Long Term Contracts, Arbitrage, and Vertical Restraints

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May 1995

Abstract

The paper argues that sellers sometimes impose exclusivity clauses on their buyers in order to prevent arbitrage between brands. In a duopoly model in which the sellers compete through fairly general long term contracts, it is shown that common agency is always allowed whenever reselling can be controlled directly, but that exclusive dealing is imposed otherwise. The model also offers a new rationale for ex post inefficient penalties for breach of contract.

Equilibrium long term contracts are shown to reduce sellers' profits and to increase the buyers' surplus relative to the spot market level. Exclusive dealing lowers overall welfare in this model. As an illustration, the theory is applied to the case of British brewers.

KEYWORDS: vertical restraints, exclusive dealing, requirements contracts, breach.
JEL Code: L1,L4.

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1 Introduction

There is a large and growing literature studying the fine details of vertical contractual relationships (see Tirole (1988, ch 4), Katz (1989) and Rey (1994) for surveys). In part, the literature is motivated by the desire to provide good explanations for actual business practices, but it is fair to say that the topic derives much of its interest from antitrust controversy. Authorities have been worried about the anti–competitive effects of vertical restraints, i.e. contracts which restrain trade with outside parties. Notably the law has been against contracts prohibiting purchases from competing suppliers, i.e. exclusive dealing.[1]

In this paper, I will neglect any effects of vertical restraints on downstream competition, and focus on cases where the buyer is a final customer or a monopoly retailer. There are currently two main strands of literature studying exclusive dealing with a single buyer. One strand, represented by Comanor and Frech (1985), Aghion and Bolton (1987) and Rasmusen, Ramseyer and Wiley (1991), focuses on the possibility that incumbent or dominant sellers can use long term contracts to exclude entrants or minor sellers from the market, or to extract some of their surplus.[2] This is usually referred to as the foreclosure hypothesis, because the contract is designed to deny competitors market access. The other strand explores how vertical restraints could be motivated by the more innocuous desire to solve a variety of commitment and incentive problems. For example there could be asymmetric information concerning buyer characteristics (as in Martimort (1993)) or buyer effort (as in Bernheim and Whinston (1992)). It has been shown how, under these circumstances, vertical restraints may help the seller to extract the buyer's information rents or to provide better effort incentives. Alternatively, vertical restraints could ameliorate free–rider problems; with common dealership each seller would do too little promotion due to positive externalities between brands (see Marvel (1982) and Besanko and Perry (1993)).

The present paper proposes a different rationale for vertical restraints. I argue that in an oligopoly it is individually rational for all sellers to approach buyers as early as possible, to preempt their existing competitors and to avoid being preempted by them. The role of vertical restraints according to this theory is not mainly to exclude other sellers, but

[1] Exclusive dealing has often been argued to stifle competition, and in the U.S. it has been legally challenged under Section 1 of the Sherman Act, Section 3 of the Clayton Act and Section 5 of the FTC Act. See Ornstein (1989) for a comprehensive discussion. Several other papers in the reference list use specific antitrust cases as a backdrop for their arguments. Within the European Community contracts have been challenged under Article 85 of the Treaty of Rome.

[2] The paper by Comanor and Frech (1985) was followed by a discussion involving Mathewson and Winter (1987), Schwartz (1987) and Comanor and Frech (1987). See Bernheim and Whinston (1992) for a demonstration that in some models, in particular that of Mathewson and Winter (1987), exclusive dealing ceases to occur when non–linear wholesale prices are allowed.

to prevent arbitrage between long term contracts and the spot market. Without restraints, the buyer may simply resell what he buys under a long term contract (and either not purchase anything or purchase from other sellers). For example, it is pointless for a brewery to offer attractive contractual terms to a pub if the beer is eventually resold to one of the brewery's other buyers and then replaced by another brand. In that case, the contract does not create trade and the seller is better off by offering spot market terms only. The paper shows that *common agency* (the buyer signs a long term contract with several sellers) always occurs when arbitrage can be prevented directly. When arbitrage cannot be prevented directly, on the other hand, there are plausible parameter values such that exclusive dealing is the unique equilibrium outcome.

A key assumption, which seems fairly realistic, is that new information becomes available over the duration of a long term contract. More specifically, I assume that some buyers know that they want to purchase a product before they know exactly which specifications they want. For example, a clothing retailer knows that it will have to purchase trousers and shirts, but it does not know which brands will be most profitable in the years to come. Hence, two products (manufacturer labels) whose value to the buyer is random with the same expectation – and hence homogeneous – at an early stage, may be heterogeneous once the value is realized.

As a consequence of ex ante homogeneity, long term contracting tends to be more competitive than spot market contracts. Intuitively, competition in long term contracts removes the cushion provided in the spot market by product differentiation.[3] In the current model, the sellers would all gain if vertical restraints were outlawed, and buyers would lose.[4] In this sense, the vertical restraints are pro–competitive. The total effect of vertical restraints on welfare depend on the circumstances. If reselling is prevented directly, the welfare is unabiguously higher, because in equilibrium the buyer accepts the contracts from both sellers and hence always makes an optimal purchasing decision. With an exclusivity clause, the welfare effect is negative, because the buyer risks having to purchase the wrong product. This result contradicts the popular view, held by Posner (1976) and Bork (1978) among others, that exclusive contracts are efficient because otherwise they would not be signed by the buyers. While it is true that the buyers gain, the sellers' joint loss is greater.

To illustrate the theory's applicability, I confront it with the particular case of the British brewing industry. Earlier writers on the history of the beer industry have identified preemption as the main motive for tying pubs to brewers, and detailed features of the

[3]Polo (1991), in a model of horizontal product differentiation, also demonstrates that a market is more competitive the fewer are the buyers who know which products they like.

[4]In the model of Besanko and Perry (1993) there is also a region of parameter space such that exclusive dealing occurs in equilibrium while being harmful to the sellers.

contracts also conform to the the current theory.

The paper is outlined as follows. Section 2 sets up the model, and the main results are presented in Section 3. Briefly the results are (i) that reselling is prevented directly whenever possible (Proposition 4), (ii) if arbitrage cannot be directly prevented, the sellers will instead introduce a clause restricting purchases from competitors (Proposition 1), although (iii) penalties for breach will be set at a level which allows breach some of the time (Proposition 2). Section 4 briefly discusses the case of the British brewing industry in light of the theory. Final remarks are collected in Section 5.

2 The Model

There are two sellers in the market. There is one "long-term" buyer, called LTB (or when the meaning is clear; the buyer), with whom it is possible to write a contract prior to the opening of the spot market. In addition there are "short-term" buyers who are only active in the spot market. Each buyer wants exactly one unit of the product.

The two sellers are located at opposite ends of an Hotelling line of length 1, producing with a unit cost of 0 (positive unit costs do not affect results qualitatively). LTB's net valuation of seller 1's product is

$$w := v - tx,$$

where x is the distance from the buyer's location to seller 1, and t is a "transportation" cost. (As usual, I interpret t more broadly as a taste parameter.) It is assumed that x is uncertain ex ante, with a distribution $G : [0,1] \to [0,1]$, and that its realization coincides with the opening of the spot market. Unlike in the standard model I will sometimes allow even v to be a random variable, with distribution $F : [0,1] \to [0,1]$. The reason is that with v fixed there is no scope for trade creation in this framework. The distributions F and G are assumed to be independent. I shall refer to the pair (x, v) as the long term buyer's "type."

the density functions corresponding to F and G are denoted f and g respectively, and it is assumed that $g(x)$ is symmetric around 1/2. While I do not impose a full support condition, I shall assume that "high" values of x and v occurs with positive probability:

Assumption 1 *$F(1-\epsilon) < 1$ and $G(1-\epsilon) < 1$ for all $\epsilon > 0$.*

This completes the description of production technology and taste, and I am ready to start the analysis of transactions.

The timing is as follows. *Stage 1a:* The two sellers make simultaneous offers of long term contracts (the nature of which will be made clearer below) to LTB. *Stage 1b:* These offers are either accepted or rejected. *Stage 2a:* LTB learns his valuation. *Stage 2b:* Delivery is carried out according to long term contracts, if any are in place. The two sellers make their spot market offers, and spot transactions (including any reselling) are concluded.

2.1 Short Term Contracts

As a benchmark, let us establish what would happen if LTB always knew his valuation, or equivalently if sellers could only offer short term contracts. Because LTB demands (at most) a single unit, a short term contract is nothing but a price. To simplify the analysis of arbitrage, it is also assumed that the equilibrium price derived below is identical to the equilibrium spot market offer made to other buyers.

Notice first that the identity of LTB's preferred seller does not depend on v. Seller 1 is preferred to seller 2 if $x \leq d$, where d solves the "marginal man" equation

$$p_1 + td := p_2 + (1 - td).$$

The solution is

$$d = \frac{p_2 - p_1 + t}{2t}. \tag{1}$$

Now, given that $x \leq d$, LTB will purchase if and only if $w \geq p_1$. Thus, seller 1's expected profit from selling to LTB is

$$\pi_1 := \int_0^d p_1(1 - F(p_1 + tx))g(x)\,dx. \tag{2}$$

Seller 2's profit function is

$$\pi_2 := \int_d^1 p_2(1 - F(p_2 + t(1 - x)))g(x)\,dx. \tag{3}$$

It is assumed that both sellers maximize profit, conditional on their expectations about the other seller's strategy. In the Appendix I report a general, but implicit, expression for a symmetric equilibrium price. A closed form solution for the Nash equilibrium in short term conracts can be obtained for specific functional forms. Throughout the paper I will repeatedly consider two special cases, referred to as case A and B respectively. In both these cases G is taken to be uniform, so that $g(x) = 1$ for all $x \in [0, 1]$. In case A, v is deterministic, as in the standard Hotelling model, whereas in case B, F is uniform on the interval $[0, 1]$. To ensure market coverage (i.e. that the equilibrium prices are such that LTB purchases with positive probability regardless of x) in each of these cases, we make the following assumption.

Assumption 2 $t < 2/3$.

Case A was studied by Hotelling (1929) himself. Seller 1's profit is $\pi_1^A = p_1 d$, and seller 2's profit is $\pi_2^A = p_2(1 - d)$. The Nash equilibrium, $p^A = (p_1^A, p_2^A)$, is the pair of prices for which the two first-order conditions both hold:

$$p_1^A = p_2^A = t. \tag{4}$$

Case B requires a bit more algebra, but is solved in a similar fashion. Here, the unique equilibrium, $p^B = (p_1^B, p_2^B)$, is

$$p_1^B = p_2^B = \frac{2 + 3t - \sqrt{13t^2 - 4t + 4}}{4}. \tag{5}$$

In case A the equilibrium profit is

$$\pi^A = p^A/2, \tag{6}$$

while in case B it is

$$\pi^B = \frac{p^B(4 - 4p^B - p^B t)}{8}. \tag{7}$$

Subscripts are omitted, as the profit is the same for each seller. Notice that in both cases price is an increasing function of t, and the price equals marginal cost when $t = 0$. It is also easily shown that $p^B < p^A$. The reason is that in case B the sellers need to worry about the valuation v (which is more likely to bind the higher is the price) and not only the price of the competitor. Another distinction between the two cases is the impact of t on the profit. In case A, an increase in t is purely beneficial for the sellers, as the greater degree of differentiation pushes up the equilibrium price while leaving quantities constant. When v is random, however, an increase in t leads to a lower amount of trade for a given price, while the equilibrium price is less responsive to t.[5] This insight helps explain one of the results that are derived below.

2.2 Long Term Contracts

At stage 1, the sellers can make simultaneous contract offers to LTB, who may accept or reject. Recall that at this time the buyer does not know his type, (x, v).

A contract specifies the following: (i) a lump-sum transfer from the seller to the buyer,l, (ii) a price in the case of purchase, p^C, (iii) restrictions on trade with others, and (iv) a penalty for breach, y. Thus, essentially, sellers offer a form of call options, which can potentially also restrain the buyer's other deals. The two restrictions which will be considered here are a) a reselling restriction and b) an exclusivity clause (i.e. a requirements contract). Formally, then, a contract is a quintuple $\langle l, p^C, r, e, y\rangle$, where r and e are binary variables indicating whether each of the two restrictions are imposed.

[5] In case A p is proportional to t, but in case B $(dp/dt) < 1$ for all t within the relevant range (recall that $t < 2/3$ by Assumption 2).

E.g., if reselling is not permitted, r is set equal to 1, otherwise it is 0. We shall look for subgame perfect Nash equilibria of the contracting game.

3 Results

While restrictions on reselling can be enforced in many markets - automatically so when services are concerned - there are also markets where it is impossible, or very costly, for the seller to directly prevent arbitrage. As we shall see, requirements contracts constitute a way around this problem.

3.1 Exclusivity

Let us now suppose that reselling cannot be observed, and hence not prevented, but that exclusivity is enforceable. This seems like a reasonable description of many markets: A clothes manufacturer cannot detect whether a retailer resells some clothes to other retailers, but it can observe whether the retailer also sells competing brands.

For the moment let us ignore penalties by assuming that y is set at a prohibitively high level, i.e. $y = \infty$. Let $\langle l, p^C, \underline{0}, e, \underline{\infty} \rangle$ denote a possible contract in this environment. (An underlined variable indicates that its value cannot be changed.) One result is immediate.

Lemma 1 *Suppose reselling is costless. Then an optimal long-term contract (if one exists) must have the contract price, p^C, equal to the spot market price.*

To see this, suppose that a seller offers an option to buy at a price lower than the spot market price. If the buyer accepts the contract, he will always exercise the option. When the buyer's valuation is less than p^C, he will however resell everything on the spot market – replacing the seller's own sales. This is simply a variant of the insight that costless arbitrage prevents price discrimination. On the other hand, a contract price above p^C is an option that will never be exercised (the buyer would buy spot instead), and the seller would have to pay the buyer to accept it; hence, it is strictly dominated. If LTB can participate freely in the spot market (trading restrictions are not enforceable), we see that there is no point in offering long term contracts, as each seller only replicates his spot market outcome.

The main result of this paper is to demonstrate that long term contracts do appear in equilibrium once either trading restriction clause is enforceable.

Let us start with the exclusivity clause. The characterization of exclusive contracts is quite simple. By Lemma 1 the contract price is equal to the spot market price. Having set the penalty y at a prohibitive level, the only parameters to be determined are therefore the exclusivity clause and the lump-sum transfer. Suppose that seller 2 does not have an exclusivity clause; i.e. he only offers the spot market terms. If seller 1 can convince the buyer to accept an exclusive contract, his expected revenue is

$$R := \int_0^1 p^S(1 - F(p^S + tx))g(x)\,dx. \tag{8}$$

Thus, offering an exclusive contract is a best response to no contract if the buyer accepts it against a lump-sum payment $l \leq L$ where

$$L := R - \pi^S = \int_d^1 p^S(1 - F(p^S + tx))g(x)\,dx. \tag{9}$$

Note that L is the added revenue obtained due to the exclusivity clause; the buyer purchases from seller 1 whereas in the spot market he would prefer top purchase from seller 2.

Define l_{min} as the smallest payment a buyer would require to give up his freedom to choose supplier. We are then in a position to prove the following result:

Proposition 1 *(i) If $l_{min} < L$, the unique equilibrium entails both sellers offering $\langle \pi^S + L, p^S, \underline{0}, 1, \underline{\infty} \rangle$, i.e. an exclusive contract with an associated lump-sum transfer of $\pi^S + L$ to the buyer. (ii) If $l_{min} \in [L, R]$, there is an additional equilibrium in which long term contracts are not offered by either seller.*

Proof: (i) That this is *an* equilibrium is trivial. Any smaller lump-sum payment means that the buyer will accept the other seller's exclusive contract (as will an offer of no exclusivity). A larger lump-sum payment means that the expected profit is negative. Uniqueness is proved by ruling out all other candidate equilibria: Consider the situation that $\max\{l_1, l_2\} < \pi^S + L$. Then the seller whose offer will be rejected (or in the case of identical offers; both sellers) has an incentive to offer the buyer a higher payment. If $\max\{l_1, l_2\} > \pi^S + L$, the winning seller expects to lose money on the contract, so this cannot form part of an equilibrium. Finally, consider the situation where no seller offers an exclusive contract. Here it is profitable to deviate by offering an exclusive contract with a lump-sum payment of l_{min}. (ii) The existence of the additional equilibrium follows from the fact that now it is no longer profitable for a seller unilaterally to deviate from spot market conditions to an exclusive contract: In order to accept an exclusive contract, the buyer requires a compensation, l_{min}, which is greater than or equal to the seller's expected revenue increase, L. $\square$

When $l_{min} > L$ (part (ii) of the proposition), the equilibrium with long term contracts is payoff dominated by the equilibrium in which the sellers confine their competition to the spot market. Part (i) is different, however. Here, exclusivity is a feature of the unique equilibrium; the unambiguous prediction of the model. It remains to check that part (i) has some relevance, i.e. that there are parameters such that $l_{min} < L$. A general expression for l_{min} is

$$
\begin{aligned}
l_{min} \;:=\;& \int_0^{1/2}\int_{p+tx}^{p+t(1-x)} (v-p-tx)f(v)g(x)\,dv\,dx \\
+\;& \int_0^{1/2}\int_{p+t(1-x)}^{\overline{v}} (t(1-x)-tx)f(v)g(x)\,dv\,dx.
\end{aligned} \tag{10}
$$

When v is deterministic and G is uniform (Case A), we get the simpler expression

$$
l^A_{min} = \int_0^{1/2} (t(1-x)-tx)\,dx = t/4. \tag{11}
$$

Since $L = \pi^A = t/2$ in this case, we have that $l_{min} < L$, as desired: Both sellers offer requirements contracts in the unique equilibrium.

Again, case B demands more computations, but it is still tractable. Equation (10) becomes

$$
l^B_{min} = \frac{t(6-6p+t)}{24},
$$

whereas

$$
L^B = \frac{p(4-4p-3t)}{8}.
$$

Inserting the equilibrium price from (5), we find that $l^B_{min} < L$ if and only if $t < 0.302$. In other words, exclusivity is a feature of the unique equilibrium only as long as the products are not too differentiated. (Recall from Assumption 2 that $t < 2/3$.) I have already hinted at the reason why case B differs from case A: The increase in profitability from a higher degree of differentiation is smaller in case B. Thus, eventually as t increases, the rent that can be captured through an exclusivity clause is smaller than the efficiency loss associated with restricting the buyer's choice of supplier.

To summarize, there are plausible conditions under which requirements contracts occur in the unique equilibrium. Moreover, in this equilibrium the sellers' profit is competed down to zero, whereas the long term buyer is better off.

If we neglect the redistribution of surplus, the welfare effect of the long term contract is unambiguously negative. Since the buyer's decision whether or not to purchase is based on the spot market price, and since the contract deprives the buyer of the choice between the two products, trade is less efficient than it would have been without the long term contract.

3.2 Breach

So far we have studied unconditional requirements contracts, assuming that the penalty for breach (liquidated damages paid by the buyer if he switches supplier) is prohibitive. This is not fully satisfactory. In general the buyer would be willing to accept a lower lump sum transfer in return for an option to switch supplier.

Consider again a buyer who has written a requirements contract with seller 1. Clearly, the buyer breaches only if

$$v - t(1-x) - p - y \geq v - tx - p.$$

Define $\hat{x}$ as the location at which the condition holds with equality,

$$\hat{x} := \frac{t+y}{2t}. \tag{12}$$

The second condition for switching is that the buyer makes positive profit by it, or

$$v - t(1-x) - p - y \geq 0.$$

Define $\hat{v}$ as the gross valuation for which this profit is exactly zero;

$$\hat{v} := p + y + t(1-x). \tag{13}$$

The buyer's expected net benefit from being able to switch supplier is then

$$\beta := \int_{\hat{x}}^{1} \int_{p+tx}^{1} (tx - t(1-x)) f(v) g(x)\, dv\, dx + \int_{\hat{x}}^{1} \int_{\hat{v}}^{p+tx} (v - \hat{v}) f(v) g(x)\, dv\, dx, \tag{14}$$

where the second term is the gain from being able to buy from seller 2 when he otherwise would have bought from seller 1, and the last term is the benefit from buying from seller 2 when he otherwise would not have bought at all. Seller 1's expected net benefit (loss) from breach is

$$\lambda := \int_{\hat{x}}^{1} \int_{p+tx}^{1} (y - p) f(v) g(x)\, dv\, dx. \tag{15}$$

Since the seller can extract the buyer's expected gain through the lump sum payment, l, the optimal penalty maximizes $\tau := \beta + \lambda$.

We already know that optimal penalties are strictly positive. (Indeed, I have given conditions under which prohibitive penalties dominate no penalties.) Hence, the challenge is to show whether optimal penalties are prohibitive. Suppose $p \leq t$. (We give a set of sufficient conditions for this in the Appendix.) It is then straightforward to check that it is optimal to have breach with positive probability; just set the penalty slightly below t. This gives a strictly positive probability of breach ($\hat{x} = (t+y)/(2t) < 1$), and, because $p \leq t$, at most a second order loss for the seller. The expected gain to the buyer, on the other hand, is first order.

Using our parametrized examples, we can get a handle on the magnitudes involved. Again, case A is particularly easy to study. The total benefit from allowing breach is

(remember that $p = t$)

$$\tau^A = \int_{\hat{x}}^{1} (y - t)\, dx + \int_{\hat{x}}^{1} (tx - t(1-x))\, dx.$$

The benefit is maximized using the penalty $y = 2t/3$, implying a probability of switching equal to $1 - \hat{x} = 1/6$. Clearly, this represents a substantial improvement in welfare, as the worst ex post inefficiencies are avoided. On the other hand, the situation is still far from first best (which would require switching with probability 1/2).

Case B is computationally harder, and the closed form expression for the penalty is therefore omitted. Table 1 reports some solutions for different values of t.

t	p	y	$\hat{x}$
0.1	0.0922	0.0637	0.8185
0.2	0.1678	0.1202	0.8005
0.3	0.2269	0.1675	0.7792

TABLE 1: OPTIMAL BREACH

We see that greater product differentiation leads to an increase in the probability of renegotiation. (When $t = 0.1$ the probability is roughly 18%, when $t = 0.3$ the probability has gone up to 22%.) For all t the probability of switching is higher than in case A. The reason is that in case B there is not only the savings from switching supplier (the first term in equation (14), but also the net increase in trade (the second term in (14)) which speaks in favor of a lower penalty. Again, breach does not remove nearly all the inefficiency. There is a considerable probability that the buyer purchases the wrong product ex post or that he purchases none at all despite the fact that his valuation for seller 2's product exceeds its price. It is worth emphasizing that the penalty is renegotiation–proof; as long as the seller does not know the buyer's valuation, the penalty maximizes the seller's expected surplus.

It is also interesting to note that once breach is allowed, the profit from long term contracts must be bounded above zero. Otherwise, a seller can just abstain from offering a contract: If the competitor offers one, the buyer will be released ex post with positive probability, in which case he may switch and pay the spot price. Instead of driving profits to zero, they are driven down to the point at which a seller is indifferent between getting the contract or waiting for the buyer to breach the competitor's contract.

The discussion can be summarized as follows.

Proposition 2 *In equilibrium, requirements contracts impose penalties for breach which are strictly positive, but allow some breach.*

This result is related to the work by Aghion and Bolton (1987). There, penalties are set in such a way as to maximize the expected rent which can be extracted from a competing seller (a potential entrant), whose cost is private information. Here, the penalty maximizes the rent that a seller can extract from the buyer whose taste is private information. An important difference is that Aghion and Bolton study a situation in which an incumbent seller has a first–mover advantage which can be used to exclude an entrant.[6] Here, I have shown that inefficient exclusive contracts occur in equilibrium even when no seller has a strategic advantage. Another interesting difference is that the penalty considered by Aghion and Bolton is not renegotiation–proof, as demonstrated by Spier and Whinston (1995).

3.3 No reselling

Let us turn now to the situation where reselling *can* be prevented directly. As argued above, this is realistic for example in service industries. In this case, it is possible – in fact optimal – to set the contract price, p^C, equal to marginal cost (here;zero). Any surplus is extracted through the lump sum transfer. Hence, what was a payment from the seller to the buyer under the requirements contract becomes a franchise fee here.

As we shall see, it is no longer optimal to restrict trade with the other seller. Instead, I prove below that the interesting equilibrium has both sellers offer the contract $\langle N, 0, 1, 0, 0\rangle$, where N is the transfer which exactly extracts the buyer's surplus from one contract given that he has accepted the other. In equilibrium, the buyer accepts both contracts.

It is easier to prove existence and uniqueness after we have derived an expression for the lump sum transfer, N. To do this, define x^* by the equation

$$p + tx^* := (1 - x^*)t, \tag{16}$$

where $p = p^S$ (we drop the superscript to save notation). Only if $x \leq x^*$, would the buyer be willing to purchase from seller 1 at a spot price of p, given that he has already accepted the equilibrium contract from seller 2. The reason why we are interested in x^* is that a seller is limited in his ability to extract surplus not only by the terms of the competitor's contract, but also by his own spot market price. Notice that in case A, $x^* = 0$. However, in case B we know that $p < t$, so x^* is interior. The profit for seller 1 can then be written as

[6] Other recent papers studying exclusion of entrants are Rasmusen, Ramseyer and Wiley (1991) and Innes and Sexton (1994). These papers mainly discuss the opportunity for a seller to take advantage of uncoordinated buyers to prevent entry. The idea is that a seller can play the buyers off against each other; if sufficiently many others others sign exclusive dealing contracts, it is individually rational for each buyer to do so.

$$
\begin{aligned}
\pi_1^C = -N \quad := \quad & \int_0^{x^*} \int_{tx}^{p+tx} (v - tx) f(v) g(x) \, dv \, dx \\
+ \quad & \int_0^{x^*} \int_{p+tx}^{\overline{v}} p f(v) g(x) \, dv \, dx \\
+ \quad & \int_{x^*}^{1/2} \int_{tx}^{t(1-x)} (v - tx) f(v) g(x) \, dv \, dx \\
+ \quad & \int_{x^*}^{1/2} \int_{t(1-x)}^{1} (t(1-x) - tx) f(v) g(x) \, dv \, dx.
\end{aligned} \tag{17}
$$

The four terms on the right hand side of (17) correspond to the buyer's taste being located in different parts of (x, v)-space. The first two terms apply the situation where the buyer prefers seller 1's spot price to seller 2's contract price, as $x \leq x^*$: The first term measures the trade creation effect (the buyer surplus generated because some of the buyer types who would reject p accept to buy at marginal cost), the second term is the surplus obtained by the buyer when he pays the maginal cost of zero when he otherwise would have had to pay p (these are the buyer types who would otherwise have bought from seller 1 in the spot market). While the second term is merely a transformation of profits from variable to fixed, the first term measures a real *expansion effect,* boosting seller 1's profit. The third term is also a pure expansion effect: These are the types of buyers who will purchase only under seller 1's contract, but would prefer seller 2's contract to seller 1's spot price. Finally, the last term concerns the type of buyer who prefers seller 1's contract to that of seller 2, but who would purcase even at the terms of the latter. The fact that these types ranks seller 2's price of 0 as preferable to seller 1's spot price, means that seller 1 must give them a better deal than under spot contracting. I call this the *competition effect* of the long term contracts.

Which of the two effects is the strongest? As of yet, I have not been able to provide a general answer to this question. Let us therefore consider the two special cases. Case A is particularly simple to analyze. Here, there can be no (net) trade creation, and consequently no extra surplus for the sellers to extract. On the other hand, the competition effect is still present, so the profit for both sellers must decrease. The magnitude is also easily computed. Under spot market competition, we know from (6) that $\pi_i^S = t/2$, whereas with long-term contracts, each seller can only extract (recall that in case A, $x^* = 0$)

$$\pi_1^C = \int_0^{1/2} (t(1-x) - tx) \, dx = t/4.$$

We see here that profits are exactly halved. Ex ante competition is twice as tough as ex post competition.

Consider now case B. Equation (7) gives the spot market profit. With F and G being uniform distributions in (17) we find

$$\pi_1^C = \frac{p^3 - p^2(2+t) + pt(4-t)}{8t}.$$

Comparing the two profit figures it takes only two lines of algebra to see that $\pi^S > \pi^C$ if and only if $p < 2 - 3t$. By Assumption 2, $t < 2/3$, so the condition simplifies to $p < 1$. We know from (4) that $p^B < t$; hence $p < 1$. It follows that $\pi^S > \pi^C$: The competition effect more than outweighs the expansion effect also in case B. To summarize, we have found:

Proposition 3 *Suppose reselling can be prevented. Then, for parametrizations A and B, competition in long-term contracts drives the sellers' profit down below the spot market levels.*

While the sellers are worse off, the buyer does strictly better under the long term contracts. Nothing prevents him from trading in the spot market, as before, and because of the rivalry, the sellers do not jointly extract all the surplus the buyer derives from signing contracts. Clearly welfare is also higher, as the trading is now fully efficient.

Having characterized the equilibrium, let us complete the analysis by proving existence and uniqueness.

Proposition 4 *If reselling can be prevented, the payoff dominant equilibrium entails both sellers offering the contract* $\langle N, 0, 1, 0, 0\rangle$*; i.e. a contract restricting reselling, and offering to sell at marginal cost, in return for a franchise fee, N. The buyer accepts both contracts.*

Proof: To see that we have described *an* equilibrium, let us consider each of the contract terms in turn. ($l = N$): A seller should of course extract all available surplus. ($p^C = 0$): Since a seller can extract the buyer's full (expected) gain from a reduction in the contract price, he should offer the suplus maximizing contract price. ($r = 1$): Giving up the reselling restriction without imposing exclusivity is effectively ruled out by Lemma 1. ($e = 0$): There is no gain attached to imposing exclusivity when reselling is prevented. ($y = 0$) Since the seller does not earn anything on actual sales, there are only losses associated with penalties for breach. This proves that the proposed pair of contracts constitutes *an* equilibrium. (*Uniqueness*):The only remaining candidate for an equilibrium has both sellers imposing exclusivity. This is also an equilibrium, but by the logic of Proposition 1, this pair of contracts drives the equilibrium profit to 0. As we have seen the sellers earn a higher profit in the equilibrium described in the proposition.□

4 Application: The British Beer Industry

To illustrate the scope of the model, I will briefly use it to shed light on the distribution of beer in Britain. As is well known, British brewers have a long history of imposing vertical restraints, and in particular excluding competing brands. Only through legislation has it been possible to "untie" a large fraction of this business. My treatment of the case is based on the thorough study by Vaizey (1960) and material relayed by Sutton (1991).

A particular important historical event was "the scramble of 1886." That year there was a rush to buy licenced property (pubs), in which the brewer would allow the sale only of its own brand of beer, rapidly increasing such tied trade by a third. According to Vaizey (1960, p.10), the decision was of a strategic nature:

> The reasons for the scramble, once it began, were obviously the fear of exclusion from existing or potential markets as rivals bought tied houses.

At first glance, it may seem as if the case falls outside our theory. After all, this is a case of vertical integration rather than vertical restraints. But keep in mind that although the physical property (the pub) was frequently bought by the brewer, the publican would most often rent the premises (rather than being paid a fixed wage), and by far the most important part of the rent was the "wet rent" proportional to the amount of beer purchased from the brewer. The distinction between a free house, where the publican owned the premises, and a tied house rarely had anything to do with exclusivity. Rather, with a free house, the publican typically borrowed money from the brewer in return for exclusivity, but kept residual control over the premises.[7] Hence, what the brewers got whether they purchased a pub or made large loans to a separately owned pub, was essentially a long term contract with a buyer of beer. It is the nature of such contracts rather than the question of ownership of physical assets which is the focus of this paper.

A number of features fit our story. Publicans paid above marginal cost for the beer. Indeed, Vaizey reports that in the late 1950's, the prices paid by untied buyers in the free market (restaurants, clubs etc.) was frequently as low or lower than that paid by tied houses. Fixed payments to a large extent were made from the brewer in terms of investments or subsidized loans rather than from the publican.[8] Our model explains this by arbitrage. Theoretically, beer could be resold by the publican to the free market (replacing the brewer's other sales) to give room for the merchandise from a competitor. But by selling at a relatively high price and requiring exclusivity, this is prevented by the

[7]Indeed, Vaizey reports that in London already around year 1800 it was common for brewers to extend considerable credit to landlords in return for exclusive supply rights.

[8]As noted by Besanko and Perry (1993) there were similar payments in cash or in kind from the seller to the buyer in a variety antitrust cases concerning exclusive dealing in the US. Of course, there may be other reasons for these payments, but at least they are consistent with our model.

brewer.

According to our theory, the brewers should make a collective loss (and the buyers of their beer a corresponding profit) when tying rather than dealing with truly free houses.[9] The best piece of evidence is that, as a result of the scramble, the price of licenced property rose sharply. Within a short time span, the price "doubled and even trebled." Clearly, then, there was a large transfer of wealth from the brewers to the original owners of licensed property. It should also be mentioned that for many of the brewers profit declined as a result of the purchases of tied houses, and for some the strategy brought serious losses. But then of course we cannot know for sure what would have happened absent the scramble.

Let me finally relate the theory to some of the remarks made by The Monopolies Commission in 1969 (quotations after Sutton (1991, p 518)), which found that

> competition among brewers principally takes the form of competition to acquire captive portions of the retail market ...

Since the free market is small, and because the tied trade must occur at terms not much different from those in the free market (to prevent arbitrage), even the free market terms should not be expected to be very competitive. (Here, I have not provided a formal model of this relationship, but it is fairly obvious.) Note that the Commission does acknowledge the competition for captive trade, in support of Proposition 1.

The Monopolies Commission also considered the effects of tying on the industry structure.

> Moreover, the ownership of tied houses has, in itself, afforded the less efficient brewers some protection. The brewers themselves have told us that the tied house system has allowed a number of small brewers who could not otherwise have survived to co–exist with the large brewers. We think that this is true and it suggests that concentration of brewing capacity, and the elimination of less efficient brewers, have not proceeded as far or as fast as they would have done if a large part of the industry had not already been vertically integrated.

The Commission here identified the tied system as a source of inefficient supply of beer. What then prevents sale of tied houses to independent operators or to the brewers who can make best use of the tie? The model suggests that it is due to asymmetric information. The current owner trades off a high probability of selling the supply rights against selling

[9] Of course, I haven't explained how a relatively free regime came to exist in the first place. One story would be tacit collusion. There could be a silent agreement that a part of the market was kept free, sustained by the threat that if someone infringed, everybody would start to establish ties. The stricter licensing laws introduced at this point put a limit to expansion of licenses, thus both triggering a new regime and making a head start in tying more profitable.

them at a high price (Proposition 2). E.g., for our parametrization A the original tie would be broken only in one third of the cases in which it would be efficient to do so. Hence, the model presents some possible theoretical support for the recent government policy of breaking up the ties.

5 Final Remarks

The paper offers a new rationale for vertical restraints, and in particular for exclusive dealing contracts which impose high penalties for breach. The basic argument is that new information becomes available over time and that these restraints make it possible to sign long term contracts while preventing arbitrage through the spot market.

The results are somewhat related to those of Caminal and Matutes (1990). They study a two period model in which buyers purchase one unit of a product in each period, but may change taste between periods (think of frequent flyer programs). When sellers can commit in period 1 to a period 2 price, it is shown that the market becomes more competitive than under successive spot market interaction, in line with our intuition that long term contracts make markets more competitive.

In Caminal and Matutes, reselling is prevented by assumption. At the same time contracts are exclusive, because the sellers only offer a low second period price to their period 1 buyers, and the buyers only purchase one item in the first period. Hence, the authors exogenously restrict reselling as well as imposing exclusivity, whereas in our model such clauses arise endogenously depending on the possibilities of arbitrage. Note also that in their model the products are heterogeneous at stage 1, so competition is less fierce than in the current model.[10] Arguably, the current model better captures the nature of contracting over many periods: The longer the horizon, the less importance is attached to the initial transaction relative to future trading.[11]

Of course, the model applies a number of simplifying assumptions. For example, by investigating the case of a single long term buyer, I have been able to neglect the issue of downstream competition. In markets where the buyer is a monopoly retailer, which is also the case creatting most concern by antitrust authorities, this is without loss of generality. When the buyers are competing retailers who resell to final consumers, the producers sometimes need to take into account the fact that an exclusive contract with one retailer does not kill off competition in the retail market. Besanko and Perry (1994)

[10]Another difference is that Caminal and Matutes postulate a totally inelastic demand, whereas this model utilize a more general formulation of demand, allowing the volume of trade to be affected by the contracts.

[11]Truly frequent flyers fly more than twice, and may well take part in the programs of more than one airline. A prediction of the current model is that the airlines should voluntarily abstain from imposing exclusivity.

investigate some of the additional issues which may arise under retail competition.

While conceding that vertical restraints may impede competition ex post, I have shown that they could well enhance competition ex ante. Exclusive dealing (and downstream vertical integration) is harmful for welfare in this model because the ex ante competition merely represents a wealth transfer from sellers to buyers, whereas exclusivity implies real ex post distortions.

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6 Appendix

In this appendix I first compute the symmetric equilibrium price (conditional on market coverage). I then go on to give conditions under which $p < t$.

Differentiation of seller 1's profit function yields the first order condition

$$\begin{aligned} \frac{\partial \pi_1}{\partial p_1} &= \int_0^d (1 - F(p_1 + tx)g(x)\, dx \\ &- p_1 \left(\frac{(1 - F(p1 + d))g(d)}{2t} + \int_0^d f(p_1 + tx)g(x)\, dx \right) = 0. \end{aligned} \tag{18}$$

Define $\hat{g} := g(1/2)$. Since $g(x)$ is symmetric, we know that $\hat{g} = 1/2$. Integrating by parts and rearranging, the symmetric equilibrium price ($p = p_1 = p_2$) is given implicitly by

$$p = \frac{t(1 - F(p + t/2)) - 2t \int_0^{1/2} f(p + tx)g(x)\, dx}{(1 - F(p + t/2))\hat{g} - 2t \int_0^{1/2} f(p + tx)g(x)\, dx}. \tag{19}$$

It is useful to write the solution as

$$p = \frac{at - b}{a\hat{g} - b}, \tag{20}$$

where

$$a = 1 - F(p + t/2)$$

and

$$b = 2t \int_0^{1/2} f(p + tx)g(x)\, dx.$$

We shall say that the market is "covered under contract" if $p + t < 1$. In other words, there are some types of buyer $(1, v)$ to whom trading under the contract yields a surplus.

We want to find conditions under which the equilibrium price is less than t. A set of such conditions are presented here. Define $\gamma = \max\{b/a, 1 - b/a\}$.

Proposition 5 *If $p + t < 1$, and $\hat{g} > \gamma$, then $p < t$.*

PROOF: It is particularly easy to show for $\hat{g} > 1 + b/a$. Then, because $a - a\hat{g} + b < 0$, we can write $p < t$ as

$$t > \bar{t}_{eq} := \frac{b}{a - a\hat{g} + b},$$

which holds because the right hand side is negative.

Consider now $\hat{g} \in (\gamma, 1 + b/a)$. Then, because $a\hat{g} - b < 0$, $p < t$ implies

$$t < \bar{t}_{eq} = \frac{b}{a - a\hat{g} + b},$$

only now the denominator is positive. If the market is covered under contract, $p + t < 1$, or equivalently

$$t < \bar{t}_{cov} := \frac{a\hat{g}}{a + a\hat{g} - b}.$$

To complete the demonstration, we must show that $\bar{t}_{cov} < \bar{t}_{eq}$, or

$$(b - a\hat{g})(b + a\hat{g} - a) < 0.$$

The first term is negative because $\hat{g} > b/a$ and the second is positive because $\hat{g} > 1 - b/a$.
$\square$

Intuitively, the density g must not be too small at $x = 1/2$, because then it may pay to more or less neglect fighting for customers on the margin, and raise the price above t.