system, the ratio π_i^*/x_i^* is constant with respect to all the terms in the demand function for good i, including the price p_j of the other good. Second, the particular specification suggested by Shubik and Levitan and adopted above implies that, in a symmetric model in which $p_i = p_j$, the market size for either good does not depend on the substitutability/complementarity parameter λ. This second property makes the comparative statics with respect to the parameter λ (especially those performed in Section 4) more informative, since it controls for the confounding effect of changes in market size.

With this demand system, for given price p_j in the other market, in stage five of the game the incumbent in market i sets its price according to the following reaction function

$$p_i^* = R_i(p_j) = \frac{1}{2}\left[c + \frac{2v + \lambda p_j}{2+\lambda}\right]. \tag{12}$$

Using (10) and (12) the profits earned by the incumbent producer of good i from each buyer can be written as

$$\pi_i^* = \frac{[2(v-c)+\lambda(p_j-c)]^2}{16(2+\lambda)}, \tag{13}$$

while using (7) and the indirect utility associated with (9) yields the following equilibrium compensation

$$x_i^* = \frac{3\,[2(v-c)+\lambda(p_j-c)]^2}{32(2+\lambda)}, \tag{14}$$

Using (13) and (14) one obtains that $\pi_i^*/x_i^* = 2/3$ (and thus independent of p_j).[17] Furthermore, setting $p_i = c$ in (10) above, one obtains an explicit expression for $D(c, p_j)$. Using these results in (8), the critical level of fixed costs above which monopolization is a coalition-proof equilibrium in market i is

$$\tilde{k}_i(p_j) = \frac{1}{12}\,[2(v-c)+\lambda(p_j-c)] \tag{15}$$

Thus in the linear model of this section an increase in the price of one good makes exclusion in the market for the other good less likely when the two goods are substitutes ($\lambda > 0$) and more likely when the two goods are complementary ($\lambda < 0$). This is the case because a higher level of $\tilde{k}_i(p_j)$ implies that there exists a broader range of entry cost realizations for which monopolization is too costly for the incumbent (because it would require it to sign up too many buyers) and does not take place in equilibrium. In the simple set-up of this section, the effects of p_j on the probability of exclusion in market i come only from a scale effect, since π_i^* and x_i^* rise or fall proportionally and their ratio π_i^*/x_i^* is unaffected. In particular, an increase in the price of a substitute good makes it easier for the potential entrant to achieve viable scale if it decides to enter and makes it thus necessary for the incumbent to sign up more buyers to monopolize the market for good i, which makes monopolization more costly for the incumbent and thus less likely. An increase in the price of a complementary good has instead the opposite effect: by reducing the size of the potential market available to the potential entrant, it makes it necessary for the incumbent to sign up fewer buyers, which makes exclusion less costly and thus more likely.

[17] This is a general property of any linear demand function, regardless of the specific values of the parameters.

4 Multi-market equilibria

In this section I characterize the equilibria in the two markets when these are determined jointly. The key question in this section is the following: if market j is monopolized, how does this affect the likelihood of monopolization of market i (and vice versa)? Note that asking what are the effects of monopolization of market j is a different question from simply asking what are the effects of an exogenous change in p_j, as I did in the previous section. More precisely, while in the previous section p_j was exogenous and did not change in response to changes in p_i, this section compares situations in which entry occurs in market j (and thus in which p_j is always equal to c) to situations in which incumbent j has market power and is therefore able to respond to an increase in p_i by raising its price according to the reaction function $p_j = R_j(p_i)$. The full-fledged solution of the model derived in this section, and in particular the determination of the buyer compensations x_i^*, is more involved than the solution of the partial equilibrium model in the previous section. As we show further below, the effects of monopolization in market j on x_i^* depend crucially on the relationship between the inframarginal harm caused by monopolization of only one market when the other market remains competitive and the marginal harm caused by the monopolization of a second market, taking as given that the first market is monopolized. Let denote the inframarginal harm caused by monopolization of only one market by $h_{i,E_j=1}$ (where h stands for "harm" and $E_j = 1$ indicates that entry occurs in the other market) and the marginal harm caused by monopolization of the second market by $h_{i,E_j=0}$ (where $E_j = 0$ indicates that entry does not occur in the other market), so that

$$h_{i,E_j=1} = V(c,c) - V(R_i(c), c), \tag{16}$$

$$h_{i,E_j=0} = V(c, R_j(c)) - V(p^m, p^m). \tag{17}$$

where $p_i^m = p_j^m = p^m$ denote the equilibrium prices when $E_i = E_j = 0$, i.e. $p^m = R(p^m)$. The following proposition characterizes the conditions for exclusion in market i when there is entry in market j and when market j is monopolized, both for the case in which $h_{i,E_j=0} > h_{i,E_j=1}$ (which, in a linear demand system, is the case if and only if the goods are substitutes) and the case in which $h_{i,E_j=0} < h_{i,E_j=1}$ (which in a linear demand system is the case if and only if the goods are complements.)

Proposition 2 *For $i \in \{1, 2\}$, let $E_i = 1$ if entry occurs in market i and $E_i = 0$ otherwise and assume that the potential entrants cannot coordinate their entry decisions.*

1. *For all i and j, $i \neq j$, incumbent i monopolizes its market when there is entry in*

market j (i.e. $E_i = 0$ when $E_j = 1$) if

$$\frac{\pi^*_{i,E_j=1}}{x^*_{i,E_j=1}} \geq n^*_i\left(c\right). \tag{18}$$

where

$$x^*_{i,E_j=1} = V\left(c,c\right) - V\left(R_i\left(c\right),c\right) \tag{19}$$

2. *For all i and j, $i \neq j$, incumbent i monopolizes its market when market j is monopolized (i.e. $E_i = 0$ when $E_j = 0$) if*

$$\frac{\pi^*_{i,E_j=0}}{x^*_{i,E_j=0}} \geq n^*_i\left(R(c)\right). \tag{20}$$

where

$$x^*_{i,E_j=0} = \begin{cases} V\left(c, R_j\left(c\right)\right) - V(p^m, p^m) & \text{if } h_{i,E_j=0} > h_{i,E_j=1} \\ \dfrac{V\left(c,c\right) - V(p^m, p^m)}{2} & \text{if } h_{i,E_j=0} < h_{i,E_j=1} \end{cases} \tag{21}$$

As already discussed above, while the determination of the equilibrium profits π^*_i in the presence of competition and exclusion in market j is fairly straightforward, the determination of the compensation x^*_i that the incumbents must pay to buyers in order to induce them to sign exclusive contracts is more involved and requires some explanation. When there is competition in market j, the entrant in that market sets $p_j = c$ regardless of whether market i is monopolized or not. Consequently, incumbent i needs to compensate each of the N^*_i buyers that it signs up only for the increase in the price of its own good, which it can do by paying the buyer an amount $x^*_{i,E_j=1} = h_{i,E_j=1}$. However, when market j is monopolized the determination of the compensation paid by incumbent i becomes more complicated for two reasons: i) monopolization of market i has an effect on p_j, and ii) each buyer may (and in fact does) receive offers from more than one incumbent. While a rigorous and detailed derivation of the compensation paid by the incumbent in the second part of Proposition 2 is provided in the Appendix, here I will briefly discuss that derivation at an intuitive level. If the two incumbents offer contracts to the same set of buyers (which, as proved in the Appendix, must be the case in any coalition-proof equilibrium in which both incumbents exclude) and $h_{i,E_j=0} > h_{i,E_j=1}$, a coalition-proof equilibrium in which the exclusive offers of both incumbents are accepted exists only if each incumbent i compensates the buyer for the marginal harm $h_{i,E_j=0}$ caused by monopolization of market i when market j is also monopolized. If either incumbent offered a compensation $x^*_{i,E_j=0} < h_{i,E_j=0}$, the buyer would be better off rejecting the offer, since by doing so it could enjoy an increase in surplus equal to $h_{i,E_j=0}$. If instead $h_{i,E_j=0} < h_{i,E_j=1}$ a coalition-proof equilibrium in which the exclusive offers of both incumbents are accepted exists only if $x^*_{i,E_j=0} \geq h_{i,E_j=0}$ and $x^*_{i,E_j=0} + x^*_{j,E_i=0} = [V(c,c) - V(p^m, p^m)]$ (i.e. the sum of the compensations offered by the two buyers must be at least as large as the total surplus loss caused by monopolization of both markets). If the latter were not the case, the buyer would find it optimal to reject both contracts and enjoy an increase in surplus equal to $[V(c,c) - V(p^m, p^m)]$. For simplicity, here and in the remainder of the paper I focus on a symmetric solution in which $x^*_{i,E_j=0} = x^*_{j,E_i=0}$, i.e. in which each incumbent provides half of the total compensation, although other equilibria are possible.

Before proceeding further with the analysis of the interaction between entry or exclusion in the two markets, it is useful to reformulate the conditions for multi-market equilibria derived in Proposition 2 in terms of the threshold levels of the fixed cost, $\tilde{k}_i$, below which entry occurs in a market, with an approach similar to that introduced in Corollary 1 for the case of exogenous price in the other market. Note, however, that in the case of the multi-market equilibria considered in this section, the threshold level of entry cost in a given market is not unique, as it depends crucially on whether the other market is monopolized or competitive. This approach has the advantage of allowing one to characterize the probability of entry or exclusion with a single, continuous variable and of lending itself to intuitive graphical representation, which I exploit in Figure 1 to characterize the full set of multi-market equilibria for the case of linear demand.

Corollary 2 *Given $\pi^*_{i,E_j=1}$, $\pi^*_{i,E_j=0}$, $x^*_{i,E_j=1}$ and $x^*_{i,E_j=0}$, as defined in Proposition 2:*

1. *The critical level of the fixed cost above which $E_i = 0$ when $E_j = 1$ is*

$$\tilde{k}_{i,E_j=1} \equiv \left(1 - \frac{\pi^*_{i,E_j=1}}{x^*_{i,E_j=1}}\right) D(c,c). \tag{22}$$

2. *The critical level of the fixed cost above which $E_i = 0$ when $E_j = 0$ is*

$$\tilde{k}_{i,E_j=0} \equiv \left(1 - \frac{\pi^*_{i,E_j=0}}{x^*_{i,E_j=0}}\right) D(c,R(c)). \tag{23}$$

Inspection of (22) and (23) reveals that the "scale effect" tends to cause $\tilde{k}_{i,E_j=0} > \tilde{k}_{i,E_j=1}$ when the goods are substitutes (since in that case $D(c,R(c)) > D(c,c)$) and $\tilde{k}_{i,E_j=0} < \tilde{k}_{i,E_j=1}$ when the goods are complements (since in that case $D(c,R(c)) < D(c,c)$). However, as explained in Section 3, the comparison between $\pi^*_{i,E_j=1}/x^*_{i,E_j=1}$

and $\pi^*_{i,E_j=0}/x^*_{i,E_j=0}$ (i.e. an assessment of the "profit extraction effect") is less clear for general demand systems. More concrete results can, however, be obtained by considering the linear demand system introduced in (10) and (11), since this demand system imposes more structure on the behavior of π^*_i/x^*_i when prices in market j change.

Multi-market equilibria with linear demand

In what follows I first solve the model by applying the results in Corollary 2 to the case of linear demand. I then introduce a convenient graphical apparatus that can be used to characterize the full set of possible equilibria for any degree of substitutability or complementarity between goods and for any pair of realizations k_i and k_j of the entry costs for the potential entrants in the two markets. Finally, I provide an intuitive discussion of the characteristics of equilibria, paying particular attention to the mechanisms determining whether, for any given set of parameters, the model has a unique equilibrium or multiple equilibria.

A first important observation is that with linear demand the marginal harm from monopolization of a second market is grater than the inframarginal harm from monopolization of the first market if and only if the goods are substitute (i.e. $h_{i,E_j=0} > h_{i,E_j=1} \iff \lambda > 0$), whereas the opposite is true if and only if the goods are complements (i.e. $h_{i,E_j=0} < h_{i,E_j=1} \iff \lambda < 0$).

As can be seen from Corollary 2, solving the model requires calculating the profits earned and the compensation paid by the incumbent in each market under the alternative assumptions of entry and monopolization in the other market, as well as the level of demand available to the potential entrant if it enters. Given the relationship between marginal and inframarginal consumer harm and the degree of substitution/complementarity λ discussed above, the ratios π^*_i/x^*_i with and without entry in market j, as defined in Proposition 2, are, respectively,

$$\frac{\pi^*_{i,E_j=1}}{x^*_{i,E_j=1}} = \frac{2}{3} \qquad \text{for all } \lambda$$
$$\frac{\pi^*_{i,E_j=0}}{x^*_{i,E_j=0}} = \begin{cases} \dfrac{8(2+\lambda)^2}{48+56\lambda+13\lambda^2} & \text{if } \lambda > 0 \\ \dfrac{2+\lambda}{3+\lambda} & \text{if } \lambda < 0 \end{cases} \tag{24}$$

The individual demand levels for good i with and without entry in market j are, respectively,

$$D(c,c,) = \frac{1}{2}(v-c), \quad (25)$$

$$D\left(c,R(c)\right) = \frac{(4+3\lambda)}{4(2+\lambda)}(v-c). \quad (26)$$

It is straightforward to verify that $D\left(c,R(c)\right) > D(c,c)$ if $\lambda > 0$ (substitute goods) and $D\left(c,R(c)\right) < D(c,c)$ if $\lambda < 0$ (complementary goods), which confirms that the scale externality between incumbents is negative (positive) for substitute (complementary) goods, in that, all else equal, exclusion in one market makes exclusion in the other market more (less) expensive through this channel.

Using (24) through (26) in (22) and (23), the threshold levels of the entry cost below which entry in market i occurs with and without entry in market j are, respectively,

$$\begin{aligned} \tilde{k}_{i,E_j=1} &= \frac{1}{6}(v-c) && \text{for all } \lambda \\ \tilde{k}_{i,E_j=0} &= \begin{cases} \dfrac{2(2+\lambda)(4+3\lambda)}{48+56\lambda+13\lambda^2}(v-c) & \text{if } \lambda > 0 \\ \dfrac{(4+3\lambda)}{4(3+\lambda)}(v-c) & \text{if } \lambda < 0 \end{cases} \end{aligned} \quad (27)$$

These critical levels of the fixed entry cost are shown in Figure 1 as a function of the substitutability/complementarity parameter λ. Figure 1 provides a particularly convenient framework for determining the nature of the multi-market equilibria of the model for any value of the substitutability or complementarity parameter λ and any pair of realizations (k_i, k_j) of the entry costs for the potential entrants in the two markets. In particular, the two markets can each be represented by a point in the graph, (λ, k_i) for market i and (λ, k_j) for market j, and the multi-market equilibrium is pinned down by the positions of these two points relative to the $\tilde{k}_{i,E_j=1}(\lambda)$ and $\tilde{k}_{i,E_j=0}(\lambda)$ curves. For example, considering substitute goods (i.e. the region in which $\lambda > 0$), if one of the points were in region A while the other were in region C there would be exclusion in the market in region A and entry in the market in region C. To see this note that the potential entrant in region A has $k_i > \tilde{k}_{i,E_j=0} > \tilde{k}_{i,E_j=1}$ and thus does not enter regardless of what happens in the other market; while the potential entrant in region C has $k_j < \tilde{k}_{j,E_i=0}$ and decides thus to enter when market i is monopolized. If instead, in another example, one of the points were in region C while the other were in region E, entry would occur in the market in region E, while the market in region C would

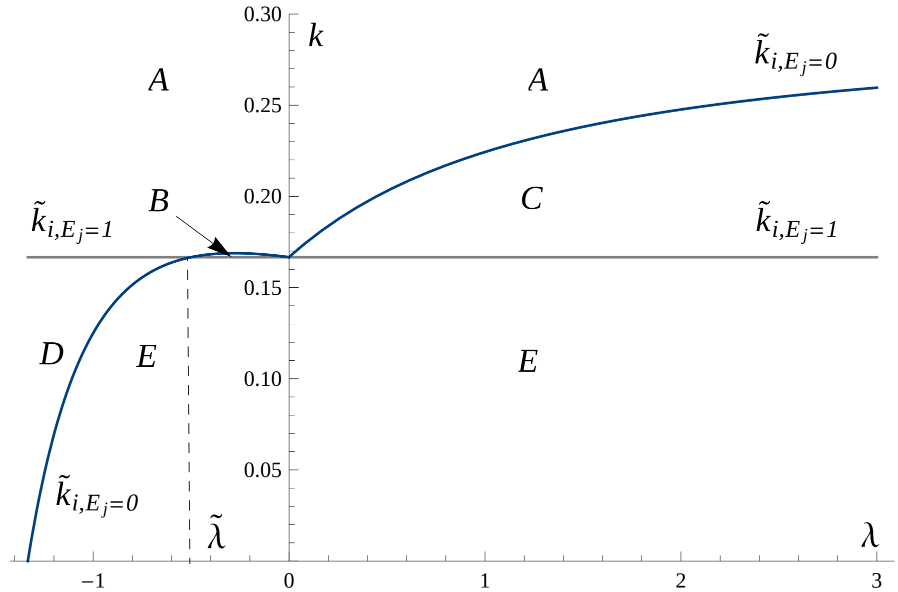

Figure 1: Threshold entry costs with exclusion ($\tilde{k}_{i,E_j=0}$) and entry ($\tilde{k}_{i,E_j=1}$) in other market.

be monopolized. Although a complete list and discussion of all the possible types of multi-market equilibria of the model is beyond the scope of this intuitive explanation and not particularly instructive, a detailed discussion of the uniqueness or multiplicity of equilibria is instead important.

As discussed more rigorously and proven in Proposition 3 below, multiple equilibria exist if both entrants have intermediate levels of the entry costs. In particular, in region D of Figure 1, where the goods are strong complements and both entrants have intermediate levels of entry costs, each incumbent monopolizes its market when he expects the other incumbent to do so as well (since in that region $k_i > \tilde{k}_{i,E_j=0}$ for both incumbents), and accommodates entry when he expects the other incumbent to do so as well (since in this region $k_i < \tilde{k}_{i,E_j=1}$ for both incumbents). In other words, in region D the monopolization decisions of the two incumbents are strategic complements, in that a decision by incumbent i to move from accommodating to deterring entry makes entry deterrence more profitable for incumbent j and induces that incumbent to monopolize its market as well.[18] This leads to the existence of two pure-strategy equilibria: one in which both incumbents monopolize their market and another in which neither does.

[18] For an analysis of super-modular games with strategic complementarities see, for example, Milgrom and Roberts (1990), Vives (1990) and Cooper (1999).

In regions B and C, where the goods are substitute or weak complements and both entrants have intermediate levels of entry costs, the monopolization decisions of the two incumbents are strategic substitutes, in that monopolization of one market makes monopolization of the other market less profitable. This leads to the existence of two asymmetric pure-strategy equilibria: one in which incumbent i monopolizes its market, while incumbent j does not, and another in which incumbent j monopolizes its market, while incumbent i does not. Finally, if at least one potential entrant has very high or very low entry costs (i.e. in regions A and E), the equilibrium is unique, with monopolization or entry in either or both markets, depending on parameter values.

Proposition 3 *In the linear demand model there exists a $\tilde{\lambda} < 0$ such that if $\lambda \leq \tilde{\lambda}$ then $\tilde{k}_{i,E_j=0}(\lambda) \leq \tilde{k}_{i,E_j=1}(\lambda)$, whereas if $\lambda \geq \tilde{\lambda}$ the opposite is true. This implies that*

1. *If $\lambda \leq \tilde{\lambda}$ and $k_i, k_j \in \left[\tilde{k}_{i,E_j=0}(\lambda), \tilde{k}_{i,E_j=1}(\lambda)\right]$ (in region D of Figure 1):*

   The entry-deterrence game played by the two incumbents has two Pareto-rankable pure-strategy equilibria, one in which both incumbents deter entry (i.e. in which $E_i = E_j = 0$) and one in which neither incumbent does (i.e. in which $E_i = E_j = 1$), with the former equilibrium yielding higher profits for both incumbents and lower social welfare in both markets than the latter equilibrium.

2. *If $\lambda \geq \tilde{\lambda}$ and $k_i, k_j \in \left[\tilde{k}_{i,E_j=1}(\lambda), \tilde{k}_{i,E_j=0}(\lambda)\right]$ (in regions B and C of Figure 1):*

   The entry-deterrence game played by the two incumbents has two non-Pareto-rankable pure-strategy equilibria, one in which one incumbent deters entry while the other does not (i.e. in which $E_i = 0$ and $E_j = 1$) and the other in which the opposite is the case (i.e. in which $E_i = 1$ and $E_j = 0$), with each incumbent preferring the equilibrium in which it deters entry and social welfare being the same in both equilibria.

3. *For all other parameter values (in regions A and E of Figure 1):*

   There exists a unique equilibrium, with entry or entry-deterrence in either or both markets depending on the specific parameter values.

Before concluding, it is helpful to discuss briefly the main factors that explain why the monopolization decisions of the two incumbents are strategic complements when the goods are strong complements in demand and strategic substitutes when the goods are substitutes in demand. In both cases the most important effect is the scale effect. When the goods are strong complements in demand, monopolization of market j, and thus an increase in the price of good j, strongly reduces the demand for good i and thus the scale that the potential entrant in market i can achieve if it enters, which makes monopolization of market i more profitable and thus more likely. When the goods are instead substitutes in demand, an increase in the price of good j increases the demand available to the potential entrant in market i if it decides to enter, making monopolization of that market less profitable and thus less likely. Although the profit extraction effect π_i^*/x_i^* is also affected by monopolization of market j both in the case of complementary and substitute goods, this effect either works in the same direction as the scale effect or is not sufficiently strong to offset the scale effect.[19]

5 Conclusions

This paper has provided a framework for analyzing the externalities imposed on each other by firms that are attempting to monopolize related markets for substitute or complementary goods. Within this multi-market framework monopolization of a given market affects the likelihood of monopolization of another market through the effect it has on the scale of production that the potential entrant can achieve if it enters (the "scale effect") and the effect it has on the profitability of monopolization relative to the harm it causes (the "profit extraction effect"). With linear demand, when the goods display a strong degree of complementarity in demand and the potential entrants in both markets have intermediate levels of entry costs, the monopolization decisions of the two incumbents are strategic complements and there exist two Pareto-rankable equilibria: one with monopolization in both markets and one with entry in both markets. When instead the goods are substitutes or weak complements in demand, the monopolization decisions of the two incumbents are strategic substitutes and there exist two asymmetric equilibria, in each of which a different incumbent excludes, while the other incumbent does not.

This model can be applied to a number of real world situations in which interaction between markets are important. The fact that, in those situations, the model predicts different types of multiple equilibria for certain parameter values suggests a potentially important role for antitrust policy. For example, when the production of a final good or service in a given sector of the economy requires a number of complementary inputs, monopolization of the market for one of those inputs tends to reduce output in the entire downstream sector, therefore reducing the derived demand for the other complementary inputs. This contraction in derived demand makes it easier for the incumbent producers of the other inputs to exclude potential entrants, making it more likely that also those

[19] A more detailed and formal discussion of the profit extraction effect is available from the author on request.

inputs will fall prey to monopolization. In situations like this, it is thus important for antitrust authorities to be aware of this possibility and, all else equal, to pursue antitrust enforcement more aggressively.[20]

This model can also be applied to the study of monopolization and antitrust enforcement in countries that engage in international trade of substitute goods with one another. When an industry in a given country exports a significant share of its output, the government of that country may have fewer incentives to prevent monopolization of that industry than it would have in the absence of international trade. This is because, in the presence of exports, by monopolizing the domestic industry an incumbent can earn significant profits at the expense of foreign buyers. Under certain conditions, this effect can be so large as to offset the welfare loss caused by monopolization of the domestic market.[21] The results in this paper suggest that the gains to each country from this "beggar-thy-neighbour" policy may be greater than one would expect. The fact the monopolization decisions in the two countries are strategic substitutes may give, under certain conditions, national governments incentives to commit to laxer antitrust enforcement in the hope of selecting the equilibrium that is more desirable for their country. Recent history has shown that it is not uncommon for trading partners, such as the United States and the European Union, to have conflicting interests over national antitrust policies and enforcement. Over the last two decades, divergent enforcement decisions regarding some high-profile mergers and unilateral conduct cases have caused significant tensions between the two trading partners. Most of these disputes have seen the U.S. government and U.S. companies voicing reservations about the correctness and impartiality of the enforcement actions undertaken by the European Commissions

[20] Note that exclusive contracts may also be efficiency enhancing – see, for example, Segal and Whinston (2000b) – and antitrust authorities and courts often have some degree of uncertainty about the real motives and consequences of exclusive arrangements. This implies that excessive antitrust enforcement has costs and that pursuing the most aggressive enforcement stance possible may not be an optimal policy in some circumstances. In those circumstances, the authorities will weigh the benefits and costs of enforcement. The argument presented above suggests that the benefits of antitrust enforcement may be relatively large in markets for complementary inputs and thus tend to tip the scale in favor of relatively more aggressive enforcement in those markets.

[21] These arguments are closely related to the literature on strategic trade and industrial policy. See Brander (1995) for a comprehensive survey. The existing literature on antitrust policy in an international context is, however, more scant. Levinsohn (1994) provides a survey of interesting policy issues but not much in the way of formal analysis. Spencer and Jones (1991) present a model in which a country is the only producer of an input used by downstream firms in the other country and can affect the price of this input in a way that favors domestic downstream firms. Raff and Schmitt (2005, 2006) present models of vertical restraints (exclusive territories and exclusive dealing) in the presence of international trade but, unlike in my paper, in their paper vertical restraints have the purpose of reducing downstream competition in the retail market rather than of foreclosing potential rivals in the same market.

against U.S. companies.[22] These divergences might be explained to a large extent by different institutional settings and views regarding the purpose of antitrust policy, but one cannot rule out that at least part of the explanation may relate to conflicts over the profits generated by the companies in question, with the E.U. attempting to shift those profits towards European consumers and competitors and the U.S. attempting to prevent this from happening. Although the framework developed in this paper can constitute a starting point to analyze these issues, a complete assessment of its implications for the optimal antitrust policies of different countries and their coordination would require a full-fledged model of endogenous antitrust policy-making in which national agencies consider both the costs and benefits of their actions.[23]

[22] Well-known examples of these tensions include the Boeing-McDonnell Douglas and the GE-Honeywell mergers, as well as the monopolization case brought against Microsoft. At the time of writing, both the U.S. Federal Trade Commission and the E.C. are investigating unilateral conduct by Google and considering whether to bring a case. A divergent decision on the Google case could be a source of renewed tensions between the two governments.

[23] I am currently developing such a model in ongoing work.

Appendix

Calculations explaining Assumption 1
The profit of the potential entrant in market i when the price of the foreign good is p_j is

$$\pi_i^E(p_i, p_j) = [p_i - (1 - a_i)c] \, ND(p_i, p_j).$$

The potential entrant sets a price equal to the incumbent's marginal cost c if the derivative of the expression above with respect to p_i is non-negative at $p_i = c$. This is the case when $\epsilon_i(c, p_j) \leq (1/a_i)$.

Proof of Proposition 1:
I start from stage five and work my way backward through the time line of the game.

Stage 5: If entry occurred in stage four the entrant and the incumbent compete á la Bertrand and, given Assumption 1 about the entrant's cost advantage relative to the elasticity of its demand, the entrant sets a price equal to c. If instead entry did not occur, the incumbent has market power and sets its price according to its reaction function $R_i(p_j)$.

Stage 4: Let s_i denote the share of buyers that have signed exclusive contracts with the incumbent producer of good i in stage two. After having observed s_i and the (exogenously given) price of good j, p_j, the potential entrant decides to enter only if $s_i < n_i^*(p_j)$, where $n_i^*(p_j)$ is given by (4); otherwise no entry occurs.

Stage 3: Consider first a continuation game in which the incumbent has offered an exclusive contract to a share $s_i < n_i^*(p_j)$ of buyers in stage two. In this continuation game buyers know that entry will occur in stage four and thus accept an exclusive contract only if the payment for exclusivity that they receive, x_i, compensates them completely for the loss of competition in good i, i.e. only if $x_i \geq x_i^*(p_j) = V(c, p_j) - V(R_i(p_j), p_j)$. Consider next a continuation game in which the incumbent has offered exclusive contracts to a share $s_i \geq n_i^*(p_j)$ of buyers in stage two. Entry will not occur in stage four unless a subset of buyers arrange a deviation that makes each of them better off. Note that, by the definition of coalition-proof equilibrium (see Bernheim et al. (1987)), this deviation involves coordination among buyers but no side-payments between them. This deviation will occur if one or more of the S_i buyers that have been offered an exclusive contract have been offered a payment that is less than the full compensation $x_i^*(p_j)$ calculated above, because these buyers know that by deviating they can cause entry in stage four. The deviation will, however, not occur if the incumbent offers each of the S_i buyers a payment equal to $x_i^*(p_j)$ (given the assumption that buyers sign an exclusive contract when they are indifferent). Therefore, in any coalition-proof Nash equilibrium the payment to each of the S_i buyers that sign exclusive contracts must always be equal or greater than $x_i^*(p_j)$.

Stage 2: Given the entry cost realization k_i drawn by the potential entrant in stage one, the incumbent knows that it can deter entry only by signing up at least a share $n_i^*(p_j)$ of buyers and paying each of them at least $x_i^*(p_j)$. If the incumbent decides to exclude, it does so at minimum cost by offering contracts with a payment equal to $x_i^*(p_j)$ to a share $s_i = n_i^*(p_j)$ of buyers and no payment to the remaining share $[1 - n_i^*(p_j)]$ of buyers. The incumbent will thus exclude if $N\pi_i^*(p_j) \geq N_i^*(p_j)x_i^*(p_j)$, which can be re-written as $n_i^*(p_j) \leq \pi_i^*(p_j)/x_i^*(p_j)$; that is, if the profit from exclusion exceeds its total cost. If $n_i^*(p_j) > \pi_i^*(p_j)/x_i^*(p_j)$ exclusion is not profitable for the incumbent and the incumbent does not offer a positive payment to any buyer. ■

Proof of Proposition 2:

Part 1: Entry in market j **(**i.e. $E_j = 1$**)**

Stage 5: If $E_j = 1$ the price in market j is c. If $E_i = 1$ the price in market i is also c, whereas if $E_i = 0$ it is $R_i(c)$.

Stage 4: The potential entrant in market i anticipates that the price of good j will be c and knows that its gross profits following entry will be $acND(c, c)$. He therefore decides to enter only if the share of buyers that have signed exclusive contracts with the incumbent in market i is less than $n_i^*(c)$, where $n_i^*(c)$ is given by (4).

Stage 3: A buyer considering signing an exclusive contract with the incumbent producer of good i observes that other buyers have not received any offer of positive payments for exclusivity from the incumbent producer of good j, and thus anticipate that the potential producer of good j will enter in stage four. Thus this buyer knows that $p_j = c$ in stage five. As for the price of good i, it will be equal to c if entry occurs in market i and to $R_i(c)$ if it does not. In a coalition-proof equilibrium buyers sign exclusive contracts only if the payment for exclusivity that they receive fully compensates them for the loss of competition. The full compensation required to obtain exclusivity on good i when entry occurs in market j must be $x_i^* \geq V(c, c) - V(c, R_j(c))$.

Stage 2: If the incumbent in market i decides to exclude it does so at minimum cost, i.e. it pays $x^*_{i,E_j=1} = V(c,c) - V(c, R_j(c))$ to a share $n^*_i(c)$ of buyers. Given this $x^*_{i,E_j=1}$, exclusion in market i is profitable and occurs in equilibrium if $\pi^*_{i,E_j=1}/x^*_{i,E_j=1} \geq n^*_i(c)$.

Part 2: Exclusion in market j ***(*** i.e. $E_j = 0$)

Stage 5: Contrary to the proof of Proposition 1, the existence of market power in market j implies that, for any p_i, p_j is set optimally by incumbent j according to the reaction function $R_j(p_i)$. Therefore in a continuation game in which $E_i = 0$ and $E_j = 0$, prices are given by the equilibrium of the differentiated Bertrand duopoly game between the incumbents in the two markets (i.e. they are p^m_i and p^m_j such that $p^m_i = R_i(p^m_j)$ and $p^m_j = R_j(p^m_i)$, and given symmetry $p^m_i = p^m_j = p^m$.) If instead $E_i = 1$ and $E_j = 0$, $p_i = c$ and $p_j = R_j(c)$, for all $i, j \in \{A, B\}$.

Stage 4: Since I am considering a situation with exclusion in market j and in which potential entrants cannot coordinate their entry decisions, the potential entrant in market i takes it as given that the potential entrant in market j will not enter. Therefore, potential entrant i anticipates that if it entered it could earn at most a total profit equal to $acD(c, R_j(c))$ on each free buyer (i.e. on each buyer that has not signed a contract with incumbent i). To see this, note that if potential entrant i entered and set $p_i = c$, incumbent j would respond by setting $p_j = R_j(c)$, which would generate a demand for good i equal to $D(c, R_j(c))$ from each free buyer. Thus, potential entrant i decides not to enter if $(1 - s_i) Na_i cD(c, R_j(c)) < K_i$, which, given $k_i \equiv K_i/Na_i c$ and using (4), is the case if $s_i \geq n^*_i(R_j(c))$. Given symmetry, for an equilibrium with exclusion in both markets each incumbent must, therefore, have signed up at least a share $n^*(R(c))$ of buyers. Since (as can be seen in stage two below) it is not optimal for an incumbent to sign up (with positive compensation) more buyers than the minimum necessary for exclusion, below we focus on the case in which each incumbent signs up exactly a share $n^*(R(c))$ of buyers (ignoring integer constraints.)

Stage 3: Consider a situation in which each incumbent has offered contracts to the same set of buyers (as I show in the discussion of stage two further below, offering contracts to different sets of buyers does not constitute an equilibrium when each incumbent can observe the set of buyers to which the other incumbent offers contracts.) The minimum compensation x^*_i that each incumbent i must pay each buyer for that buyer to sign both contracts depends on whether the marginal harm from exclusion ($h_{i,E_j=0}$) is greater or less than the inframarginal harm from exclusions ($h_{i,E_j=1}$) and can be determined as follows:

$h_{i,E_j=0} > h_{i,E_j=1}$. If $x^*_i < h_{i,E_j=1} < h_{i,E_j=0}$ for at least one incumbent, it is always optimal for the buyer to reject that incumbent's offer, regardless of whether it plans to accept or reject the offer of the other incumbent, i. In particular, if it plans to reject j's offer, the incremental utility that the buyer would get buy rejecting also i's offer x_i^* is $h_{i,E_j=1}$, which is greater than x_i^*. If the buyer plans to accept j's offer, the incremental utility it would get by rejecting i's offer would be $h_{i,E_j=0}$, which is also greater than x_i^*. Next, consider a situation in which $x_i^* \geq h_{i,E_j=1}$ for both incumbents, but $x_i^* < h_{i,E_j=0}$ for at least one incumbent. Since $x_j^* \geq h_{i,E_j=1}$, if the buyer were to reject i's offer, its best option would be to accept j's offer. Given this, the buyer would reject i's contract if the compensation x_i^* were such that $V(p^m, p^m) + x_i^* + x_j^* < V(c, R(c)) + x_j^*$, which is always the case for $x_i^* < V(c, R_j(c)) - V(p^m, p^m) = h_{i,E_j=0}$. Finally, if $x_i^* \geq h_{i,E_j=0}$ for both incumbents, a buyer cannot increase its utility by rejecting either offer or both offers. This proves that, when $h_{i,E_j=0} > h_{i,E_j=1}$, a buyer that has received offers from both incumbents accepts both offers only if $x_i^* \geq h_{i,E_j=0} = V(c, R_j(c)) - V(p^m, p^m)$ for both incumbents $i \in \{1, 2\}$.

$h_{i,E_j=0} < h_{i,E_j=1}$. The following proves that the buyer accepts both offers only if $x_i^* + x_j^* \geq V(c, c) - V(p^m, p^m)$ and $x_i^* \geq h_{i,E_j=0} = V(c, R_j(c)) - V(p^m, p^m)$ for both incumbents $i \in \{1, 2\}$. If $x_i^* + x_j^* < V(c, c) - V(p^m, p^m)$ the buyer is better off rejecting both offers. If $x_i^* + x_j^* \geq V(c, c) - V(p^m, p^m)$ but $x_i^* < V(c, R_j(c)) - V(p^m, p^m)$ for one incumbent, the buyer would accept j's offer and reject i's offer. To see this, note that the two previous inequalities imply $x_j^* \geq V(c, c) - V(c, R_j(c))$, which in turn implies that the buyer is better off accepting j's offer when it rejects i's offer. Given this, the buyer does in fact reject i's offer, given that it is not sufficient to compensate it for the incremental harm done by monopolization of market i. Finally, if $x_i^* + x_j^* \geq V(c, c) - V(p^m, p^m)$ and $x_i^* \geq V(c, R_j(c)) - V(p^m, p^m)$ for both incumbents the buyer always accepts both offers.

Stage 2: If incumbent i decides to exclude it is optimal for it to do so at minimum cost, taken as given the contracts offered by incumbent j. Consider first the case in which both incumbents make offers to the same set of buyers, which has been analyzed in stage three above. For the case in which $h_{i,E_j=0} > h_{i,E_j=1}$ this implies that if incumbent i decides to exclude it offers exactly $x_i^* = h_{i,E_j=0} = V(c, R_j(c)) - V(p^m, p^m)$. For the case in which $h_{i,E_j=0} < h_{i,E_j=1}$ this implies $x_i^* + x_j^* = V(c, c) - V(p^m, p^m)$ and $x_i^*, x_j^* \geq V(c, R_j(c)) - V(p^m, p^m)$. Since there are many combinations of x_i^* and x_j^* that satisfy the two conditions in the last sentence, for concreteness in the rest of the paper I focus on a symmetric solution in which both incumbents offer the same compensation $x_i^* = x_j^* = [V(c, c) - V(p^m, p^m)]/2$.

It remains to be proven that each incumbent finds it optimal to make offers to exactly the same set of buyers as the other incumbent. Assume this were not the case and that incumbent i offers a contract to one or more buyers that do not have an offer from incumbent j (which also implies that there is an equal number of buyers that receive only offers from incumbent j, since the total number of contracts offered by the two incumbents is the same in this symmetric model). In a coalition-proof equilibrium the buyers that receive contracts only from i would need to be compensated by i for the entire loss of competition on both goods, i.e. each of them would need to be paid $x_i^* \geq V(c, c) - V(p^m, p^m)$, otherwise, if incumbent j has offered $x_j^* < V(c, c) - V(p^m, p^m)$ to each of the buyers that receive only its contract, the buyers that receive only i's contract could always cause entry in both markets by rejecting their contract and inducing the buyers that received only contracts from incumbent j to reject theirs as well. Therefore, incumbent i finds it optimal to approach the same buyers that have received offers from incumbent j and induce them to sign by offering only $V(c, R_j(c)) - V(p^m, p^m) < V(c, c) - V(p^m, p^m)$ to each of them. If instead incumbent j has offered $x_j^* \geq V(c, c) - V(p^m, p^m)$ to each buyer that does not have a contract from i, it is incumbent j that finds it optimal to approach the buyers that have an offer only form incumbent i and induce them to sign by offering only $V(c, R_j(c)) - V(p^m, p^m) < V(c, c) - V(p^m, p^m)$. This establishes that when the two incumbents can observe or infer to which buyers the other incumbent has made offers but do not make offers to the same set of buyers, there always exists a profitable deviation that involves at least one of the two incumbents making offers to at least one of the buyers that receives an offer from the other incumbent. ■

Proof of Proposition 3:

Part 1: $\lambda \leq \tilde{\lambda}$ and $k_i, k_j \in \left[\tilde{k}_{i,E_j=0}(\lambda), \tilde{k}_{i,E_j=1}(\lambda)\right]$, (***Region D)***

Consider a candidate equilibrium in which both incumbents exclude, i.e. in which $E_i = 0$ and $E_j = 0$. Since the model is symmetric, $\tilde{k}_{i,E_j=0}(\lambda) = \tilde{k}_{j,E_i=0}(\lambda)$ (i.e. the curve $\tilde{k}_{i,E_j=0}(\lambda)$ in the graph applies to both incumbents when the other incumbent excludes.) Therefore in region D one has $k_i > \tilde{k}_{i,E_j=0}(\lambda)$ and $k_j > \tilde{k}_{j,E_i=0}(\lambda)$ and exclusion is profitable for each provider when the other provider excludes. This implies that there exists no profitable deviation from $E_i = 0$ and $E_j = 0$. Consider now a candidate equilibrium with entry in both markets, i.e. with $E_i = 1$ and $E_j = 1$. As above, since the model is symmetric, $\tilde{k}_{i,E_j=1}(\lambda) = \tilde{k}_{j,E_i=1}(\lambda)$ (i.e. the curve $\tilde{k}_{i,E_j=1}(\lambda)$ in the graph applies to both incumbents when the other incumbent does not exclude.) In region D one has $k_i < \tilde{k}_{i,E_j=1}(\lambda)$ and $k_j < \tilde{k}_{j,E_i=1}(\lambda)$ and exclusion is not profitable for either provider when the other provider does not exclude. Therefore there exists no profitable deviation from $E_i = 1$ and $E_j = 1$.

Part 2: $\lambda \geq \tilde{\lambda}$ and $k_i, k_j \in \left[\tilde{k}_{i,E_j=1}(\lambda), \tilde{k}_{i,E_j=0}(\lambda)\right]$, (***Regions B and C)***

For $\lambda \geq \tilde{\lambda}$ it is always the case that $\tilde{k}_{i,E_j=0}(\lambda) > \tilde{k}_{i,E_j=1}(\lambda)$. This means that monopolization in market j tends to make monopolization (weakly) less profitable in market i since it raise the threshold of the potential entrant's entry cost above which exclusion by incumbent i is profitable. Analogously, entry in market j tends to make monopolization weakly more profitable in market i. Consider a candidate equilibrium with $E_i = 0$ and $E_j = 1$. When k_i and k_j are in regions B or C, $k_i \geq \tilde{k}_{i,E_j=1}(\lambda)$ and a deviation by incumbent i would not profitable; moreover, $k_j \leq \tilde{k}_{j,E_i=0}(\lambda)$ and a deviation by incumbent j would not profitable either, which together imply that $E_i = 0$ and $E_j = 1$ is an equilibrium. Consider next a candidate equilibrium with $E_i = 1$ and $E_j = 0$. When k_i and k_j are in regions B or C, $k_j \geq \tilde{k}_{j,E_i=1}(\lambda)$ and $k_i \leq \tilde{k}_{i,E_j=0}(\lambda)$ and a prove similar to the one above applies.

Part 3: (***Regions A and E)***

Denote by (E_i, E_j) one of the four possible outcomes of the entry-deterrence game, so that $(E_i, E_j) \in \{(0,0), (1,1), (0,1), (1,0)\}$. It is straightforward to show that, when at least one (not necessarily both) of k_i and k_j are in regions A or E, if one of these outcomes is an equilibrium, the other three cannot be an equilibrium. ■

References

Abito, Jose Miguel and Julian Wright (2008), "Exclusive Dealing with Imperfect Downstream Competition," *International Journal of Industrial Organization* 26, pp. 227-246.

Bernheim, B. Douglas (1984), "Strategic Deterrence of Sequential Entry into an Industry," *RAND Journal of Economics*, 15 (1), Spring, pp. 1-11.

Bernheim, B. Douglas, Bezalel Peleg, and Micahel D. Whinston (1987), "Coalition-Proof Nash Equilibria I. Concepts." *Journal of Economic Theory* 42, pp. 1-12.

Bork, Robert (1978), *The Antitrust Paradox: A Policy at War with itself.* New York: Basic Books.

Brander, James (1995), "Strategic Trade Policy," in *Handbook of International Economics*, Vol. 3, (G. Grossman and K. Rogoff eds.), Elsevier B.V.: Amsterdam, Chapter 27, pp. 1395-1455.

Cooper, Russell (1999), *Coordination Games: Complementarities and Macroeconomics*, Cambridge University Press.

Fumagalli, Chiara and Massimo Motta (2006), "Exclusive Dealing and Entry, when Buyers Compete," *American Economic Review* 96(3), pp. 785-95.

Gilbert, Richard and Xavier Vives (1986), "Entry Deterrence and the Free Rider Problem," *Review of Economic Studies*, 53, pp. 71-83.

Kaplow, Louis and Carl Shapiro (2007), "Antitrust," in *Handbook of Law and Economics*, Volume 2, (A. M. Polinsky and S. Shavell eds.), Chapter 15, Elsevier B.V.: Amsterdam.

Levinsohn, James (1994), "Competition Policy and International Trade," NBER Working Paper No. 4972.

Milgrom, Paul and John Roberts (1990), "Rationalizability, Learning and Equilibrium in Games with Strategic Complementarities," *Econometrica*, 58, pp. 1255-1278.

Posner, Richard (1976), *Antitrust Law: An Economic Perspective*, Chicago: University of Chicago Press.

Raff, Horst and Nicolas Schmitt (2005), "Endogenous Vertical Restraints in International Trade," *European Economic Review*, 49, pp. 1877-1889.

Raff, Horst and Nicolas Schmitt (2006), "Exclusive Dealing and Common Agency in

International Markets," *Journal of International Economics*, 68 , pp. 485-503.

Rasmusen, Eric B., J. Mark Ramseyer, and John S. Wiley (1991), "Naked exclusion," *American Economic Review* 81, pp. 1137-1145.

Segal, Ilya and Michael D. Whinston (2000a), "Naked exclusion: Comment," *American Economic Review* 90, pp. 296-309.

Segal, Ilya and Michael D. Whinston (2000b), "Exclusive Contracts and Protection of Investments," *RAND Journal of Economics*, 31, Winter 2000, 603-33.

Shubik, Martin and Richard Levitan (1980), *Market Structure and Behavior*. Cambridge, MA: Harvard University Press.

Simpson, John and Abraham Wickelgren (2007), "Naked Exclusion, Efficient Breach, and Downstream Competition," *American Economic Review* 97(4), pp. 1305-1320.

Spector, David (2011), "Exclusive Contracts and Demand Foreclosure" *RAND Journal of Economics*, Vol. 42 No. 4 (Winter), pp. 619-638.

Spencer, Barbara and Ronald Jones (1991), "Vertical Foreclosure and International Trade Policy," *Review of Economic Studies*, 58, pp. 153-170.

Tirole, Jean (1988), *The Theory of Industrial Organization*, (Cambridge, MA, MIT Press).

Vives, Xavier (1990), "Nash Equilibrium with Strategic Complementarities," *Journal of Mathematical Economics*, 19, pp. 305-321.

Waldman, Michael (1991), "The Role of Multiple Potential Entrants/Sequential Entry in Noncooperative Entry Deterrence," *RAND Journal of Economics*, 22, Autumn, pp. 446-453.

Whinston, Michael D. (2006), *Lectures on Antitrust Economics*, Cambridge, MA: MIT Press.

Wright, Julian (2009), "Exclusive Dealing and Entry, when Buyers Compete: Comment," *American Economic Review* 99, pp. 1070-1081.