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Exclusive Dealing

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In this paper, we provide a conceptual framework for understanding the phenomenon of exclusive dealing, and we explore the motivations for and effects of its use. For a broad class of models, we characterize the outcome of a contracting game in which manufacturers may employ exclusive dealing provisions in their contracts. We then apply this characterization to a sequence of specialized settings. We demonstrate that exclusionary contractual provisions may be irrelevant, anticompetitive, or efficiency-enhancing, depending on the setting. More specifically, we exhibit the potential for anticompetitive effects in *noncoincident* markets (i.e., markets other than the ones in which exclusive dealing is practiced), and we explore the potential for the enhancement of efficiency in a setting in which common representation gives rise to incentive conflicts. In each instance, we describe the manner in which equilibrium outcomes would be altered by a ban on exclusive dealing. We demonstrate that a ban may have surprisingly subtle and unintended effects.

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I. Introduction

A manufacturer engages in exclusive dealing when it prohibits a retailer or distributor that carries its product from selling certain other products (typically those of its direct competitors). Historically, the courts have treated exclusive dealing harshly. For example, in one well-known case, *Standard Fashion Company v. Magrane-Houston Company* (1922), a leading manufacturer of dress patterns (Standard) contracted with a prominent Boston retailer (Magrane-Houston) to sell its patterns on the condition that Magrane-Houston not sell the patterns of any other manufacturer.[1] Fearful of the foreclosure of competitors from retail outlets, the court struck down the contract, arguing that "the restriction of each merchant to one pattern manufacturer must in hundreds, perhaps in thousands, of small communities amount to giving such single pattern manufacturer a monopoly of the business in such community."

Despite the court's position, many antitrust experts have come to believe that exclusive dealing cannot serve as a profitable mechanism for monopolization and that it should instead be regarded as an efficient contractual form. Commenting on *Standard Fashion,* Bork (1978, pp. 306–7) argues that

> Standard can extract in the prices that it charges all that its line is worth. It cannot charge the retailer that full amount in money and then charge it again in exclusivity that the retailer does not wish to grant. To suppose that it can is to commit the error of double counting. . . . Exclusivity has necessarily been purchased from it, which means that the store has balanced the inducement offered by Standard . . . against the disadvantage of handling only Standard's patterns. . . . If consumers would prefer more pattern lines at higher prices, the store would not accept Standard's offer. The store's decision, made entirely in its own interest, necessarily reflects the balance of competing considerations that determine consumer welfare. Put the matter another way. If no manufacturer used exclusive dealing contracts, and if a local retail monopolist decided unilaterally to carry only Standard's patterns because the loss in product variety was more than made up in the cost saving, we would recognize that decision was in the consumer interest. We do not want a variety that costs more

[1] For a summary of federal exclusive dealing cases that reached at least the appellate level, see Frasco (1991).

> than it is worth. . . . If Standard finds it worthwhile to purchase exclusivity. . . , the reason is not the barring of entry, but some more sensible goal, such as obtaining the special selling effort of the outlet.

In comparison with other vertical restrictions (such as exclusive territories and resale price maintenance), exclusive dealing has received little formal attention (see Katz's [1989] survey; exceptions include Marvel [1982] and Mathewson and Winter [1987], discussed below). In this paper, we provide a unified framework for understanding the motivations for and effects of these contractual provisions. Central to our approach is the view that exclusive dealing is best understood by studying its costs and benefits relative to those of "common agency" (Bernheim and Whinston 1986*a*, 1986*b*).

Section II studies a simple game in which players bid for representation. Using this game, we exhibit two thematic principles that resurface repeatedly throughout the paper. The first principle is that the form of representation (exclusivity or common representation) that arises in equilibrium maximizes the joint surplus of the manufacturers and the retailer, subject to whatever inefficiencies may (or may not) characterize incentive contracting between the retailer and the manufacturers. The second principle is that explicit contractual exclusion (as distinguished from a retailer's unilateral decision to carry only one product) will not arise unless common representation involves externalities among the manufacturers that cause inefficiency in incentive contracting.

In Section III, we consider the simplest incentive contracting problem: the retailer buys and resells the manufacturers' products, and these choices are contractible. The model follows closely the scenario envisioned by Bork. We show that incentive contracting, whether under exclusive or common representation, is always efficient in this setting. Our first general principle therefore implies that the market outcome maximizes the profits of the vertical structure as a whole: one obtains the fully integrated solution. Thus exclusive dealing can arise in this setting only when it is efficient for one product to be sold. Moreover, we show that, although the outcome need not be first-best (since consumer surplus is ignored), banning exclusive dealing cannot raise aggregate welfare. All these conclusions are consistent with Bork's analysis.

The difficulty with this analysis is that it fails to account for the existence of exclusive dealing. Since there are no contracting externalities in this setting, our second general principle implies that exclusionary provisions are superfluous; when the fully integrated solution would involve the sale of only one product, this outcome can always be supported through *nonexclusionary* contracts. Consequently, in this model, there is no reason either to ban or to permit exclusive dealing.

Given these results, it is natural to ask whether exclusionary provisions can ever serve a meaningful purpose. Commentators have suggested a number of possible motivations (see, e.g., Scherer 1980; Areeda and Kaplow 1988): some believe that it arises from a desire to foreclose markets and extend market power, whereas others see it as an efficient contractual device.[2] In Sections IV and V, we provide rigorous theoretical foundations for each of these views, by appropriately extending the simple model of Section III.

In Section IV, we demonstrate that exclusive dealing can serve as a device for extracting rents from markets other than the ones in which they are employed. We refer to this as a *noncoincident* market effect. We examine a model in which retail markets develop sequentially and in which manufacturers must serve more than one market to achieve important economies. Effective exclusion (i.e., only one product is sold) occurs in the early developing (first) market whenever it is jointly optimal for the manufacturers and the first retailer (a reflection of our first general principle). Exclusion may occur in this context precisely because it affects the degree of competition among manufacturers in the second market and, hence, the extraction of profits from the second retailer (whose profits are not considered in the joint optimization problem that determines representation in the first market). Moreover, we show that it may be impossible to achieve the exclusionary outcome in the absence of explicit contractual exclusion, precisely because the existence of noncoincident effects may generate contracting externalities for the manufacturers under common representation (a reflection of our second general principle). In addition, we demonstrate that exclusion may persist even in the presence of a ban on explicitly exclusive deals; indeed, a ban may lead to exclusion through less efficient practices such as quantity forcing or quantity discounts.[3] Thus the welfare implica-

[2] According to Scherer (1980, p. 586), "For manufacturers, exclusive dealing arrangements are often appealing, because they ensure that their products will be merchandised with maximum energy and enthusiasm."

[3] In light of this result, there are some noteworthy aspects of a recent lawsuit filed by Virgin Atlantic Airways against British Airways. While British Airways apparently has not attempted to engage any travel agent in an exclusive relationship, it has offered travel agent commission override programs, which grant rebates if agents purchase large quantities or high fractions of their customers' travel services from British Airways. Virgin Airways has alleged that these programs effectively amount to exclusive dealing arrangements and that they result in market foreclosure. See the decision of U.S. District Judge Miriam Goldman Cedarbaum concerning British Airways' motion for dismissal, Memorandum of Opinion and Order, 93 Civ. 7270(MGC), December 30, 1994.

tions of a ban are ambiguous, even when the motive for exclusion is foreclosure.

In Section V, we study the role of exclusive dealing in circumstances in which common representation involves incentive conflicts. We examine a model in which a risk-averse retailer takes unobservable actions that influence the manufacturers' sales. In this setting, common representation entails contracting externalities that produce inefficiencies. This can lead to exclusive dealing when the associated costs are large relative to the benefits of variety (a reflection of our two general principles). We explore the nature of these inefficiencies and the precise circumstances in which exclusive dealing arises. We also demonstrate that a ban on exclusive dealing may have surprisingly subtle effects. For example, a ban can reduce welfare even in cases in which no exclusion would have occurred.

Section VI contains concluding remarks. All formal proofs are contained in the Appendix.

II. Some Unifying Principles

Although this paper investigates the motivations for and effects of exclusive dealing in a number of distinct models, our analysis is connected by several unifying principles. Through an appreciation of these principles, one gains an intuitive understanding of our formal results. The purpose of this section is to elucidate the unifying principles in the simplest possible setting.

Consider in particular the following three-stage game.

Stage 1.—Two manufacturers ($j = \mathrm{A, B}$) simultaneously "bid" for representation by a retailer. Each bid consists of two numbers: an announced "required payoff" for the manufacturer in the event the manufacturer is represented exclusively (p_j^e for manufacturer j) and a required payoff for the manufacturer in the event the retailer represents both manufacturers (p_j^c for manufacturer j).

Stage 2.—The retailer chooses to represent one manufacturer, both manufacturers, or neither. If it chooses to represent neither, the game ends, and all parties earn zero.

Stage 3.—The retailer enters into a contract (or contracts) with the party (or parties) that it has chosen to represent. Here, we treat this process as a "black box," simply assuming that the aggregate payoffs under common representation are $\hat{\Pi}^c$ and are Π^j when the retailer represents manufacturer j exclusively. If the retailer has chosen to represent both manufacturers, it pays an amount to each manufacturer j sufficient to provide that manufacturer with a net payoff of p_j^c. If the retailer has chosen to represent only manufacturer j, it pays an amount to j sufficient to provide j with a net payoff of p_j^e.

Hence, the retailer receives a payoff of $\hat{\Pi}^c - p_A^c - p_B^c$ if it serves both manufacturers and $\Pi^j - p_j^e$ if it serves manufacturer j exclusively. Throughout, we shall assume that the products of manufacturers A and B are *substitutes,* in the sense that $\Pi^A + \Pi^B > \hat{\Pi}^c$.

The models considered in subsequent sections have a similar structure, except that the contracting process in stage 3 is modeled explicitly and takes place as part of the bidding process in stage 1. We have adopted a more ad hoc (and clearly less satisfactory) structure here because it allows us to separate simple bidding issues from potentially complex contracting and incentive issues. It turns out that this simplification does little violence to the underlying economic principles that govern the structure of equilibria. As we demonstrate in the Appendix, the fundamental principles developed in this section carry over to a broad range of cases in which contracting occurs as part of the stage 1 bidding process, including all models considered later in this paper.[4]

The model outlined above can give rise to multiple equilibria. Following Bernheim and Whinston (1986*b*), we refine the equilibrium set by treating the retailer as a passive, reactive party and look for equilibria that are Pareto-undominated (within the set of equilibria) for the manufacturers, on the grounds that they act as first-movers.[5] As a general matter, we can classify equilibria according to whether they are *exclusive* (the retailer contracts with only one manufacturer) or *common* (the retailer contracts with both manufacturers).

Consider, first, exclusive equilibria. If each manufacturer j sets $p_j^c = +\infty$, then bidding is reduced to competition to obtain an exclusive relationship with the retailer. The following two conditions characterize equilibria in which the retailer serves manufacturer j exclusively:

$$\Pi^j - p_j^e = \Pi^i - p_i^e > 0 \tag{1}$$

and

$$p_j^e \geq 0 \geq p_i^e. \tag{2}$$

Condition (1) has several components: (i) the retailer must earn strictly positive profits (otherwise i, the excluded manufacturer, could profitably deviate to some bid slightly less than Π^i); (ii) the retailer must not earn less serving j than serving i (otherwise it would choose to serve i); and (iii) the retailer must not earn less serving

[4] The models considered here and in later sections are closely related to, but not special cases of, the framework of menu auctions developed in Bernheim and Whinston (1986*b*).

[5] In the current setting, this is equivalent to requiring that the equilibria be perfectly coalition-proof (see Bernheim, Peleg, and Whinston 1987).

i than serving j (otherwise j would lower its bid). Condition (2) requires that j receive a nonnegative payoff (otherwise it would withdraw its bid). Manufacturer i, on the other hand, must receive a nonpositive payoff if its bid is accepted (otherwise it would increase its bid slightly to obtain exclusive representation).

It follows from these conditions that $\Pi^j \geq \Pi^i$; that is, in any exclusive equilibrium, the retailer must serve the manufacturer that generates the highest surplus. Henceforth, without loss of generality, we take this to be manufacturer A. To see that the existence of an exclusive equilibrium is guaranteed, simply set $p^e_{\mathrm{A}} = \Pi^{\mathrm{A}} - \Pi^{\mathrm{B}}$ and $p^e_{\mathrm{B}} = \Pi^{\mathrm{B}}$, and note that both equilibrium conditions are satisfied. There are other exclusive equilibria, but none gives a higher payoff to either manufacturer. Thus the preferred exclusive equilibrium yields payoffs of $\Pi^{\mathrm{A}} - \Pi^{\mathrm{B}}$ to manufacturer A, zero to manufacturer B, and Π^{B} to the retailer.

Now consider common equilibria. The following conditions characterize equilibria in which the retailer serves both manufacturers:

$$\Pi^j - p^e_j = \hat{\Pi}^c - p^c_{\mathrm{A}} - p^c_{\mathrm{B}} > 0, \tag{3}$$

$p^c_j \geq 0$, and $p^e_j \leq p^c_j$, $j = \mathrm{A}, \mathrm{B}$. To understand the first condition, note first that $\hat{\Pi}^c - p^c_{\mathrm{A}} - p^c_{\mathrm{B}} > 0$: this expression clearly could not be less than zero (or the retailer would decline to represent both manufacturers); if it was equal to zero, j could profitably induce the retailer to accept an exclusive contract.[6] Next, observe that one must have $\Pi^j - p^e_j = \hat{\Pi}^c - p^c_{\mathrm{A}} - p^c_{\mathrm{B}}$ for each j; clearly, one cannot have $\Pi^j - p^e_j > \hat{\Pi}^c - p^c_{\mathrm{A}} - p^c_{\mathrm{B}}$ (otherwise the retailer would serve j exclusively). If $\Pi^j - p^e_j < \hat{\Pi}^c - p^c_{\mathrm{A}} - p^c_{\mathrm{B}}$, then (since $\hat{\Pi}^c - p^c_{\mathrm{A}} - p^c_{\mathrm{B}} > 0$) manufacturer i could profitably deviate by slightly increasing p^c_i and setting $p^e_i = +\infty$. One obtains the remaining equilibrium conditions as follows: if $p^c_j < 0$ for some j, then j would withdraw its offer; if $p^e_j > p^c_j$, then j could reduce p^e_j slightly, thereby (in light of [3]) profitably inducing the retailer to accept a (more profitable) exclusive offer.

Unlike exclusive equilibria, common equilibria do not always exist. It is easy to verify that the set of bids satisfying the equilibrium constraints is nonempty if and only if $\hat{\Pi}^c \geq \Pi^{\mathrm{A}}$. Thus exclusive representation necessarily arises whenever exclusion generates the greatest joint surplus.

[6] To establish this claim, note that $\Pi^j - p^c_j > 0$ for at least one manufacturer j (since $\Pi^{\mathrm{A}} + \Pi^{\mathrm{B}} > \hat{\Pi}^c$). Suppose that this manufacturer deviates by setting $\tilde{p}^e_j = p^c_j + \epsilon$ for some small $\epsilon > 0$. If this exclusive offer is accepted, then j is clearly better off, and the deviation is profitable. As long as ϵ is sufficiently small, the retailer would earn $\Pi^j - \tilde{p}^e_j > 0$ by accepting j's exclusive offer, compared with zero for the common offers and at most zero (since this is a common equilibrium) for the exclusive offer of j's competitor. Consequently, j's exclusive offer is accepted.

When $\hat{\Pi}^c > \Pi^A$, the game gives rise to many common equilibria. It turns out—somewhat surprisingly—that there is a unique Pareto-undominated equilibrium. To establish this point, we actually find the equilibrium. Note that there is only one equilibrium satisfying $p_j^e = p_j^c$ for both manufacturers; it is obtained by substituting these expressions into (3) to obtain two linear equations in two unknowns. The solution to these equations is given by $p_j^c = \hat{\Pi}^c - \Pi^i$, $i \neq j$. In this equilibrium, each manufacturer j earns $\hat{\Pi}^c - \Pi^i$, $i \neq j$ (its marginal contribution to total surplus), and the retailer earns $\Pi^A + \Pi^B - \hat{\Pi}^c$. It is easily demonstrated that no other equilibrium is undominated.[7]

Taken together, these results lead to the following conclusions: (i) when $\hat{\Pi}^c < \Pi^A$, in equilibrium the retailer necessarily serves manufacturer A exclusively; (ii) when $\hat{\Pi}^c > \Pi^A$, there are both exclusive and common equilibria, but there is a unique common equilibrium that Pareto-dominates (for the manufacturers) all other equilibria, both common and exclusive; and (iii) when $\hat{\Pi}^c = \Pi^A$, there is a unique Pareto-dominant (for the manufacturers) payoff vector, but it is achievable through either an exclusive or a common equilibrium.

From these results, we deduce two general principles that provide unifying themes for the remainder of this paper. The first principle is that *the form of representation (i.e., exclusivity or common representation) is chosen to maximize the joint surplus of the manufacturers and the retailer, subject to whatever inefficiencies may (or may not) characterize incentive contracting between the retailer and the represented parties.* The final qualifying phrase in the previous sentence is important. In particular, when calculating joint surplus for this purpose, we do not pretend that the contracting outcome under common representation (in stage 3) is necessarily efficient for the manufacturers, that is, equal to the outcome that would arise were the manufacturers to cooperate. On the contrary, $\hat{\Pi}^c$ may be strictly less that the total surplus, call it $\bar{\Pi}^c$, that could be obtained if the manufacturers selected incentive schemes cooperatively under common representation.

This observation leads to our second unifying principle. While it is easy to imagine reasons why $\hat{\Pi}^c$ might be less than Π^A, it is hard to imagine that $\bar{\Pi}^c$ would be less than Π^A. Indeed, since representation of a second manufacturer only expands opportunities, one would generally expect the opposite. Thus we would expect to have $\hat{\Pi}^c < \Pi^A$ only if there is a contracting inefficiency resulting from the noncooperative provision of incentives under common representa-

[7] Consider some equilibrium in which $p_i^e < p_i^c$. Then $\Pi^i - p_i^c < \Pi^i - p_i^e = \hat{\Pi}^c - p_A^c - p_B^c$; hence $p_j^c < \hat{\Pi}^c - \Pi^i$, $i \neq j$, for each j.

tion (i.e., only if $\hat{\Pi}^c < \overline{\Pi}^c$). Coupling this with our previous result, we conclude that, in general, *explicit exclusive dealing (as distinguished from a retailer's unilateral decision to carry only one product) will not arise unless common representation involves externalities among the manufacturers that result in contracting inefficiencies.* This principle focuses our attention on the efficiency of joint incentive contracting as the key factor influencing the use of explicit exclusive dealing provisions.

III. The Simplest Contracting Problem

We begin our formal analysis of exclusive dealing by studying the potential for it to arise in a simple setting that corresponds closely to the environment envisioned by Bork. In particular, we assume that the retailer directly controls the level of retail sales for each manufacturer j, henceforth denoted x_j. Manufacturer j can observe and verify x_j, as well as the nature of j's relation with the retailer (exclusive or nonexclusive); however, j is unable either to observe or to verify the level of retail sales made on behalf of manufacturer $-j$ (x_{-j}).

Here and in all subsequent sections, we depart from the simple ad hoc model of Section II by assuming that firms announce *contract offers* in stage 1, rather than simple payments. A contract offer for manufacturer j consists of a contingent pair (P_j^e, P_j^c): P_j^e is an *exclusive* contract, which applies if the retailer contracts only with manufacturer j; P_j^c is a *common* contract, which applies if the retailer contracts with both manufacturers. Each contract is a function that maps x_j to a monetary payment. In essence, each manufacturer can offer the retailer a compensation scheme that ties monetary payments to its own sales, as well as to the nature of its relationship with the retailer, but cannot tie payments to sales of another manufacturer's product.[8] Once contract offers are announced, the retailer chooses to represent either or both manufacturers (stage 2). Finally, in stage 3, the retailer chooses sales levels (x_A, x_B) (positive values of x_j are permitted only if the retailer has accepted one of manufacturer j's offers), receives revenues of $R(x_A, x_B)$ (for convenience, we sometimes write $R(x_j, x_{-j})$), and makes payments to the manufacturers as required

[8] As shown in a previous version of this paper (Bernheim and Whinston 1992), our analysis is essentially unchanged when one permits manufacturers to condition payments on each other's sales. The central difference is that, under this alternative assumption, manufacturers can always write nominally nonexclusive contracts that are equivalent to exclusive contracts (e.g., by permitting the retailer to serve other manufacturers, while penalizing the retailer heavily whenever the sales of another manufacturer are positive). Thus the alternative assumption obscures the formal distinction between exclusive and nonexclusive contracts without adding to the substantive content of the problem.

by the contract or contracts accepted in stage 2.[9] In the course of producing x_j, manufacturer j incurs costs of $c_j(x_j)$ (where $c_j(0) = 0$). The formal analysis of this contracting game is developed in detail in the Appendix.

In this setting, a fully integrated vertical structure would choose to produce and sell

$$x^{**} = (x_A^{**}, x_B^{**}) \equiv \underset{x_A, x_B}{\operatorname{argmax}} R(x_A, x_B) - \sum_{j=A,B} c_j(x_j),$$

which, for convenience only, we assume to be unique. On the other hand, were only product j available, a vertically integrated firm consisting of the retailer and firm j would select

$$x_j^* = \underset{x_j}{\operatorname{argmax}} R(x_j, 0) - c_j(x_j).$$

We make the following assumption.

ASSUMPTION B1.

$$\Pi^A \equiv R(x_A^*, 0) - c_A(x_A^*) > \Pi^B \equiv R(0, x_B^*) - c_B(x_B^*) > 0.$$

Thus product A is the more profitable of the two products if only one of them can be sold.[10] We also assume that the two products are substitutes, in the sense that product j contributes less in incremental profits when product $-j$ is also sold than it does when it alone is sold.

ASSUMPTION B2.

$$\overline{\Pi}^c \equiv R(x^{**}) - c_A(x_A^{**}) - c_B(x_B^{**}) < \Pi^A + \Pi^B.$$

A. *Characterization of Equilibria*

The following result characterizes undominated equilibria for this model.

PROPOSITION 1. In any undominated equilibrium, the retailer chooses x^{**}, manufacturer j earns its marginal contribution to joint profits, $\overline{\Pi}^c - \Pi^{-j}$, and the retailer earns $\Pi^A + \Pi^B - \overline{\Pi}^c$. There is always a common equilibrium yielding this undominated outcome.

According to proposition 1, undominated equilibria always maximize the joint payoffs of the retailer and both manufacturers (they generate the vertically integrated outcome). Unless the products are

[9] If the retailer rejects both of manufacturer j's offers, no payment is made to or from j.

[10] If the first inequality in assumption B1 holds with equality, all our results continue to hold. But there are also exclusive equilibria (possibly with payoffs that are dominated for the manufacturers) in which B is served; see proposition 1.

perfect substitutes, this typically requires common representation. Moreover, even when an undominated equilibrium outcome entails no sales for manufacturer B, this outcome can always be achieved through nonexclusionary contracts.

Proposition 1 is easily understood in light of our general unifying principles. To see this, consider the characteristics of exclusive representation and common representation. Imagine first an intrinsically exclusive setting, in which the retailer must accept an exclusive offer from manufacturer j or represent no one at all. In this setting, j's optimal contract offer has the property that j extracts all economic surplus over and above the retailer's reservation payoff. Manufacturer j can, for example, achieve this outcome through a "forcing contract" that requires the retailer to choose x_j^* and specifies a level of compensation such that the retailer's participation constraint just binds. Joint payoffs for manufacturer j and the retailer are then given by Π^j.

Next imagine a setting with intrinsic common representation (Bernheim and Whinston 1986*a*), in which the retailer must accept offers from both manufacturers or from neither. Were the manufacturers to cooperate with each other in their choice of contracts, they would induce the retailer to choose x^{**} (e.g., through forcing contracts), and they would extract all economic surplus over and above the retailer's reservation payoff. Joint profits for the manufacturers and the retailer would then be given by $\overline{\Pi}^c$.

Of course, the structure of the game does not permit the manufacturers to cooperate. Nevertheless, there still exist equilibria that implement x^{**} and generate cooperative payoffs for the manufacturers (holding the retailer to its reservation payoff). One such equilibrium involves forcing contracts: the payments to A and B are set at a level that provides the retailer with its reservation utility conditional on choosing x^{**}, and each firm j demands an infinite payment for any $x_j^c \neq x_j^{**}$. Another involves "sellout" contracts of the form $P_j^c(x_j) = F_j + c_j(x_j)$, which essentially transfer to the retailer the full marginal returns from the sale of each product j in return for fixed payments $F_j = \overline{\Pi}^c - \Pi^{-j}$. For these equilibria, joint payoffs for the manufacturers and the retailer are $\hat{\Pi}^c = \overline{\Pi}^c$.

In this setting, one necessarily has $\hat{\Pi}^c \geq \Pi^j$, and the inequality is strict provided that the vertically integrated outcome entails positive output by both manufacturers ($x^{**} \gg 0$). Since the (undominated) equilibrium outcome of the bidding game maximizes the joint surplus of the manufacturers and the retailer (our first general principle), we see that exclusive dealing never occurs in this context, except in the degenerate case in which there is an equivalent outcome with common representation. This conclusion is also a direct reflection of our second general principle: in this model, $\hat{\Pi}^c = \overline{\Pi}^c$, so *there are no contracting externalities that could give rise to the need for explicit exclusion.*

B. Policy Implications

The preceding analysis corroborates Bork's (1978) argument that exclusive dealing cannot be used profitably to foreclose a rival from a market. Because each manufacturer must effectively compensate the retailer to attract it to an exclusive deal, manufacturers internalize the retailer's cost from the loss in product variety. As a result, the market outcome is exactly the one that would arise with a fully integrated vertical structure. Indeed, just as Bork asserts, in equilibrium each manufacturer extracts a profit exactly equal to the incremental value of its product.

In light of our results, it is surprising that, using a model similar to ours in many respects, Mathewson and Winter (1987) reach strikingly different conclusions. In their model, producers offer wholesale contracts to the retailer on a take-it-or-leave-it basis. These contracts specify a wholesale price and possibly an exclusive dealing requirement. Mathewson and Winter show that exclusive dealing arises as the unique equilibrium outcome for a range of parameter values.

The key difference between our model and that of Mathewson and Winter concerns the set of feasible contracts.[11] In our notation, Mathewson and Winter allow only contracts of the form $P_j^e(x_j) = w_j^e x_j$ and $P_j^c(x_j) = w_j^c x_j$ for constants w_j^e and w_j^c. *These restrictions create contracting externalities for the manufacturers,* and this largely accounts for the differences between our findings. Even the flexibility to charge fixed fees would, in many instances, restore our results. The importance of fixed fees is easily understood in the context of Bork's argument. If a manufacturer insists on exclusivity, it must compensate the retailer for the loss of surplus associated with selling other products. If a fixed fee is not available, then the manufacturer can compensate the retailer only by reducing its wholesale price. However, this form of compensation alters the retailer's incentives on the quantity margin; its value to the retailer is therefore less than its cost to the manufacturer.

[11] There are also some differences in the timing of decisions. In Mathewson and Winter, both firms first decide whether to insist on exclusivity; if either does, then both compete in the offering of exclusive contracts (otherwise, the retailer sells the products of both manufacturers). However, if we were to change the timing of contract offers in our model while retaining flexibility in the form of the contracts, the basic conclusions of our analysis would be unaltered.

Proposition 1 implies that the retailer and manufacturers act as an integrated unit. However, contrary to Bork's assertion, it does not follow that the equilibrium maximizes social surplus unless the retailer is able to extract all consumer surplus (say, through perfect price discrimination). From a social perspective, the integrated solution can involve the production of either too many or too few products and inefficient retail pricing (Tirole 1988, pp. 104–5). Nevertheless, for this model, Bork is correct that a ban on exclusive dealing cannot promote social welfare. Formally, we model this prohibition as the restriction that $P_j^c(x_j) = P_j^e(x_j)$, so that manufacturer j is prevented from conditioning compensation on the retailer's decision to serve $-j$. The following result demonstrates that a prohibition on exclusionary contracts leaves the equilibrium outcome unaffected.[12]

PROPOSITION 2. Suppose that manufacturers are restricted to offering contracts that satisfy $P_j^c(x_j) = P_j^e(x_j)$. Then there is an equilibrium in which the retailer accepts both manufacturers' contracts and chooses x^{**}, and payoffs are exactly as in proposition 1. Furthermore, this equilibrium weakly dominates (for the manufacturers) any other equilibrium of this game.[13]

Although propositions 1 and 2 appear to confirm much of Bork's reasoning, in one important sense they fail to do so: exclusionary provisions are superfluous in this model. Whether exclusionary provisions are permissible has no effect on undominated equilibrium outcomes, which are always achievable through nonexclusionary contracts, even when one manufacturer is effectively excluded (i.e., makes no sales). Hence, in this model, there is no reason either to ban or not to ban these arrangements. Thus the present model may provide a poor framework for understanding the effects of the exclusionary contracts that are observed in practice. In the next two sections, we turn our attention to models in which exclusionary provisions serve a meaningful purpose.

[12] Proposition 2 does not follow directly from proposition 1, despite the fact that undominated equilibria need never employ exclusive contracts. As a formal matter, the prohibition on exclusionary contracts changes the nature of manufacturers' strategies and could in principle subtly alter their incentives.

[13] O'Brien and Shaffer (1991) analyze a model that is equivalent to this restricted game. They show that in any equilibrium of this restricted game, the quantities chosen by the retailer (x_A°, x_B°) must satisfy

$$x_j^\circ = \underset{x_j}{\operatorname{argmax}}\, [R(x_j, x_{-j}^\circ) - c_j(x_j) - c_{-j}(x_{-j}^\circ)]$$

for $j =$ A, B. Thus, if integrated profits are strictly concave, all equilibria result in a choice of x^{**}.

IV. Exclusive Dealing with Noncoincident Market Effects

One frequently cited motive for exclusive dealing is the desire to create or enhance market power. Yet in the model of Section III, no such effect could occur: The equilibrium market outcome always maximized the total profits of the vertical structure, and it achieved effective exclusivity (where jointly efficient) without any explicit exclusionary provisions.

Thus far, however, we have confined our attention to an isolated set of vertically related parties. Commentators have also expressed concern that the exclusion of competitors from one market might enhance a firm's power in other markets. In this section, we show that the concern over what we shall call *noncoincident* market effects does indeed have a valid theoretical foundation.

We explore the role of noncoincident market effects for a model in which two retail markets develop sequentially and in which important economies can be achieved only by serving more than one market.[14] As in Section III, effective exclusion occurs whenever it is jointly optimal for the manufacturers and the retailer in the first market. In this context, exclusion may arise precisely because it reduces competition in the second market and hence facilitates the extraction of profits from the second retailer (whose profits are not considered in the joint optimization problem that determines representation in the first market). Moreover, it may be impossible to achieve exclusivity without explicit contractual exclusion, precisely because the existence of noncoincident effects may generate contracting externalities for the manufacturers. We also examine the effects of banning exclusive dealing and demonstrate that this does not always end effective exclusion. Indeed, in the presence of a ban, effective exclusion may be achieved through even less efficient practices.

A. The Model

Suppose that initially there is a single retail market (market 1), served by a single retailer (retailer 1). With time, another retail market (market 2), again served by a single retailer (retailer 2), becomes viable. Manufacturers and retailers can enter into long-term contracts. Thus, prior to the emergence of market 2, manufacturers can contract with retailer 1 for sales made after the emergence of market

[14] Similar noncoincident market effects can arise in other contexts, e.g., when an exclusive contract between a manufacturer and a retailer reduces competition for the manufacturer's inputs.

2. Manufacturers cannot, however, contract with retailer 2 for sales in market 2 until this market emerges. To isolate the key role played by long-term contracts in market 1, we suppress all sales in market 1 that occur prior to the emergence of market 2 (one can easily make earlier sales explicit at the expense of some additional notation).

The game unfolds in three phases. In phase 1, manufacturers offer contracts to retailer 1; as in Section III, the retailer then chooses among contract offers and selects quantities. Production, however, does not occur until phase 3.[15] In phase 2, each manufacturer j has the opportunity to invest a fixed sum (K_j) in cost reduction. This investment reduces the unit cost of production from $c_j + \delta_j$ (where $\delta_j \geq 0$) to c_j. In phase 3, having observed each other's investment decisions, the two manufacturers engage in a contracting game with retailer 2 (as in Sec. III). Finally, production is carried out and the retailers make the payments required by their contracts. Retailer n's revenues are given by a continuous function $R_n(x_{An}, x_{Bn})$, where x_{jn} denotes manufacturer j's sales to retailer n. As in Section III, a retailer earns zero if it accepts no contracts, and a manufacturer earns zero in any market in which the retailer rejects its contract.

For the sake of simplicity, we focus on the case in which $K_A = \delta_A = 0$ and $\delta_B = +\infty$. In other words, we assume that manufacturer A has no further opportunities to reduce costs and that manufacturer B cannot produce at all unless the investment is undertaken. These assumptions imply that A may be able to eliminate competition from B in market 2 by excluding B from market 1. However, B does not have a symmetric incentive to exclude A from market 1.

It is convenient to define for each market $n = 1, 2$ the joint profit levels

$$\hat{\Pi}_n^c = \overline{\Pi}_n^c \equiv \max_x \{R_n(x) - c_A x_A - c_B x_B\}$$

and

$$\Pi_n^j \equiv \max_{x_j} \{R_n(x_j, 0) - c_j x_j\}.$$

As in Section III, these would be the joint payoffs from common and exclusive outcomes were only market n to exist. In parallel to the notation of Section III, we denote the (unique) solutions to these maximizations by $(x_{An}^{**}, x_{Bn}^{**})$ and x_{jn}^{*} (j = A, B), respectively, and

[15] The retailer's choice of quantities can also be delayed without affecting the conclusions, but the game is somewhat easier to solve if this decision is made immediately.

assume that these quantities are strictly positive. We also assume that assumption B2 holds in each market, so $\Pi_n^A + \Pi_n^B > \hat{\Pi}_n^c$ for $n = 1, 2$.

To focus attention on the cases of greatest interest, we state several pertinent assumptions.

ASSUMPTION C1. $0 < \hat{\Pi}_2^c - \Pi_2^A < K_B$.

ASSUMPTION C2. $\hat{\Pi}_1^c + \hat{\Pi}_2^c - \Pi_1^A - \Pi_2^A - K_B > 0$.

ASSUMPTION C3. $\Pi_1^A + \Pi_2^A > \hat{\Pi}_1^c + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B$.

Assumption C1 states that manufacturer B's contribution to total profit in market 2 is positive but strictly less than B's required investment. Since B's profits in market 2 (gross of K_B and conditional on having invested in phase 2) are given by the middle term in assumption C1 (see proposition 1), this condition implies that, if excluded from market 1, B will neither invest in phase 2 nor compete against A in market 2 during phase 3; thus assumption C1 creates the potential for the foreclosure of a noncoincident market. Assumption C2 indicates that if retailer 2's profits are also considered, aggregate profits are maximized when B participates. If the retailers practice perfect price discrimination, this implies that B's participation is socially desirable and that B's exclusion from market 1 is inefficient. Assumption C3 states that the joint payoffs for retailer 1 and the two manufacturers are higher if B is excluded from market 1 (given B's subsequent decision not to participate in market 2) than if B makes sales to retailer 1. The intuition developed in Section II suggests that this condition is required to generate effectively exclusive outcomes in market 1.

We assume throughout that assumptions C1 and C2 are satisfied, and we investigate the properties of equilibria contingent on whether assumption C3 holds.

B. *Equilibrium Exclusion*

To understand the properties of equilibria for this model, it is helpful to build intuition using the principles developed from the simple analytic framework of Section II. A small amount of work is first required before the applicability of this framework becomes evident.

To solve for equilibria, one would begin with phase 3. If B has chosen to invest in phase 2, then phase 3 payoffs for manufacturer j are given by $\hat{\Pi}_2^c - \Pi_2^i$, $i \neq j$ (see proposition 1). If B has chosen not to invest, then manufacturer A faces no competition in market 2. In that case, A extracts all the potential rents from retailer 2, earning Π_2^A.

Next consider the phase 2 investment decision of manufacturer B. If retailer 1 has chosen a positive quantity for B, manufacturer B certainly invests (otherwise B would incur infinite losses since its contract would require it to produce x_{B1} at infinite costs). If retailer 1 has an exclusive relationship with A or has simply chosen $x_{B1} = 0$, then B chooses not to invest (given assumption C1 and proposition 1).

Finally, consider the phase 1 contract offers by manufacturers A and B to retailer 1. Note that the phase 1 problem can be treated as the type of game considered in Section III, provided that we define payoffs appropriately to reflect outcomes on the equilibrium continuation paths. In particular, we can solve the phase 1 contracting problem with retailer 1 by studying an equivalent single-market model, in which the costs of manufacturers A and B are given by

$$C_A(x_{A1}, x_{B1}) = c_A x_{A1} - \Pi_2^A - I(x_{B1} > 0)(\hat{\Pi}_2^c - \Pi_2^B - \Pi_2^A)$$

and

$$C_B(x_{B1}) = c_B x_{B1} - I(x_{B1} > 0)(\hat{\Pi}_2^c - \Pi_2^A - K_B),$$

where the indicator function $I(x_{B1} > 0)$ equals unity when $x_{B1} > 0$, and zero otherwise. Note that this equivalent single-market model differs from the class considered in Section III in one important respect: A's implicit "costs" depend on B's production as well as on A's production. The importance of this observation becomes evident below.

It is for this equivalent, single-market problem that one can develop intuition by invoking the principles developed in Section II. As in Section III, we proceed by considering the characteristics of exclusive representation and common representation. Imagine first an intrinsically exclusive setting involving the retailer and manufacturer A. Under the optimal exclusive contract the retailer chooses sales of x_{A1}^*, and joint payoffs for the manufacturers and the retailer are given by

$$R_1(x_{A1}^*, 0) - C_A(x_{A1}^*, 0) = \Pi_1^A + \Pi_2^A \equiv \Pi^A.$$

Next imagine an intrinsically exclusive setting involving the retailer and manufacturer B. Under the optimal exclusive contract the retailer chooses sales of x_{B1}^*, and joint payoffs for the manufacturers and the retailer are given by

$$R_1(0, x_{B1}^*) - C_B(x_{B1}^*) + (\hat{\Pi}_2^c - \Pi_2^B)$$

$$= \Pi_1^B + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B \equiv \Pi^B$$

(where $\hat{\Pi}_2^c - \Pi_2^B$ denotes the payoff to manufacturer A when A is excluded from market 1).

Finally, imagine a setting with intrinsic common representation. Were the manufacturers to cooperate with each other, they would extract all economic surplus over and above the retailer's reservation payoff, and they would induce the retailer to make the joint profit-maximizing choice among $(x_{A1}^{**}, x_{B1}^{**})$, $(x_{A1}^{*}, 0)$, and $(0, x_{B1}^{*})$. It is easy to check that the third choice is always inferior to the first; consequently, cooperative joint profits are given by[16]

$$\max\left\{\hat{\Pi}_1^c + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B, \Pi^A\right\} \equiv \overline{\Pi}^c.$$

Once again, the structure of an intrinsic common agency game does not permit the manufacturers to cooperate. To be consistent with our earlier notation, we use $\hat{\Pi}^c$ to denote the joint payoffs associated with the undominated noncooperative equilibrium of the intrinsic common agency game. Obviously, $\hat{\Pi}^c \leq \overline{\Pi}^c$. Notably, in contrast to Section III, one cannot rule out strict inequality in this context. We shall explain and elaborate on this point shortly.

Now consider this setting in light of the principles developed in Section II. When assumption C3 holds, $\Pi^A = \overline{\Pi}^c \geq \hat{\Pi}^c$, and the cooperative common outcome in market 1 involves effective exclusion (quantities of $(x_{A1}^{*}, 0)$). Exclusion of manufacturer B from market 1 is jointly efficient for retailer 1 and the two manufacturers since joint losses in market 1 from reduced variety, $\hat{\Pi}_1^c - \Pi_1^A$, are more than offset by the joint gain arising from reduced competition in market 2, $\Pi_2^A - \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B$. These gains reflect the more effective expropriation of rents from retailer 2, who loses $\Pi_2^A + \Pi_2^B - \hat{\Pi}_2^c$. Since the (undominated) equilibrium outcome of the bidding game maximizes the joint surplus of the manufacturers and the retailer (our first general principle), *effective* exclusion arises in this case. Moreover, this is so precisely because of anticompetitive effects in the noncoincident market.

In contrast, if assumption C3 is strictly reversed, then $\overline{\Pi}^c > \Pi^A$ and the cooperative common outcome yields $(x_{A1}^{**}, x_{B1}^{**}) \neq (x_{A1}^{*}, 0)$. Moreover, for this case, one can show that there is an equilibrium of the intrinsic common agency game in which $(x_{A1}^{**}, x_{B1}^{**})$ is sustained through forcing contracts, so $\hat{\Pi}^c = \overline{\Pi}^c$. Intuition based on the framework of Section II therefore suggests that any undominated equilibrium of the contracting model in this case is a common equilibrium with quantities in market 1 of $(x_{A1}^{**}, x_{B1}^{**})$.

[16] The first term in braces is simply the joint profit level associated with $(x_{A1}^{**}, x_{B1}^{**})$ and is derived from the expression $R_1(x_{A1}^{**}, x_{B1}^{**}) - C_A(x_{A1}^{**}, x_{B1}^{**}) - C_B(x_{B1}^{**})$.

The following proposition confirms the validity of these intuitive arguments.

PROPOSITION 3. When assumption C3 holds, all undominated equilibria involve effective exclusion of manufacturer B from market 1 (i.e., $x_{B1} = 0$). When the inequality in assumption C3 is (strictly) reversed, no undominated equilibrium involves effective exclusion of manufacturer B from market 1.

Of course, as we have emphasized, there is an important distinction between effective, noncontractual exclusion and explicit, contractual exclusion. Indeed, for the single-market setting of Section III, explicit exclusionary provisions were superfluous: whenever effective exclusion (i.e., only one product is sold) was jointly optimal for the retailer and the two manufacturers, this could be achieved through nonexclusive contracts. However, the logic of that finding depended on the equality of $\hat{\Pi}^c$ and $\overline{\Pi}^c$, which in turn followed from the assumption that A's costs were independent of B's sales (i.e., no cost externalities). This assumption permitted the firms to support $(x_A^*, 0)$ using sellout contracts that transferred all variation in profits, without violating the restriction that a common contract cannot condition compensation on a rival's sales. In the current context, there *are* cost externalities, since A's implicit "costs," $C_A(x_{A1}, x_{B1})$, do depend on B's sales; thus, without an ability to condition compensation on B's sales, A cannot transfer all residual profit variation to retailer 1. This implies that contracts between retailer 1 and B may impose externalities on A, in which case we might have $\hat{\Pi}^c < \overline{\Pi}^c = \Pi^A$. In such a situation, the undominated equilibrium would still maximize joint profits through exclusion, but this would require *explicit* contractual exclusion of manufacturer B.

As noted above, when assumption C3 is strictly reversed, $\hat{\Pi}^c = \overline{\Pi}^c$, and so the presence of cost externalities does not interfere with the efficiency of intrinsic common representation. However, when assumption C3 holds, a deviation from the jointly efficient outcome, $(x_{A1}^*, 0)$, may benefit retailer 1 and manufacturer B precisely because positive sales for B impose a negative externality on A. When will this externality be of sufficient size to justify the deviation? To answer this question, we define the following set:

$$D \equiv \{x_{A1} | \max_{x_{B1}} [R_1(x_{A1}, x_{B1}) - c_B x_{B1} + I(x_{B1} > 0) \times (\hat{\Pi}_2^c - \Pi_2^A - K_B)] \leq R_1(x_{A1}, 0)\}.$$

In words, $x_{A1} \in D$ if and only if retailer 1 and manufacturer B cannot jointly benefit by arranging a deviation from $(x_{A1}, 0)$ to (x_{A1}, x_{B1}) for any $x_{B1} > 0$. Henceforth, we shall refer to D as the *deterrence set.* One would expect to observe explicit exclusionary practices whenever x^*_{A1} is *not* in the deterrence set D, since in this case one cannot support the efficient exclusionary outcome through common representation ($\hat{\Pi}^c < \overline{\Pi}^c = \Pi^A$). This intuition is confirmed in the following result.

PROPOSITION 4. When assumption C3 holds, undominated equilibria necessarily involve an explicit exclusive dealing provision (and output of (x^*_{A1}, 0) in market 1) if and only if $x^*_{A1} \notin D$.

Thus when assumption C3 holds and $x^*_{A1} \notin D$, retailer 1 agrees to an exclusive arrangement with manufacturer A to enhance A's market power in a noncoincident market and to capture a share of the resulting profits. Given assumption C2, this outcome is inefficient in the sense that it fails to maximize total retailer and producer surplus.[17] Even under the assumption that retailers can perfectly price-discriminate (which, as explained in the last section, is implicit in Bork's analysis), exclusive dealing depresses social welfare.[18] Our analysis therefore provides a theoretical foundation for the concern that exclusive dealing can foreclose markets anticompetitively.

C. *The Effects of Banning Exclusive Dealing*

The preceding subsection raises the possibility that, under certain circumstances, exclusive dealing is an anticompetitive practice with adverse consequences for social welfare. This observation suggests a potential role for antitrust policy. One possibility would be to impose a ban on exclusive dealing, which we model as in Section III. However, as we now show, when an inefficient market outcome arises that involves exclusive dealing, the welfare effects of a ban are ambiguous; it may make things even worse. Moreover, a ban can have surprising effects on the distribution of payoffs.

We found in Section IV*B* that our model gives rise to one of three outcomes: explicit exclusion, effective exclusion, and common representation. Each outcome emerges for different parameterizations. Accordingly, we organize our discussion of policy around three cases.

[17] Despite the inefficiency of equilibrium, opportunities for renegotiation need not alter our conclusions. Imagine that retailer 1 and manufacturer A have entered into an exclusive relation, but B has nevertheless invested in phase 2. Retailer 1 and manufacturer A should be willing to renegotiate their contract at the start of phase 3 to permit sales by B. However, B will typically capture less than 100 percent of the surplus gained through renegotiation. If B's share is sufficiently small, even the anticipation of renegotiation will fail to justify investment by B once A has consummated an exclusive contract with retailer 1. Thus, as long as B's bargaining power is not too great, exclusive dealing emerges exactly as in proposition 4.

[18] Ironically, without perfect price discrimination by retailers, exclusive dealing could conceivably raise social welfare.

Case 1. *Explicit exclusion.*—Assumption C3 holds and $x^*_{A1} \notin D$.

Case 2. *Effective exclusion.*—Assumption C3 holds and $x^*_{A1} \in D$.

Case 3. *Common representation.*—Assumption C3 is strictly reversed.

For cases 2 and 3, it is natural to conjecture that a ban on (explicit) exclusive dealing would be irrelevant. It turns out that this is *almost* correct. Proposition 5 below demonstrates that, in the presence of a ban, effective exclusion and common representation persist in cases 2 and 3, respectively. However, in the course of proving this result, we isolate a condition under which, in case 3 (common representation), the imposition of a ban shifts payoffs from retailer 1 to manufacturer B (see the Appendix for details). This occurs because the ban alters out-of-equilibrium alternatives in a way that improves B's ability to extract rents from retailer 1. Intuitively, if explicit exclusion is more profitable than effective exclusion, then B need not cede as much surplus to secure representation when (explicit) exclusive dealing is proscribed.

Case 1 is of much greater interest. Although A enters into an explicit exclusive deal with retailer 1, it does not necessarily follow that the imposition of a ban on this practice would end the effective exclusion of manufacturer B. Although it is impossible in this case to sustain an effectively exclusive equilibrium wherein A produces x^*_{A1}, it may nevertheless be possible to achieve an exclusionary outcome through the use of a contract that induces retailer 1 to choose some $x_{A1} \in D$. On the basis of our first general principle (Sec. II), one might expect to obtain such an outcome as long as the joint profits for retailer 1, manufacturer A, and manufacturer B exceed the joint profits received by these parties when B makes strictly positive sales in market 1.

Following this intuition, we define

$$\tilde{x}_{A1} \equiv \underset{x_{A1} \in D}{\operatorname{argmax}} \, [R_1(x_{A1}, 0) - c_A x_{A1}].$$

Retailer 1 and manufacturer A receive higher joint profits in market 1 from $\tilde{x}_{A1}$ than from any other output level in the deterrence set D. Effective exclusion of B through selection of $\tilde{x}_{A1}$ maximizes the total profits of retailer 1 and *both* manufacturers whenever the following assumption holds.[19]

Assumption C4.

$$[R_1(\tilde{x}_{A1}, 0) - c_A \tilde{x}_{A1}] + \Pi_2^A > \hat{\Pi}_1^c + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B.$$

We use this condition to define two subcases.

[19] Note that assumption C4 is always satisfied in case 2: since $x^*_{A1} \in D$, we have $\tilde{x}_{A1} = x^*_{A1}$, which implies that assumptions C4 and C2 are equivalent. This is not true in case 1: when $x^*_{A1} \notin D$, assumption C4 is more demanding than assumption C2.

Case 1*a*. *Explicit exclusion.*—Assumptions C3 and C4 hold, and $x^*_{A1} \notin D$.

Case 1*b*. *Explicit exclusion.*—Assumption C3 holds and $x^*_{A1} \notin D$, but assumption C4 is strictly reversed.

Our intuition suggests that a ban will lead to effective exclusion in case 1*a* and to common representation in case 1*b*. Moreover, note that in case 1*a*, effective exclusion requires a quantity $x_{A1} \neq x^*_{A1}$ and hence is inefficient (from the standpoint of profits in market 1). In the typical case in which $\partial^2 R_1(\cdot)/\partial x_{A1} \partial x_{B1} < 0$, we have $x_{A1} > x^*_{A1}$.

As in previous sections, the model gives rise to multiple equilibria. However, in the presence of a ban on exclusive dealing, there is not necessarily a unique Pareto-undominated outcome.[20] Nevertheless, it is still possible to rule out many equilibria on other grounds. Formally, we shall say that B's proposed contract is *compensatory* if, for all x_{B1},

$$P_{B1}(x_{B1}) \geq c_B x_{B1} - I(x_{B1} > 0)(\hat{\Pi}^c_2 - \Pi^A_2 - K_B).$$

If B's contract is not compensatory, then it fails to cover the true incremental costs that B incurs in producing x_{B1}. In such cases, B's equilibrium contract offer is weakly dominated by another contract that covers incremental costs in all instances.

With one additional technical assumption,[21] it is possible to prove the following result.

PROPOSITION 5. The effects of a ban on exclusive dealing are as follows: (i) Cases 1*a* (explicit exclusion, assumption C4 holds) and 2 (effective exclusion): If exclusive dealing is banned, there is an effectively exclusive equilibrium with sales in market 1 of $(\tilde{x}_{A1}, 0)$ (recall that $\tilde{x}_{A1} = x^*_{A1}$ in case 2). This is the only equilibrium in which B's contract offer is compensatory. (ii) Cases 1*b* (explicit exclusion, assumption C4 strictly reversed) and 3 (common representation): If exclusive dealing is banned, there is an equilibrium in which both manufacturers' contracts are accepted, and sales in market 1 are $(x^{**}_{A1}, x^{**}_{B1}) > 0$. Furthermore, all undominated equilibria have $x_{B1} > 0$.[22]

[20] When exclusive dealing is banned in case 1*a*, effectively exclusive equilibria are Pareto-ranked (with first-period sales of $(\tilde{x}_{A1}, 0)$ generating the dominant result). However, we believe that it is possible in some instances to construct common equilibria that give manufacturer B positive payoffs in market 1, in which case the payoff-dominance criterion cannot rule out some nonexclusive equilibria.

[21] Specifically, define D^+ analogously to D, replacing $\leq$ with $<$. Assume that $D = \text{clos}(D^+)$.

[22] This result does not establish that the Pareto-dominance criterion uniquely selects $(x^{**}_{A1}, x^{**}_{B1})$. However, if one assumes that joint payoffs in market 1 are strictly concave in (x_{A1}, x_{B1}) when $x_{B1} > 0$, it is easy to verify that this is the unique undominated equilibrium outcome.

Among other things, proposition 5 tells us that, in case $1a$, the ban on exclusive dealing fails to end B's exclusion. Rather, when $\partial^2 R_1(\cdot)/\partial x_{A1}\partial x_{B1} < 0$, A engages in nonexplicit exclusion by inducing retailer 1 to purchase enough output from A to render B's participation unprofitable. Thus explicit exclusion is replaced by effective exclusion implemented through quantity forcing or quantity discounts. The welfare consequences of this response are ambiguous. If retailer 1 practices perfect price discrimination (as assumed implicitly by Bork), social welfare declines. If retailer 1 is instead a conventional nondiscriminating monopolist, the increase in A's output may enhance welfare (unless deterrence of B requires A's output to be sufficiently excessive from a social perspective).

V. Exclusive Dealing as a Consequence of Incentive Conflicts

In Section IV we saw that the potential for foreclosure of noncoincident markets can provide a coherent motivation for exclusive dealing. A commonly expressed alternative view is that exclusive dealing arises in response to a manufacturer's fear that common representation would subject the retailer to conflicting incentives. In this section, we show how exclusive dealing can indeed arise when problems of incentive provision are introduced.

Before proceeding, we should stress that although we focus here on a model with moral hazard, similar points could be established in other settings in which the provision of incentives is costly. For example, Marvel's (1982) (informal) argument—that exclusive dealing protects manufacturers' quasi rents—can be viewed formally as an example of double moral hazard (manufacturers advertise, whereas the risk-neutral retailer can switch consumers among brands). Since the double moral hazard problem also makes it costly to provide incentives, one can obtain similar results.[23]

A. *The Model*

We consider a situation in which the retailer chooses nonverifiable prices for each of the products it carries.[24] We denote the retail price

[23] Similar effects also arise in settings in which the retailer possesses hidden information and either faces an interim individual rationality constraint or is risk-averse. See Martimort (1996) and Stole (1990). Given this fact and the results below, it is surprising that Marvel (1982, pp. 3–4) argues against the view that exclusive dealing is a device to obtain increased dealer promotional effort.

[24] For example, the true price charged by a new car dealer is often unverifiable because of trade-ins. The retailer's price choice in this model could also be interpreted as the choice of a nonobservable level of service that has a monetary value to customers equal to its cost of provision. In any case, the basic points developed below hold for much more general kinds of nonobservable marketing choices.

of product j by p_j for j = A, B. When both products are carried by the retailer, price choices of (p_A, p_B) lead to a stochastic realization of demand for each product j, given by $x_j = \theta q_j(p_A, p_B)$, where $\theta \in \mathbb{R}_+$ is a nonnegative random variable with distribution function $\Phi(\cdot)$. We adopt the normalization that $E(\theta) = 1$, so that $q_j(p_A, p_B)$ represents manufacturer j's expected sales level given retail prices (p_A, p_B). When firm j's product is carried exclusively at retail price p_j, its sales are $x_j = \theta q_j(p_j, \infty)$. Manufacturer j's production costs are c_j per unit, and for simplicity we assume that the retailer's only costs are the costs of acquiring products from the manufacturers. We also assume that $q_j(c_j, \infty) > 0$ for j = A, B.

Each manufacturer is restricted to offering contracts that condition compensation on sales of only its own product (i.e., not on the sales of its competitor or on prices). Moreover, we restrict these payments to be linear in sales: $P_j(x_j) = F_j + \beta_j x_j$ (actual incentive contracts often have this relatively simple structure; for one formal justification, see Rey and Tirole [1986]).

We assume also that the retailer maximizes expected utility and has a Bernoulli utility function of the constant absolute risk aversion form $u(w) = 1 - e^{-aw}$, where $a > 0$. Risk aversion $(a > 0)$ makes incentive provision costly (i.e., the first-best is not attainable) and thereby introduces the possibility that common representation will lead to contracting externalities (see Bernheim and Whinston 1986*a*, theorems 2 and 3). As in Section III, a manufacturer earns zero if its contract is not accepted, and the retailer earns zero if it rejects both manufacturers' offers.

To establish our results, we require one additional technical (but fairly standard) assumption. Let $[P_A(q_A, q_B), P_B(q_A, q_B)]$ denote the inverse of the function $[q_A(p_A, p_B), q_B(p_A, p_B)]$, and suppose that this inverse is well defined on $\mathbb{R}^2_+$. Define

$$R(q_A, q_B; \beta^c_A, \beta^c_B) = \sum_{j=A,B} [P_j(q_A, q_B) - \beta^c_j] q_j$$

(expected variable profits to the retailer as a function of expected sales), and make the following assumption.

ASSUMPTION D1. The function $R(\cdot)$ is twice continuously differentiable and strictly concave in (q_A, q_B), and $\partial R(\cdot)/\partial q_A \partial q_B < 0$ at all $(q_A, q_B) \geq 0$.

Under assumption D1, the mean sales induced by contracts $[(F^c_A, \beta^c_A), (F^c_B, \beta^c_B)]$ are given by continuously differentiable functions $q^c_j(\beta^c_j, \beta^c_{-j})$, j = A, B, which are nonincreasing in β^c_j and nondecreasing in β^c_{-j} (strictly so at any (β^c_A, β^c_B) such that $[q^c_A(\beta^c_A, \beta^c_B), q^c_B(\beta^c_A, \beta^c_B)] \gg 0$).

B. *Equilibrium Behavior*

As in previous sections, one can define Π^j, $\overline{\Pi}^c$, and $\hat{\Pi}^c$ to be the levels of joint profits for the retailer and manufacturers under (respectively) exclusive representation of manufacturer j, cooperative common representation, and noncooperative common representation. The general principles articulated in Section II (and formalized in the Appendix) imply that $\hat{\Pi}^c < \overline{\Pi}^c$ is a *necessary* condition for exclusive dealing to arise in all undominated equilibria: equilibria in the intrinsic common agency game must involve some inefficiency. The next result shows that this condition *always* holds when the cooperative outcome involves positive expected sales levels of both products.

PROPOSITION 6. Suppose that assumption D1 holds and that $[(F_A^*, \beta_A^*), (F_B^*, \beta_B^*)]$ maximizes the manufacturers' joint profits in the intrinsic common agency setting with retailer reservation utility $U = 0$. Then if $[q_A^c(\beta_A^*, \beta_B^*), q_B^c(\beta_A^*, \beta_B^*)] \gg 0$, $[(F_A^*, \beta_A^*), (F_B^*, \beta_B^*)]$ is not a Nash equilibrium of the intrinsic common agency game. Hence, if all cooperative contracts involve positive expected sales for both manufacturers, then $\hat{\Pi}^c < \overline{\Pi}^c$.

Proposition 6 follows because the presence of retailer risk aversion makes incentive provision costly: with cooperative contracts, the manufacturers retain some risk ($\beta_j^* - c_j > 0$). But this immediately gives rise to an externality: if manufacturer $-j$ lowers β_{-j}, this causes the retailer to reduce q_j and lowers manufacturer j's expected profits.[25]

The fact that $\hat{\Pi}^c < \overline{\Pi}^c$ creates the potential for exclusive dealing. Indeed, we saw in Section II that no common equilibria exist when $\hat{\Pi}^c < \max\{\Pi^A, \Pi^B\}$: all equilibria are exclusive. The same principle applies here. Thus, if $\max\{\Pi^A, \Pi^B\}$ is close to $\overline{\Pi}^c$, we can expect exclusive dealing to arise; intuitively, the gain from having both products available were the manufacturers to cooperate in incentive provision is small relative to the loss due to incentive conflicts.

To see this more concretely, consider the limiting case in which products A and B are perfect substitutes with identical costs $c_A = c_B = c$. Obviously, $\Pi^A = \Pi^B = \overline{\Pi}^c$. Hence, as long as $\hat{\Pi}^c < \overline{\Pi}^c$, exclusive dealing must arise. Though we cannot use proposition 6 directly here (because assumption D1 is violated in the limiting case of perfect substitutes), we nevertheless obtain the expected result.

PROPOSITION 7. Consider the case of perfect substitutes with identical costs of production. Assume that $R(q_j, 0; \beta_j, 0)$ is twice continu-

[25] When the retailer is risk-neutral, the derivations in the proof of proposition 6 (see the Appendix) can be used to show that $\beta_j^* - c_j = 0$ for $j =$ A, B. Hence, the cooperative contracts are sellout contracts, which create no externalities across manufacturers. In this case, we would have $\hat{\Pi}^c = \overline{\Pi}^c$.

ously differentiable and strictly concave in q_j at all $q_j \geq 0$. Then $\hat{\Pi}^c < \overline{\Pi}^c = \Pi^A$, and all equilibria are exclusive.

Proposition 7 follows because an efficient (common or exclusive) contract requires $\beta > c$. This is the standard consequence of the trade-off between risk bearing and incentives. In contrast, in an equilibrium of the intrinsic common agency game, Bertrand-like competition between manufacturers drives wholesale prices (β) to (or below) marginal cost.

It is interesting to consider also the opposite limiting case in which the demands for products A and B are completely independent (i.e., $q_j(p_j, p_{-j})$ depends only on p_j). This assumption removes the dependence of manufacturer j's profits on manufacturer $-j$'s choice of β_{-j} and thereby eliminates contracting externalities. To see this, note that manufacturer j's profits depend only on p_j, β_j, and F_j. Since j chooses β_j and F_j, any externality must be experienced through effects of $-j$'s contract on p_j. But it is easy to verify that p_j depends only on β_j, and not on β_{-j}. Since there are no contracting externalities, the optimal cooperative contracts also form a Nash equilibrium of the intrinsic common agency game, which implies $\hat{\Pi}^c = \overline{\Pi}^c$. Moreover, under our assumptions, $(q_A, q_B) \gg 0$ in any cooperative common outcome, so $\Pi^j < \overline{\Pi}^c$ for j = A, B. Thus we have the following proposition.

PROPOSITION 8. Suppose that products A and B are independent in demand. Then any undominated equilibrium entails common representation.

C. The Effects of Banning Exclusive Dealing

We now consider the effect of banning exclusive dealing. For the case of perfect substitutes with identical costs of production, the next proposition demonstrates that a ban always leads to an inefficient outcome (recall from proposition 7 that, for efficient incentive schemes, $\beta > c$).

PROPOSITION 9. Consider the case of perfect substitutes with identical costs of production, and let β^* denote the lowest β_j among accepted contracts. If exclusive dealing is banned, then $\beta^* = c$ and $F_j = 0$ in any contract accepted by the retailer.

In this case, the welfare consequences of a ban are simple. Consumers benefit because a lower wholesale price (β) leads to lower retail prices. Manufacturers earn zero regardless. The costs of inefficient incentive provision are borne entirely by the retailer, whose payoff falls.

The second case considered in the previous subsection might at first seem entirely straightforward. Since exclusion does not occur with independent demand, one might well expect a ban to be inconsequential. Caution is warranted, however; recall from Section IVC that a ban can alter equilibrium payoffs even in cases in which exclusion would not occur. In the current instance, the effect of a ban is even more surprising.

PROPOSITION 10. Suppose that products A and B are independent in demand. If exclusive dealing is banned, no pure strategy equilibrium exists.

We suspect (but have not verified) that the existence of mixed-strategy equilibria is generally assured. But if the manufacturers' joint maximization problem is strictly concave, mixed strategies cannot be second-best efficient. In that case, a ban cannot be Pareto-improving and may even reduce payoffs for all market participants. Thus, through subtle strategic channels, a ban on exclusive dealing can reduce the efficiency of economic activity even in cases in which no exclusion occurs.

VI. Conclusions

In this paper, we have attempted to provide a conceptual framework for analyzing the motivations for and effects of exclusive dealing. In simple settings, our analysis corroborates Robert Bork's evaluation of the practice: in particular, exclusion (whether explicit or not) occurs only when it is efficient (when we abstract from issues concerning imperfect extraction of consumer surplus). However, in that model, explicit exclusionary provisions are also superfluous: banning them is not harmful.

By introducing additional features, we generate models in which these provisions serve meaningful functions. We provide formal theoretical foundations for the view that exclusive dealing may be adopted for anticompetitive reasons (to enhance market power in noncoincident markets) and for the view that it efficiently ameliorates the incentive conflicts associated with common representation. We use these formal models to study the consequences of a ban on the practice. In either case, the welfare effects of a ban are complex. For example, even when exclusive dealing is used anticompetitively, a ban may simply lead to even less efficient forms of nonexplicit exclusion.

While these models do not encompass all possible motivations for exclusive dealing, our framework should be useful for studying the operability and consequences of other motivations. For example, as we have already suggested, Marvel's (1982) concern—that manufacturers might "free-ride" with common representation—can be captured in our framework.

In practical settings, it can be difficult to determine the motivations for exclusive dealing. For example, in his discussion of the *Standard Fashion* case, Marvel (1982) argues that Standard was attempting to prevent competitors from free-riding by copying patterns that had proved to be popular. Yet Marvel's characterization of the facts is also consistent with the two motivations modeled in this paper. For example, he attributes Standard's poor performance after the decision to a competitor's new innovation and new entry, without acknowledging that both of these developments may have been stimulated (as modeled in Sec. IV) by the court's proscription. Likewise, our model of incentive conflict (in Sec. V) easily accounts for Marvel's observation that Standard's wholesale prices were significantly above its marginal costs prior to the decision, as well as for evidence indicating that manufacturers increased fixed fees (charges for display equipment and catalogs) following the court's decision. Plainly, there is insufficient evidence to resolve Standard's motivations.

Our models have two notable limitations. First, we have assumed throughout that there is no incumbent manufacturer with a preexisting contract. This reflects reality in many, although not all, settings. Aghion and Bolton (1987) and Rasmusen, Ramseyer, and Wiley (1991), for example, study the use of exclusivity provisions (or their cousin, stipulated damage provisions) when one manufacturer has a first-mover advantage (see also Segal and Whinston 1996). Second, and perhaps more important, we have restricted our focus to markets served by a single retailer. This is often unrealistic since exclusive dealing rarely precludes rival manufacturers completely from reaching consumers in a market. The extension of our analysis to such circumstances is an important area for future research. Recent papers that make a start in this direction include Besanko and Perry (1993, 1994) (who follow Mathewson and Winter [1987] in restricting attention to the simple wholesale price contracts) and Martimort (1996).

Appendix

For the sake of brevity, many of the following proofs have been abbreviated through the omission of some details. A more detailed version is available from the authors on request.

We begin by proving some results for a general contracting game that subsumes all the specific models considered in Sections III–V. The game involves a retailer and two manufacturers (j = A, B), and the contracting process consists of the same three stages described in Section III. Contracts are arbitrary functions mapping observable outcomes to payments. The sets of feasible contracts, $\mathcal{P}_j^e$ (for *exclusive* offers) and $\mathcal{P}_j^c$ (for *common* offers), are assumed to contain ϕ, the absence of an offer. The retailer's payoff if it rejects both firms' offers is U^0, and each manufacturer j (j = A, B) earns π_j^0. If the retailer serves only manufacturer j, it chooses $\sigma^j \in \Sigma^j$; its payoff is $u^j(P_j^e, \sigma^j)$, j earns $\pi_j^j(P_j^e, \sigma^j)$, and $i \neq j$ earns $\pi_i^j(P_j^e, \sigma^j)$. If the retailer serves both manufacturers, it chooses $\sigma^c \in \Sigma^c$; its payoff is $u^c(P_A^c, P_B^c, \sigma^c)$ and j earns $\pi_j^c(P_A^c, P_B^c, \sigma^c)$, j = A, B. We denote the retailer's (possibly nonunique) optimal choices in each of these cases by

$$\hat{\sigma}^j(P_j^e) = \underset{\sigma^j \in \Sigma^j}{\operatorname{argmax}}\ u^j(P_j^e, \sigma^j)$$

and

$$\hat{\sigma}^c(P_A^c, P_B^c) = \underset{\sigma^c \in \Sigma^c}{\operatorname{argmax}}\ u^c(P_A^c, P_B^c, \sigma^c).$$[26]

The models of Sections III–V impose additional structure on the sets $\mathcal{P}_j^e$, $\mathcal{P}_j^c$, Σ^j, and Σ^c and the functions $u^j(\cdot)$, $u^c(\cdot)$, $\pi_j^j(\cdot)$, $\pi_i^j(\cdot)$, and $\pi_j^c(\cdot)$. Here we make the following minimalistic assumptions.[27]

ASSUMPTION A1. If $P_j^s \in \mathcal{P}_j^s$, then $P_j^s + K \in \mathcal{P}_j^s$ for all $K \in \mathbb{R}$ and $s = e, c$.

ASSUMPTION A2. The payoff $u^c(P_A^c + K, P_B^c - K, \sigma^c) = u^c(P_A^c, P_B^c, \sigma^c)$ for all $K \in \mathbb{R}$, $(P_A^c, P_B^c, \sigma^c) \in \mathcal{P}_A^c \times \mathcal{P}_B^c \times \Sigma^c$.

ASSUMPTION A3. Earnings $\pi_j^c(P_A^c + K, P_B^c, \sigma^c) = \pi_j^c(P_A^c, P_B^c, \sigma^c) + K$ and $\pi_j^j(P_j^e + K, \sigma^j) = \pi_j^j(P_j^e, \sigma^j) + K$ for all $K \in \mathbb{R}$, $(P_A^c, P_B^c, \sigma^c) \in \mathcal{P}_A^c \times \mathcal{P}_B^c \times \Sigma^c$, and $(P_j^e, \sigma^j) \in \mathcal{P}_j^e \times \Sigma^j$.

ASSUMPTION A4. The function $u^j(P_j^e + K, \sigma^j)$ is a continuous strictly increasing function of K that is unbounded above and below.

For $U \geq U^0$, define the function

$$\Pi_j^j(U) \equiv \max_{P_j^e \in \mathcal{P}_j^e, \sigma^j} \pi_j^j(P_j^e, \sigma^j) \tag{A1}$$

subject to $\sigma^j \in \hat{\sigma}^j(P_j^e)$ and $u^j(P_j^e, \sigma^j) \geq U$. The function $\Pi_j^j(U)$ is necessarily nonincreasing in U. Also define $\Pi_i^j(U)$ to be the (maximal if nonunique) corresponding payoff for manufacturer $i \neq j$. Let $\Pi^j(U) = \Pi_j^j(U) + \Pi_i^j(U)$.

If $\Pi_j^j(U)$ and $\Pi_i^j(U)$ are continuous for j = A, B, $i \neq j$ (as we assume below), then exclusive equilibria always exist. In any exclusive equilibrium in which the retailer contracts with manufacturer j, the retailer's equilibrium payoff $\tilde{U}$ must be such that $\Pi_j^j(\tilde{U}) - \Pi_j^i(\tilde{U}) \geq 0 \geq \Pi_i^i(\tilde{U}) - \Pi_i^j(\tilde{U})$ $(i \neq j)$ or, equivalently, $\Pi^j(\tilde{U}) \geq \Pi_i^j(\tilde{U}) + \Pi_j^i(\tilde{U}) \geq \Pi^i(\tilde{U})$. The best exclusive equilibrium (for manufacturers) gives the retailer the payoff

[26] Optimal choices may not exist for all feasible contracts. Formally, there are two ways to proceed. First, one can impose sufficient technical restrictions on payoffs and contracts to guarantee existence. Second, one could assume that, when an optimum fails to exist, the retailer follows some rule of thumb (e.g., do nothing, or "satisfice"). Both approaches lead to the same results.

[27] The term $P_j^c + K$ denotes the contract that differs from contract P_j^c only by the addition of a fixed payment K from the retailer to manufacturer j. A similar meaning applies to the contract $P_j^e + K$.

$U^e = \min\{U: \Pi_i^i(U) - \Pi_i^j(U) \leq 0$ for some i and $j \neq i\}$ and has profits of $\Pi_j^j(U^e)$ for the manufacturer who is served and $\Pi_i^j(U^e)$ for the excluded manufacturer.

As we show below, one can characterize common equilibria with reference to an associated *intrinsic common agency* game, wherein the retailer is restricted to serve both manufacturers or neither (Bernheim and Whinston 1986*a*). One obtains this game by imposing the restriction that $\mathcal{P}_j^e = \phi$ for j = A, B and by assuming that the manufacturers receive arbitrarily large negative payoffs if the retailer rejects both offers. Let $\hat{\Pi}^c(U)$ denote the highest *aggregate* payoff earned by the two manufacturers in any equilibrium of an intrinsic common agency game with retailer reservation utility U, and let $\hat{E}^c(U) \subset \mathcal{P}_A^c \times \mathcal{P}_B^c \times \Sigma^c$ denote the (set of) associated equilibrium choices. Assumptions A1–A4 imply that if $(P_A^c, P_B^c, \sigma^c) \in \hat{E}^c(U)$, then $(P_A^c + K, P_B^c - K, \sigma^c) \in \hat{E}^c(U)$.

Lemma A1. Suppose that assumptions A1–A4 hold. Then, for any (P_A^c, P_B^c, σ^c), there exists (P_A^e, P_B^e) such that $[(P_A^e, P_A^c), (P_B^e, P_B^c), \sigma^c]$ is a common equilibrium of the contracting game only if (*a*) $u^c(P_A^c, P_B^c, \sigma^c) \geq U^0$; (*b*) (P_A^c, P_B^c, σ^c) is an equilibrium of the associated intrinsic common agency game in which the retailer has reservation utility $u^c(P_A^c, P_B^c, \sigma^c)$; and (*c*) $\pi_j^c(P_A^c, P_B^c, \sigma^c) \geq \Pi_j^i(u^c(P_A^c, P_B^c, \sigma^c))$ for j = A, B. If conditions *a–c* hold and we also have (*d*) $\pi_j^c(P_A^c, P_B^c, \sigma^c) \geq \Pi_j^i(u^c(P_A^c, P_B^c, \sigma^c))$, then such a (P_A^e, P_B^e) exists.

Proof. Necessity is easily verified. For sufficiency, we argue that if *a–d* hold for some (P_A^c, P_B^c, σ^c), then there is a common equilibrium of the form $[(\hat{P}_A^e, P_A^c), (\hat{P}_B^e, P_B^c), \sigma^c]$ in which $\max_{\sigma^j \in \Sigma^j} u^j(\hat{P}_j^e, \sigma^j) = u^c(P_A^c, P_B^c, \sigma^c)$ for j = A, B. Note, first, that assumption A4 implies that exclusive contracts exist that satisfy this equality. Now, if condition *a* is satisfied, the retailer is willing to accept both manufacturers' offers. Moreover, with exclusive contract $\hat{P}_{-j}^e$ being offered, any deviation by manufacturer j that causes the retailer to continue to accept manufacturer j's offer must give the retailer a payoff of at least $u^c(P_A^c, P_B^c, \sigma^c)$. Condition *b* therefore implies that there is no profitable deviation for j that has the retailer accept *both* manufacturers' offers, whereas condition *c* implies that there is no profitable deviation for j that has the retailer accept *only* manufacturer j's offer. Finally, condition *d* implies that no deviation that causes the retailer to reject manufacturer j's offer can raise j's payoff either (since the retailer would then accept $i \neq j$'s offer). Q.E.D.

The models in Sections III–V satisfy three further conditions that help us characterize equilibria.

Assumption A5. There exist constants $(\hat{\Pi}^c, \Pi_A^A, \Pi_A^B, \Pi_B^B, \Pi_B^A)$ and a strictly increasing function $g(U)$ with $g(U^0) = 0$ such that, for all $U \geq U^0$, $\hat{\Pi}^c(U) = \hat{\Pi}^c - g(U)$, $\Pi_j^j(U) = \Pi_j^j - g(U)$ for j = A, B, and $\Pi_i^j(U) = \Pi_i^j$ for j = A, B, $i \neq j$.

Assumption A6. For some j, $\Pi_j^j > \pi_j^0$, and $\Pi_A^A + \Pi_B^B - \max\{\Pi^A, \Pi^B, \hat{\Pi}^c\} \geq 0$.

Assumption A7. For j = A, B and $i \neq j$, $\Pi_i^j \leq \min\{\pi_i^0, \pi_i^j(P_j^e, \sigma^j)\}$ for all (P_j^e, σ^j).

Given assumption A5, for j = A, B, we can also write $\Pi^j(U) = \Pi^j - g(U)$, where $\Pi^j = \Pi_j^j + \Pi_i^j$.

The following result characterizes the undominated equilibria of our contracting game.

LEMMA A2. Suppose that assumptions A1–A6 hold. In any undominated equilibrium of the contracting model, manufacturer j (j = A, B) earns $\max\{\hat{\Pi}^c, \Pi^A, \Pi^B\} - \Pi_i^i$ $(i \neq j)$ and the retailer receives a payoff of $g^{-1}(\Pi_A^A + \Pi_B^B - \max\{\hat{\Pi}^c, \Pi^A, \Pi^B\})$. (i) If $\max\{\Pi^A, \Pi^B\} > \hat{\Pi}^c$, then in any undominated equilibrium the retailer contracts with only one manufacturer j, with $\Pi^j = \max\{\Pi^A, \Pi^B\}$. The equilibrium contract and retailer action (P_j^e, σ^j) solve (A1) for $U = g^{-1}(\Pi_i^i - \Pi_i^j)$. Moreover, if assumption A7 holds, then no common equilibria exist in this case. (ii) If $\hat{\Pi}^c > \max\{\Pi^A, \Pi^B\}$, then all undominated equilibria are common equilibria. The equilibrium contracts and retailer action choice (P_A^c, P_B^c, σ^c) are elements of the set $\hat{E}^c(g^{-1}(\Pi_A^A + \Pi_B^B - \hat{\Pi}^c))$. (iii) If $\hat{\Pi}^c = \max\{\Pi^A, \Pi^B\}$, then both types of equilibria described in parts i and ii arise as undominated equilibria.

Proof. The first part of assumption A6 rules out no-contracting equilibria. The second part of assumption A6 implies that $g^{-1}(\Pi_A^A + \Pi_B^B - \max\{\hat{\Pi}^c, \Pi^A, \Pi^B\}) > U^0$, that is, that the retailer's equilibrium payoff (as given in the statement of the proposition) exceeds its reservation utility.

i) $\max\{\Pi^A, \Pi^B\} > \hat{\Pi}^c$. The preceding discussion implies that, if manufacturer j's contract is accepted in an exclusive equilibrium, then $\Pi^j = \max\{\Pi^A, \Pi^B\}$. Moreover, in the best exclusive equilibrium (for the manufacturers), the retailer earns U^e such that $\Pi_i^i - g(U^e) - \Pi_i^j = 0$ $(i \neq j)$, so $U^e = g^{-1}(\Pi_i^i - \Pi_i^j) = g^{-1}(\Pi_j^j + \Pi_i^i - \Pi^j)$; manufacturer j earns $\Pi_j^j - g(U^e) = \Pi^j - \Pi_i^i$; and manufacturer i earns $\Pi_i^j = \Pi^j - \Pi_j^j$. Part c of lemma A1, however, implies that manufacturer k's payoff (k = A, B) in a common equilibrium with a retailer who earns U is bounded above by $\hat{\Pi}^c(U) - \Pi_m^m(U) = \hat{\Pi}^c - \Pi_m^m$, where $m \neq k$. Since $\hat{\Pi}^c < \Pi^j$, both manufacturers must do strictly worse in any common equilibrium than in the best exclusive equilibrium.

Note, moreover, that when assumption A7 holds, then in any common equilibrium $\pi_i^c(P_A^c, P_B^c, \sigma^c) \geq \Pi_i^j$ for i = A, B and $j \neq i$ (otherwise i could be assured of raising its payoff by offering no contracts). Since in any common equilibrium in which the retailer earns U we must have $\pi_j^c(P_A^c, P_B^c, \sigma^c) \geq \Pi_j^j - g(U)$, this implies that in any such equilibrium $\hat{\Pi}^c - g(U) \geq \Pi_j^j + \Pi_i^j - g(U) = \Pi^j - g(U)$; this cannot hold for both manufacturers when $\max\{\Pi^A, \Pi^B\} > \hat{\Pi}^c$.

ii) $\hat{\Pi}^c > \max\{\Pi^A, \Pi^B\}$. From part i we know that each manufacturer j's payoff in any common equilibrium is bounded above by $\hat{\Pi}^c - \Pi_i^i$ for $i \neq j$. When $\hat{\Pi}^c > \max\{\Pi^A, \Pi^B\}$, this amount dominates j's payoff (for j = A, B) in the best exclusive equilibrium (see part i). Thus we establish the result by showing that common equilibria exist that achieve this upper bound for both manufacturers. Define $U^c \equiv g^{-1}(\Pi_A^A + \Pi_B^B - \hat{\Pi}^c) > U^0$ and consider any $(P_A^c, P_B^c, \sigma^c) \in \hat{E}^c(U^c)$. This generates an aggregate manufacturer payoff of $\hat{\Pi}^c(U^c) = \hat{\Pi}^c - g(g^{-1}(\Pi_A^A + \Pi_B^B - \hat{\Pi}^c)) = 2\hat{\Pi}^c - \Pi_A^A - \Pi_B^B$. Assumptions A1–A4 imply that there is a level of $K \in \mathbb{R}$ such that $(P_A^c + K, P_B^c - K, \sigma^c) \in \hat{E}^c(U^c)$ and $\pi_j^c(P_A^c + K, P_B^c - K, \sigma^c) = \hat{\Pi}^c - \Pi_i^i$ $(i \neq j)$ for j = A, B. Since $\hat{\Pi}^c > \max\{\Pi^A, \Pi^B\}$ implies $\hat{\Pi}^c - \Pi_i^i > \Pi_j^i$ for j = A, B, $i \neq j$, condition d of lemma A1 holds for the common contracts and action choice $(P_A^c + K$,

$P_B^c - K, \sigma^c$). Since conditions a–c hold as well (for a, we have $U^c \geq U^0$; for c, we have $\hat{\Pi}^c - \Pi_i^i \geq \Pi_j^j$; these both follow from assumption A6), lemma A1 tells us that there exist exclusive contracts (P_A^e, P_B^e) such that $[(P_A^e, P_B^c + K), (P_B^e, P_B^c - K), \sigma^c]$ is a common equilibrium of the contracting game. Note, finally, that any common equilibrium yielding these manufacturer payoffs must give the retailer exactly U^c.

iii) $\hat{\Pi}^c = \Pi^A$. Immediate from parts i and ii. Q.E.D.

Proof of Proposition 1

The model is clearly a special case of the general framework, where $\sigma^j = x_j$, $\Sigma^j = \mathbb{R}_+$, $\sigma^c = (x_A, x_B)$, $\Sigma^c = \mathbb{R}_+^2$, P_j^s: $\mathbb{R}_+ \rightarrow \mathbb{R}$, $s = c, e$,

$$\pi_j^c(P_A^c, P_B^c, x^c) = P_j^c(x_j^c) - c_j(x_j^c),$$

$$\pi_j^j(P_j^e, x_j^e) = P_j^e(x_j^e) - c_j(x_j^e),$$

$$u^c(P_A^c, P_B^c, x^c) = R(x_A^c, x_B^c) - P_A^c(x_A^c) - P_B^c(x_B^c),$$

$$u^j(P_j^e, x_j^e) = R(x_j^e, 0) - P_j^e(x_j^e),$$

$$\pi_A^0 = \pi_B^0 = U^0 = 0,$$

$$\pi_j^i(P_i^e, x_i) = 0 \quad \text{for all } (P_i^e, x_i),\ i \neq j,\ j = \text{A, B},$$

$$\Pi^j(U) = \Pi_j^j(U) = R(x_j^*, 0) - c_j(x_j^*) - U,$$

$$\hat{\Pi}^c(U) = R(x^{**}) - c_A(x_A^{**}) - c_B(x_B^{**}) - U.$$

It is easy to check that assumptions A1–A7 are satisfied, with $g(U) = U$, $\Pi^j = \Pi_j^j = R(x_j^*, 0) - c_j(x_j^*)$, and $\hat{\Pi}^c = R(x^{**}) - c_A(x_A^{**}) - c_B(x_B^{**})$. The proposition is then an immediate consequence of lemma A2. Q.E.D.

Proof of Proposition 2

Let (Π_A^*, Π_B^*, U^*) be the undominated equilibrium payoff defined in proposition 1. It is straightforward to verify that $[(\tilde{P}_A^e, \tilde{P}_A^c), (\tilde{P}_B^e, \tilde{P}_B^c), x^{**}]$ with $\tilde{P}_j^c(x_j) = \tilde{P}_j^e(x_j) = \Pi_j^* + c_j(x_j)$ is an undominated common equilibrium. Since this equilibrium satisfies the constraint that $P_j^c(x_j) = P_j^e(x_j)$, it continues to be an equilibrium in the restricted game. Suppose that there is some other equilibrium of the restricted game that generates profits (Π_A, Π_B) for the manufacturers such that, for some manufacturer j, $\Pi_j > \Pi_j^*$. Then it can be verified that manufacturer $-j$ has a profitable deviation to the contract $P_{-j}(x_{-j}) = (\Pi_{-j} + \epsilon) + c_{-j}(x_{-j})$—a contradiction. Thus no other equilibrium of the restricted game generates higher payoffs for either manufacturer. Q.E.D.

Proof of Proposition 3

As in the proof of proposition 1, it is easy to verify that this model is a special case of the general framework.[28] It is also easy to check that assump-

[28] Note that, for this model, $\pi_A^0 = \Pi_2^A$.

tions A1–A7 are satisfied with $g(U) = U$,

$$\Pi_A^A \equiv \Pi_1^A + \Pi_2^A, \quad \Pi_B^A \equiv 0,$$
$$\Pi^A \equiv \Pi_1^A + \Pi_2^A, \quad \Pi_B^B \equiv \Pi_1^B + (\hat{\Pi}_2^c - \Pi_2^A) - K_B,$$
$$\Pi_A^B \equiv (\hat{\Pi}_2^c - \Pi_2^B), \quad \Pi^B \equiv \Pi_1^B + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B,$$

and

$$\hat{\Pi}^c \leq \max\left\{\hat{\Pi}_1^c + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B, \Pi^A\right\} \equiv \overline{\Pi}^c.$$[29]

When this is coupled with the arguments in the text, the result follows from lemma A1. Q.E.D.

Proof of Proposition 4

The proof consists of two steps.

i) If $x_{A1}^* \notin D$, all undominated equilibria are explicitly exclusive. By lemma A2, we establish the result by showing that $\hat{\Pi}^c < \overline{\Pi}^c$ (recall that $\overline{\Pi}^c = \Pi^A$ under assumption C3). Suppose that $\hat{\Pi}^c = \overline{\Pi}^c$. Then there is an equilibrium of the intrinsic common agency game with retailer reservation utility 0 in which retailer 1 chooses $(x_{A1}^*, 0)$. Suppose that this retailer accepts (P_{A1}^c, P_{B1}^c). Then one can verify that, for sufficiently small $\epsilon > 0$, B has a profitable deviation to $\hat{P}_{B1}^c(x_{B1}) = P_{B1}^c(0) + \epsilon + c_B x_{B1} - I(x_{B1} > 0)(\hat{\Pi}_2^c - \Pi_2^A - K_B)$—a contradiction.

ii) If $x_{A1}^* \in D$, for any explicitly exclusionary undominated equilibrium, there is an equivalent equilibrium without explicit exclusion. By lemma A2, we establish the result by showing that $\hat{\Pi}^c = \overline{\Pi}^c$. It can be verified that the following are equilibrium offers in the intrinsic common agency game with a retailer reservation utility of zero and induce the retailer to choose $(x_{A1}^*, 0)$:

$$P_{A1}^c(x_{A1}) = \begin{cases} R_1(x_{A1}^*, 0) & \text{for } x_{A1} = x_{A1}^* \\ \infty & \text{otherwise,} \end{cases}$$

$$P_{B1}^c(x_{B1}) = c_B x_{B1} - I(x_{B1} > 0)(\hat{\Pi}_2^c - \Pi_2^A - K_B).$$

Q.E.D.

[29] These values reflect our simplifying assumption that retailer 1 has only one opportunity to contract with the manufacturers. If, instead, rejection of both the manufacturers' offers in phase 1 results in another contracting opportunity for retailer 1 in phase 3, then the values of π_A^0, π_B^0, and U^0 would be altered, but our conclusions would be unaltered.

Proof of Proposition 5

Noting that cases 1*a* and 2 require assumption C4 to hold, one proves part i in three steps.

1. If assumption C4 holds and exclusive dealing is banned, there is an effectively exclusive equilibrium with first-period sales of $(\tilde{x}_{A1}, 0)$. One can verify that the following contracts and the choice $(\tilde{x}_{A1}, 0)$ for retailer 1 constitute an equilibrium:

$$P_{A1}(x_{A1}) = \begin{cases} R(\tilde{x}_{A1}, 0) - [\Pi_1^B + (\hat{\Pi}_2^c - \Pi_2^A - K_B)] & \text{if } x_{A1} = \tilde{x}_{A1} \\ \infty & \text{otherwise,} \end{cases}$$

$$P_{B1}(x_{B1}) = c_{B1} x_{B1} - I(x_{B1} > 0)(\hat{\Pi}_2^c - \Pi_2^A - K_B).$$

2. If assumption C4 holds and exclusive dealing is banned, $(\hat{x}_{A1}, 0)$ is sustainable as an equilibrium outcome through contracts satisfying $P_{B1}(x_{B1}) \geq c_B x_{B1} - I(x_{B1} > 0)(\hat{\Pi}_2^c - \Pi_2^A - K_B)$ only if $\hat{x}_{A1} = \tilde{x}_{A1}$. Suppose not, and let (P_{A1}, P_{B1}) be the equilibrium contract offers for market 1. Then it is easy to verify that $\hat{x}_{A1} \in D$ (otherwise B has a profitable deviation). Recall that D^+ is defined analogously to D, with $\leq$ replacing $<$. Since (by assumption) $\text{clos}(D^+) = D$ and since $R_1(\cdot)$ is continuous, for any $\delta > 0$ one can find $x_{A1}(\delta) \in D^+$ such that $[R(\tilde{x}_{A1}, 0) - c_A \tilde{x}_{A1}] - [R(x_{A1}(\delta), 0) - c_A x_{A1}(\delta)] < \delta$. It can be verified that, for sufficiently small $(\delta, \epsilon) \gg 0$, A has a profitable deviation to

$$\tilde{P}_{A1}(x_{A1}) = \begin{cases} R_1(x_{A1}(\delta)) - (U^c + \epsilon) & \text{if } x_{A1} = x_{A1}(\delta) \\ \infty & \text{otherwise,} \end{cases}$$

where $U^c \equiv R_1(\hat{x}_{A1}, 0) - P_{A1}(\hat{x}_{A1})$—a contradiction.

3. If assumption C4 holds and exclusive dealing is banned, no (x_{A1}^c, x_{B1}^c) with $x_{B1}^c > 0$ is sustainable through contracts satisfying $P_{B1}(x_{B1}) \geq c_B x_{B1} - I(x_{B1} > 0)(\hat{\Pi}_2^c - \Pi_2^A - K_B)$. Suppose not, and let (P_{A1}, P_{B1}) be the contracts supporting (x_{A1}^c, x_{B1}^c). Then, if we define $x_{A1}(\delta)$ as above and let $U^c = R_1(x_{A1}^c, x_{B1}^c) - P_{A1}(x_{A1}^c) - P_{B1}(x_{B1}^c)$, for sufficiently small $(\delta, \epsilon) \gg 0$, A has a profitable deviation to

$$\tilde{P}_{A1}(x_{A1}) = \begin{cases} R_1(x_{A1}(\delta), 0) - U^c - \epsilon & \text{if } x_{A1} = x_{A1}(\delta) \\ \infty & \text{otherwise.} \end{cases}$$

Noting that cases 1*b* and 3 require the inequality in assumption C4 to be reversed, one proves part ii in two steps.

1. When the inequality in assumption C4 is (strictly) reversed and exclusive dealing is banned, there is an equilibrium in which both manufacturers' contracts are accepted and sales in market 1 are $(x_{A1}^{**}, x_{B1}^{**})$. We construct this equilibrium as follows. Define, for $\alpha \geq 0$,

$$D(\alpha) \equiv \{x_{A1} | \max_{x_{B1}} [R_1(x_{A1}, x_{B1}) - c_B x_{B1} + I(x_{B1} > 0) \times (\hat{\Pi}_2^c - \Pi_2^A - K_B) - \alpha] \leq R_1(x_{A1}, 0)\}.$$

Note that $D = D(0)$ and $D(\alpha) \subseteq D(\alpha')$ for $\alpha' > \alpha$. We require one additional technical assumption (strengthening $D = \text{clos}[D^+]$): $D(\alpha) = \text{clos}(D^+(\alpha))$, where $D^+(\alpha)$ is defined analogously to $D(\alpha)$, with $<$ replacing $\leq$. This implies that $D(\alpha)$ is a continuous correspondence. Next, define $\overline{\alpha}_B$ as the solution to

$$\hat{\Pi}_1^c + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B - \overline{\alpha}_B =$$
$$\max\{\Pi_1^A + \hat{\Pi}_2^c - \Pi_2^B, \max_{x_{A1} \in D(\overline{\alpha}_B)} [R_1(x_{A1}, 0) - c_A x_{A1}] + \Pi_2^A\}.$$

Under our assumptions, $\overline{\alpha}_B$ exists and is strictly positive. It can be demonstrated that the following strategies give rise to an equilibrium supporting $(x_{A1}^{**}, x_{B1}^{**})$:

$$P_{A1}(x_{A1}) = \begin{cases} \alpha_A + c_A x_{A1} - (\hat{\Pi}_2^c - \Pi_2^B) & \text{if } x_{A1} \notin D(\overline{\alpha}_B) \\ \alpha_A + c_A x_{A1} - \Pi_2^A & \text{if } x_{A1} \in D(\overline{\alpha}_B), \end{cases}$$

$$P_B(x_{B1}) = \overline{\alpha}_B + c_B x_{B1} - I(x_{B1} > 0)(\hat{\Pi}_2^c - \Pi_2^A - K_B),$$

where $\alpha_A = (\hat{\Pi}_1^c - \Pi_1^B) + (\hat{\Pi}_2^c - \Pi_2^B) > 0$.

2. When the inequality in assumption C4 is reversed and exclusive dealing is banned, all undominated equilibria have $x_{B1} > 0$. Since B earns zero if $x_{B1} = 0$, B's payoff is strictly higher in the nonexclusive equilibrium described above (since $\overline{\alpha}_B > 0$). Now consider A. In any equilibrium with $x_{B1} = 0$, $x_{A1} \in D$, and the retailer's payoff must be at *least* $\Pi_1^B + \hat{\Pi}_2^c - \Pi_2^A - K_B$ (otherwise B would have a profitable deviation to a sellout contract). Thus A can earn at most

$$\{\max_{x_{A1} \in D} [R_1(x_{A1}, 0) - c_A x_{A1}] + \Pi_2^A\} - [\Pi_1^B + (\hat{\Pi}_2^c - \Pi_2^A - K_B)]$$
$$< \left[\hat{\Pi}_1^c + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B\right] - [\Pi_1^B + (\hat{\Pi}_2^c - \Pi_2^A - K_B)]$$
$$= (\hat{\Pi}_1^c - \Pi_1^B) + (\hat{\Pi}_2^c - \Pi_2^B) = \alpha_A,$$

where the inequality follows from the fact that assumption C4 is strictly reversed. Q.E.D.

Remark.—As claimed in the text, banning exclusive dealing may increase B's payoff, even if the outcome is nonexclusive both with and without the ban. Manufacturer B's payoff in a nonexclusive equilibrium without a ban is

$$\hat{\Pi}_1^c + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B - (\Pi_1^A + \Pi_2^A)$$

(this is precisely $\hat{\Pi}^c - \Pi^A$, in accordance with lemma A2). With a ban, A's payoff is unchanged, and B's payoff is

$$\overline{\alpha}_B = \hat{\Pi}_1^c + \sum_j (\hat{\Pi}_2^c - \Pi_2^j) - K_B$$

$$- \max\{\Pi_1^{\rm A} + \hat{\Pi}_2^c - \Pi_2^{\rm B}, \max_{x_{\rm A1}\in D(\bar{\alpha}_{\rm B})} [R_1(x_{\rm A1}, 0) - c_{\rm A} x_{\rm A1}] + \Pi_2^{\rm A}\}.$$

Thus, if $x_{\rm A1}^* \in D(\bar{\alpha}_{\rm B})$, the ban leaves B's payoff unchanged (a sufficient condition is $x_{\rm A1}^* \in D$). If $x_{\rm A1}^* \notin D(\bar{\alpha}_{\rm B})$, the ban strictly increases B's payoff (recall that $\Pi_2^{\rm A} > \hat{\Pi}_2^c - \Pi_2^{\rm B}$).

As in the proofs of propositions 1 and 3, it is easy to verify that the model of Section V is a special case of the general framework and that assumptions A1–A7 are satisfied with $g(U) = U$, so that lemma A1 applies (constant absolute risk aversion delivers assumption A5).

Proof of Proposition 6

Suppose that $[(F_{\rm A}^*, \beta_{\rm A}^*), (F_{\rm B}^*, \beta_{\rm B}^*)]$ maximizes the manufacturers' joint profits in an intrinsic common agency game with $U = 0$ and that it also constitutes a Nash equilibrium of this game. Consider a deviation by j to the contract $(F_j(\beta_j), \beta_j)$ such that

$$\max_{(q_{\rm A}, q_{\rm B})\geq 0} \int_0^\infty u(\theta R(q_{\rm A}, q_{\rm B}; \beta_j, \beta_{-j}^*) - F_j(\beta_j) - F_{-j}^*)d\Phi(\theta) = 0.$$[30]

Manufacturer j's expected profit with this change is

$$\pi_j(\beta_j) = (\beta_j - c_j)q_j^c(\beta_j, \beta_j^*) + F_j(\beta_j),$$

and manufacturer $-j$ earns

$$\pi_{-j}(\beta_j) = (\beta_{-j}^* - c_{-j})q_{-j}^c(\beta_j, \beta_{-j}^*) + F_{-j}^*.$$

If $[(F_{\rm A}^*, \beta_{\rm A}^*), (F_{\rm B}^*, \beta_{\rm B}^*)]$ maximizes the manufacturers' joint profits, then $\pi_j'(\beta_j^*) + \pi_{-j}'(\beta_j^*) = 0$ ($j =$ A, B), whereas $[(F_{\rm A}^*, \beta_{\rm A}^*), (F_{\rm B}^*, \beta_{\rm B}^*)]$ is a Nash equilibrium only if $\pi_j'(\beta_j^*) = 0$ ($j =$ A, B). Hence, it must be that

$$\pi_{-j}'(\beta_j^*) = (\beta_{-j}^* - c_{-j})\frac{\partial q_{-j}^c(\beta_j^*, \beta_{-j}^*)}{\partial \beta_j} = 0 \quad (j = \text{A, B}),$$

which by assumption D1 requires $\beta_{\rm A}^* = c_{\rm A}$ and $\beta_{\rm B}^* = c_{\rm B}$. But letting $\beta^* = (\beta_{\rm A}^*, \beta_{\rm B}^*)$ and $q^* \equiv (q_{\rm A}^c(\beta^*), q_{\rm B}^c(\beta^*))$, and computing $F_j'(\beta_j^*)$, using the implicit function theorem, we can write $\pi_j'(\beta_j^*) + \pi_{-j}'(\beta_j^*) = 0$ ($j =$ A, B) as

$$\sum_{k=\text{A, B}} (\beta_k^* - c_k)\frac{\partial q_k^c(\beta^*)}{\partial \beta_j} + q_j^c(\beta^*)\left[1 - \frac{\int_0^\infty u'(\theta R(q^*; \beta^*) - F_{\rm A}^* - F_{\rm B}^*)\theta d\Phi(\theta)}{\int_0^\infty u'(\theta R(q^*; \beta^*) - F_{\rm A}^* - F_{\rm B}^*)d\Phi(\theta)}\right] = 0,$$

[30] Note that with constant absolute risk aversion, the retailer's reservation utility constraint always binds at $[(F_{\rm A}^*, \beta_{\rm A}^*), (F_{\rm B}^*, \beta_{\rm B}^*)]$. Thus $F_j(\beta_j^*) = F_j^*$.

where the term in brackets is strictly positive (θ and $u'(\cdot)$ are perfectly negatively correlated). From assumption D1 again, it follows that $\beta_j^* - c_j \neq 0$ for some j. (In fact, one can show that $\beta_j^* - c_j \gg 0$ for j = A, B.) Hence, $[(F_A^*, \beta_A^*), (F_B^*, \beta_B^*)]$ cannot be a Nash equilibrium. Q.E.D.

Proof of Proposition 7

Consider first the outcome of an exclusive arrangement between the retailer and manufacturer j, where the retailer's reservation level is zero. An argument that parallels that for proposition 6 shows that if (F^e, β^e) is manufacturer j's optimal contract, then since $q_j^e(\beta^e) > 0$ (which follows from $q_j(c_j, \infty) > 0$), we have $\beta^e > c$. Since A and B are perfect substitutes, any pair of contracts $[(F_A^c, \beta_A^c), (F_B^c, \beta_B^c)]$ that maximize the joint payoff of the two manufacturers in an intrinsic common agency setting must satisfy $\min\{\beta_A^c, \beta_B^c\} = \beta^e$ and $F_A^c + F_B^c = F^e$ for some optimal exclusive contract (F^e, β^e). Hence, $\overline{\Pi}^c = \Pi^A$. However, if $[(F_A^c, \beta_A^c), (F_B^c, \beta_B^c)]$ is a Nash equilibrium of this game, then $\min\{\beta_A^c, \beta_B^c\} \leq c$ (otherwise some manufacturer j can increase his expected profit by deviating to contract $(F_j^c, \beta_{-j}^c - \epsilon)$ for some $\epsilon > 0$). This implies that $\hat{\Pi}^c < \overline{\Pi}^c = \Pi^A$. By lemma A2, all contracting equilibria are exclusive. Q.E.D.

Proof of Proposition 8

Since lemma A2 applies, the result follows from the argument in the text. Q.E.D.

Proof of Proposition 9

One can verify that there exists an equilibrium in which $(F_j, \beta_j) = (0, c)$ for j = A, B, and the retailer accepts at least one manufacturer's offer. We now argue that, in any equilibrium, $\beta^* = c$. First, suppose that $\beta^* < c$. Without loss of generality, suppose that $\beta_{-j} = \beta^*$ and that the retailer accepts $-j$'s offer. Then j must earn zero profits (the retailer would not accept any contract that gives j positive profits). It can be verified that j has a profitable deviation to $(\hat{F}_j, c)$, where $\hat{F}_j = F_{-j} + (\beta^* - c)q^e(\beta^*) + \epsilon$ for some small $\epsilon > 0$—a contradiction. Second, suppose that $\beta^* > c$. If the retailer accepts both contracts and $\beta_A = \beta_B = \beta^*$, then it can be verified that some j can profit by deviating to $(F_j, \beta^* - \epsilon)$ for some small $\epsilon > 0$. For all other cases, it can be verified that some j, who earns zero, can profitably deviate to $(F_j, \beta_j) = (0, \beta')$ for some $\beta' \in (c, \min\{P(0), \beta^*\})$. This contradicts $\beta^* > c$.

Finally, we argue that $F_j = 0$ for any accepted contract. This is immediate if $\beta_j > \beta^*$. If $\beta_j = \beta^* = c$, one must have $F_j \geq 0$; otherwise, j's payoff would be negative. If $F_j > 0$, then $-j$'s payoff must be zero (either $-j$'s offer is not accepted, $\beta_{-j} = c$ and $F_{-j} = 0$, or $\beta_{-j} > c$, $F_{-j} = 0$, and $q_{-j} = 0$); hence, $-j$ would gain by deviating to $(F_j - \epsilon, c)$ for some small $\epsilon > 0$. Q.E.D.

Proof of Proposition 10

The proof consists of four steps.

i) In any equilibrium, both contracts are accepted and $U^{A} = U^{B} = U^{AB} > 0$ (where U^{j} and U^{AB} are, respectively, the retailer's utility if only j's contract is accepted and if both contracts are accepted). Suppose on the contrary that j's contract is rejected. Then one can verify that j has a profitable deviation to $(F_j, \beta_j) = (\epsilon, c)$ for sufficiently small $\epsilon > 0$—a contradiction. A similar argument implies that $\beta_j < P_j(0)$ for j = A, B. Now suppose that $U^{AB} = 0$. Let $R_j = [P_j(q_j(\beta_j)) - \beta_j]q_j(\beta_j)$. Since $\beta_j < P_j(0)$, $R_j > 0$. Thus

$$(1 - U^{A})(1 - U^{B}) = e^{aF_A}e^{aF_B}\left[\int_0^\infty e^{-a\theta R_A}\,d\Phi(\theta)\right]\left[\int_0^\infty e^{-a\theta R_B}\,d\Phi(\theta)\right]$$

$$< e^{eF_A}e^{aF_B}\left[\int_0^\infty e^{-a\theta R_A}e^{-a\theta R_B}\,d\Phi(\theta)\right] = (1 - U^{AB}) = 1.$$

But this can hold only if $U^{j} > 0$ for some j, in which case the retailer would not accept both offers—a contradiction. Hence, $U^{AB} > 0$. Finally, if $U^{-j} < U^{AB}$, then j has a profitable deviation involving a small increase in the value of F_j—a contradiction. Hence, $U^{A} = U^{B} = U^{AB}$.

ii) In any equilibrium, $\beta_j = \beta_j^*$, where β_j^* is defined as the optimal choice of β_j in an exclusive relation between j and the retailer. Define $F_j^e(\beta_j, U)$ to be the level of F_j that gives the retailer expected utility U when offered slope parameter β_j in an exclusive contract with j. Now suppose that $\beta_j \neq \beta_j^*$, and let U^* denote the retailer's expected utility in equilibrium. One can verify that j has a profitable deviation to $[F_j^e(\beta_j^*, U^*) - \epsilon, \beta_j^*]$ for some small $\epsilon > 0$—a contradiction.

iii) In any equilibrium, $\beta_j = \beta_j^{**}(\beta_{-j})$ where $\beta_j^{**}(\beta_{-j})$ denotes j's optimal slope parameter given any contract of the form (F_{-j}, β_{-j}) in a setting with intrinsic common agency. Define $F_j^c(\beta_j, U|\beta_{-j}, F_{-j})$ analogously to $F_j^e(\beta_j, U)$ in step ii. Suppose that $\beta_j \neq \beta_j^{**}(\beta_{-j})$. One can verify that j has a profitable deviation to $[F_j^c(\beta_j^{**}(\beta_{-j}), U^*|\beta_{-j}, F_{-j}) - \epsilon, \beta_j^{**}(\beta_{-j})]$ for some small $\epsilon > 0$—a contradiction.

iv) $\beta_j^* \neq \beta_j^{**}(\beta_{-j}^*)$. β_j^* and $\beta_j^{**}(\beta_{-j})$ must satisfy the following first-order conditions:

$$(\beta_j^* - c_j)\frac{\partial q_j(\beta_j^*)}{\partial \beta_j} + q_j(\beta_j^*)[1 - \zeta(R_j^*)] = 0$$

and

$$[\beta_j^{**}(\beta_{-j}) - c_j]\frac{\partial q_j(\beta_j^{**}(\beta_{-j}))}{\partial \beta_j}$$

$$+ q_j(\beta_j^*(\beta_{-j}))\{1 - \zeta[R_A^{**}(\beta_B) + R_B^{**}(\beta_A)]\} = 0,$$

where

$$\zeta(R) = \frac{\int_0^\infty e^{-a\theta R}\theta \, d\phi(\theta)}{\int_0^\infty e^{-a\theta R} d\phi(\theta)},$$

$$R_j^* = [\tilde{P}_j(q_j(\beta_j^*)) - \beta_j^*]q_j(\beta_j^*),$$

$$R_j^{**}(\beta_{-j}^*) = \{\tilde{P}_j[q_j(\beta_j^{**}(\beta_{-j})) - \beta_j^{**}(\beta_{-j})]\}q_j(\beta_j^{**}(\beta_{-j})).$$

If $\beta_j^* = \beta_j^{**}(\beta_{-j}^*)$, then $R_j^{**}(\beta_{-j}^*) = R_j^* > 0$ (where the sign of this term follows from $P_j(0) > c$). Consequently, since both first-order conditions must be satisfied, we have $\zeta(R_j^*) = \zeta(R_A^* + R_B^*)$ for j = A, B. Using the Cauchy-Schwarz inequality for the variables $x = (e^{-a\theta R})^{1/2}$ and $y = (e^{-a\theta R})^{1/2}\theta$, we can show that $\zeta'(R) < 0$. But then since $R_A^* + R_B^* > R_j^*$ (j ≡ A, B), we have $\zeta(R_j^*) > \zeta(R_A^* + R_B^*)$—a contradiction.

Since step iv contradicts steps ii and iii, no pure strategy equilibrium exists. Q.E.D.

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