Tie-ins, Reciprocity, and the Leverage Theory

Richard S. Markovits†

Since 1917, tie-ins imposed by “dominant” sellers or buyers have been held to be per se illegal on the theory that their sole function is to permit such producers to wield “monopolistic [or monopsonistic] leverage.”¹ According to the Supreme Court, such agreements enable the firms in question to use their power in the tying market to gain an undeserved advantage or leverage when marketing or purchasing their tied products. In fact, the illegality of such agreements is premised on the assumption that they intrude an “irrelevant and alien factor”² into the competitive process that “result[s] in economic harm to competition in the ‘tied’ [product] market.”³ Indeed, the leverage generated by such tie-ins is supposed to enable the tying producers to create second monopolies beyond the scope of their first. Thus, according to the Court, “tying agreements serve hardly any purpose beyond the suppression of competition.”⁴

Recently, in an attempt to justify their conclusion that systematic reciprocity is also prohibited by the antitrust laws, the Court,⁵ the FTC,⁶ and numerous antitrust commentators⁷ have contended that this leverage theory of tie-ins applies *mutatis mutandis* to reciprocal dealing as well. On this account, the reciprocal dealer’s patronage simply replaces the “monopolist’s” tying product as the fulcrum of the conditional sales lever which such producers allegedly use to raise their total market power.

In fact, however, the leverage theory does not provide an adequate

† Note and Comment Editor, Yale Law Journal. Lecturer, Department of Economics, Yale University. B.A. 1963, Cornell University; Ph.D. 1966, London School of Economics.

I should like to thank Dale Henderson for criticizing several written and oral versions of this article. I am also indebted to Professors Robert H. Bork and Ward S. Bowman of Yale Law School and Professor Alfred E. Kahn of Cornell University for suggesting a number of significant improvements in the final draft.

1. *Times-Picayune Publishing Co. v. United States*, 345 U.S. 594, 611 (1953).

2. *FTC v. Consolidated Foods Corp.*, 380 U.S. 592, 594 (1965).

3. *Times-Picayune Publishing Co. v. United States*, 345 U.S. at 614.

4. *Standard Oil Co. of California v. United States*, 337 U.S. 293, 305-06 (1949).

5. *FTC v. Consolidated Foods*, 380 U.S. at 594.

6. *See Consolidated Foods Corp.*, [1961-1963 Transfer Binder] TRADE REG. REP. ¶ 16,182, at 20,977 (FTC 1962).

7. *See, e.g.*, Handler, *Emerging Antitrust Issues: Reciprocity, Diversification and Joint Ventures*, 49 VA. L. REV. 433, 437 (1963); Hausman, *Reciprocal Dealing and the Antitrust Laws*, 77 HARV. L. REV. 873, 883 (1964); Turner, *Conglomerate Mergers and Section 7 of the Clayton Act*, 78 HARV. L. REV. 1313, 1388-90 (1965).

explanation of either tie-ins or reciprocity. Both devices are typically employed in situations in which they do not increase the tying firm's power in its tied product market. Indeed, even on the rare occasions on which such agreements do generate leverage, this effect is usually incidental to their rationale.

This analysis of tie-ins, reciprocity, and the leverage theory will be published in three parts. In Part I, the functions of seller-imposed tie-ins will be investigated. Part II will be concerned with the functions of buyer-imposed tie-ins and reciprocity. In Part III, the legality and welfare effects of these practices will be analyzed.

Although their similarity has been both exaggerated and misunderstood,⁸ seller-imposed tie-ins, buyer-imposed tie-ins, and reciprocity programs frequently do perform parallel functions. Hence, it may be useful to delineate the various goals that seller-imposed tie-ins can achieve before attempting to analyze buyer-imposed tie-ins or the practice of reciprocity.

It is generally supposed that seller-imposed tie-ins "serve hardly any purpose other than the suppression of competition" in the tied product market. In fact, even if they are interpreted in the most economically meaningful way, the decisions of the Supreme Court declaring such agreements illegal appear to be based on the assumption that the only reason "dominant" sellers ever impose tie-ins on their customers is to enable themselves to raise price and restrict output in the general market for the tied commodity. In what follows, we will demonstrate that this assumption is not correct, *i.e.*, that the profitability of tie-ins does not depend on the alleged ability of such agreements to increase the power of the tying producer in the general market for the tied product. In particular, we will show that such agreements can be used for four pricing purposes—(1) to increase the profitability of non-marginal cost pricing, (2) to implement a system of meter pricing, (3) to increase the profitability of price discrimination, and (4) to conceal violations of maximum or minimum price regulations—and for two non-pricing purposes—(1) to prevent the use of inferior complements and (2) to reduce the aggregate taxes, royalties, and franchise fees due on the tying firm's profits or sales. Since the profitability of these functions does not depend on their decreasing competition in the general market for the tied product, our demonstration will undermine the Court's rationale for declaring all such agreements illegal.

8. See sources cited in note 7 *supra* and materials cited therein.

I. Pricing Functions

1. *Increasing the Profitability of Non-marginal Cost Pricing*

It is commonly accepted that whenever a seller faces a downward-sloping demand curve, he will find it profitable to charge his customers more than his marginal cost for their marginal purchases. This conclusion is simply a restatement of the familiar proposition that producers who face negatively-sloped demands can increase their profits by restricting output and raising price above marginal cost. In doing so, they trade the profits they sacrifice on the unit sales they lose for the added returns they realize on the sales they retain at the higher price. Obviously, the greater the ratio of the added returns realized on the retained sales to the profits sacrificed on the lost sales, the more profitable non-marginal cost pricing. In what follows, we shall argue that sellers will frequently be able to increase this ratio by employing full requirements tie-ins (*i.e.*, full-line forcing) to shift the locus of their non-marginal cost pricing from their tying to their tied product. In order to execute this policy, the seller in question will reduce the price of his tying product and use the surplus his customers realize on their purchases of this good at the lower price to induce them to contract to purchase their full requirements of the tied product from him as well for more than its prevailing market price, *i.e.*, the seller will condition his sale of his tying product on favorable terms to its users on their agreeing to give him their patronage on another product which he sells to them for more than its prevailing market price. If the ratio of added returns to sacrificed profits just described is higher for non-marginal cost pricing on the tied than on the tying product—*e.g.*, if the relative decrease in the sales of the tied product that will be caused by any given increase in its price is lower than its counterpart for the tying product for a comparable price rise, such a transfer may enable the tying producer to increase the profitability of non-marginal cost pricing by reducing the amount of profits he must sacrifice (on his lost unit sales) in order to realize any given amount of additional returns on his retained sales by increasing his per unit charge.

It should be noted at the outset that our explanation of the profitability of full-requirements tie-ins will not depend in any way on the alleged ability of such agreements to increase the tying producer's power in the market for the tied product. In fact, the imposition of full-requirements tie-ins will rarely if ever injure competition in the tied product market. Such issues will be examined in detail in Part III of this article. In what follows, we will attempt to explain the way

in which and the conditions under which full-requirements tie-ins or full-line forcing can increase the profitability of non-marginal cost pricing.

A. A Diagrammatic and Conceptual Framework for Our Analysis

(1) *The Diagrammatic Framework*

Diagram I will be used to illustrate the ways in which seller-imposed tie-ins can enable producers to increase the profitability of non-marginal cost pricing. In this diagram, DD_{XAY} (read as "the demand X faces when selling A to Y ")⁹ indicates the demand curve faced by some seller

DIAGRAM I

X on his sales of A to his customers $Y1 \dots N$, i.e., the amount that $Y1 \dots N$ would be willing to pay X for successive units of A . Normally, $Y1 \dots N$ will not be willing to pay X the actual value of his product to them, i.e., normally $DD_{XAY} \neq$ (does not equal) DD_{XAY}^{RO} , the curve that

9. Throughout this analysis, the letters "A" and "B" will represent products while "X," "Y," and "Z" will refer to sellers and/or buyers. In subscripts, the letter preceding A or B will refer to the seller of the product in question and the letter succeeding A or B will indicate its buyer. Thus, MR_{YAZ} connotes the marginal revenue curve seller Y faces when distributing product A to Z.

Tie-ins

represents the price that Y would be willing to pay if he could not purchase A or a substitute from anyone but X . In fact, DD_{XAY} will equal DD_{XAY}^{RO} only (1) if X is a classical monopolist¹⁰—i.e., if X is the only producer of some product A for which there are no substitutes—or (2) if X can discover some means of inducing his customers to treat him as a monopolist, i.e., to agree not to purchase A or one of its substitutes from any of X 's competitors—e.g., if X can induce $Y1 \dots N$ to enter into full-requirements contracts (hence the superscript RC) on good A .

DIAGRAM II

In general, the more competitive industry A , the greater the divergence between DD_{XAY} and DD_{XAY}^{RO} . Thus, if as in Diagram II industry A were perfectly competitive, X would be precluded from extracting the full value of his product to its users by the offers of other producers to sell A for a price equal to their minimum average total cost, i.e.,

10. See Olson and McFarland, *The Restoration of Pure Monopoly and the Concept of the Industry*, 76 Q.J. ECON. 612-31 (1962).

DD_{XAY} would not equal DD_{XAY}^{RO} but the lower of DD_{XAY}^{RO} or some other curve whose height equalled the minimum average total cost of producing A .

Where $Y1 \dots N$ are intermediate buyers, DD_{XAY}^{RO} will equal the (net) marginal revenue product of A for Y —i.e., DD_{XAY}^{RO} will be equal to the additional net revenue that successive units of A generate for $Y1 \dots N$. Thus, if A is a final product and $Y1 \dots N$ are retail distributors who practice single pricing—i.e., who set one price for A and allow their customers $Z1 \dots N$ to purchase as much A as they like at that price, Y 's demand curve for A will be equal to the difference between the marginal revenue curve he faces when distributing A to $Z1 \dots N$ and the other marginal costs of engaging in this activity, i.e., $DD_{XAY}^{RO} = MR_{YAZ}$ minus the non-cost-of-goods-sold marginal cost of distributing A to Z . In what follows, we will assume that these non-cost-of-goods-sold marginal costs are zero, i.e., that $DD_{XAY}^{RO} = MR_{YAZ}$.

MR_{XAY} in Diagram I is defined to be X 's total marginal revenue curve. MR_{XAY} indicates the additional revenue X will obtain by increasing his sales if he single prices, i.e., if his only charge is a uniform price for each unit of A his customers purchase.

We have already noted that DD_{XAY}^{RO} , DD_{XAY} , and MR_{XAY} are total functions—i.e., that they represent the summation of the full value, demand, and marginal revenue curves of X 's individual customers $Y1$, $Y2, \dots YN$. In constructing Diagram I, we have assumed that all of X 's customers have identical demand curves. This simplifying assumption will be relaxed as our investigation proceeds.

MC_{XAY} is X 's marginal cost curve. For expositional reasons, we will depart from normal practice by defining MC_{XAY} so that it does not include marginal pricing and promotional costs. Like the other total curves represented, MC_{XAY} is itself the composite of the marginal costs X incurs in supplying A to each of his customers.

(2) *The Conceptual Framework*

Let us define the phrase "transaction surplus" (TS) to refer to the difference between the variable (marginal) cost of different amounts of any particular product and the amount that its immediate buyers would be willing to pay for the output in question. Thus, if consumers are willing to pay \$5 for the first unit, \$3 for the second, and \$1 for the third, and if the marginal cost of each unit is \$1, transaction surplus

will equal \$6 ($= \$4 + \$2 + \0). As defined, transaction surplus will increase with sales so long as the market value of additional output exceeds the market value of the resources expended in its production and distribution—i.e., so long as DD exceeds MC . Accordingly, transaction surplus will be maximized at the point at which DD cuts MC from above, and the single transaction surplus-maximizing (TSM) price will be equal to the seller's marginal cost at the corresponding TSM output.

Accordingly, in Diagram I, the total transaction surplus generated by any volume of X 's sales to Y will be equal to the area between DD_{XY} and MC_{XY} as quantity varies from zero to the output in question. Hence, total transaction surplus will increase with sales so long as DD_{XY} exceeds MC_{XY} . Where DD_{XY} cuts MC_{XY} from above, total transaction surplus will be maximized. In Diagram I, this maximizing output is $si = od$; the TSM price is os ; and the corresponding transaction surplus is rie . Clearly, rie will be larger the greater the dollar volume of sales represented by any point on the diagram, the larger si and the steeper the slopes of DD_{XY} (upward) and MC_{XY} (downward) to the left of the total transaction surplus-maximizing (TSM) output.

To anticipate our subsequent analysis, transaction surplus is normally divided between sellers and buyers—i.e., some of the transaction surplus generated by X 's production and/or distribution of A is realized by his customers in the form of buyer surplus and some, by X himself in the form of seller surplus. The term "buyer surplus" refers to the difference between the total cost of any product to its immediate purchasers and the highest fee that they would have chosen to pay rather than electing to do without the goods in question.¹¹ "Seller surplus" connotes the difference between the total revenue that any seller receives on his sales of a particular product and the total marginal (variable) costs he has to incur to produce and/or distribute the output under consideration. Thus, if X in Diagram I decides to allow his customers to buy as much A as they like at price $oj = lc$ per unit, his sales will be $oc = jl$, transaction surplus $rlhe$, buyer surplus rlj , and seller surplus $jlhe$.

In what follows, we will normally identify the participants in various transactions by their general status in the economic system. Thus, if X

11. It should be noted that this consumer surplus is generally less than the gross gain that buyers already realize, i.e., that "buyer surplus" refers to the gain buyers realize from purchasing the particular commodity in question from the specified supplier instead of one of its (and/or his) substitutes.

is a manufacturer who sells directly to A 's final consumers $Y1 \dots N$, the terms seller and buyer surplus will be replaced by the signs producer surplus (PS) and consumer surplus (CS) respectively. Since the tie-ins under consideration typically involve manufacturers and their local distributors, our discussion will usually concern retailer rather than consumer surplus, *i.e.*, RS rather than CS . Accordingly, unless otherwise specified, producer surplus will be seller surplus, and retailer surplus, buyer surplus. Of course, if we turn from Washington to the American eagle, the buyer surplus that retailers $Y1 \dots N$ realize on their purchases from X will appear as seller surplus, gained on their sales to final consumers $Z1 \dots N$.

It should be noted that producer surplus and producer or retailer profits are not equivalent terms. In addition to their cost of goods sold, producers and retailers must also deduct their fixed costs and all of their pricing and promotional¹² costs before computing their conventional profits. Since a producer's fixed costs (*e.g.*, the cost of his plant and equipment) are by definition fixed (*i.e.*, since they do not vary with his output), he will maximize his profits by employing a strategy that maximizes the difference between his seller surplus and his variable pricing and promotional costs. Obviously, where pricing and/or promotional costs are positive, this goal may not be compatible with maximizing producer surplus alone. In what follows, we will assume that producers and retailers try to maximize their profits in their production, promotion, and pricing decisions, and accordingly that their maximand is the difference between their producer surplus and the pricing and promotional costs they incur when making their sales. In order to simplify our analysis, we will also assume that X 's customers do not have to incur any fixed costs in order to use the products he sells.¹³

B. The Pricing Function of Full-Requirements Tie-ins or Full-line Forcing: Increasing the Profitability of Non-marginal Cost Pricing

In this section, we will investigate the possibility that full-requirements tie-ins may be used to increase the profitability of non-marginal cost pricing. Our hypothesis will be that where producers who engage

12. We continue for the present our admittedly unrealistic assumption that $Y1 \dots N$ do not incur any non-promotional marginal distribution costs.

13. This premise will enable us to assume that X can remove all of Y 's buyer surplus without endangering his long-run customer relationships. If fixed costs were positive, the elimination of all of Y 's buyer surplus would leave him with negative returns equal to the rate of depreciation of his fixed assets, *i.e.*, would induce him not to renew his plant and continue producing in the long run.

in non-marginal cost pricing can find some suitable good (*B*) to tie, they will be able to increase their returns by reducing the unit price of their tying product *A* and conditioning its sale on their customers' agreeing to purchase their full requirements of *B* from them as well for more than its prevailing market price.¹⁴

Since the process of identifying a suitable product to tie, of devising, executing, and enforcing the tying agreement, and of supplying the tied commodity to the vendee will usually be too expensive to justify the tie-in in any other circumstances, full-requirements tie-ins will usually be employed only where the transactions involved are substantial. Accordingly, such agreements will normally be imposed on intermediate buyers who are entering into long-term leases (where *A* is a durable machine and *Y1 . . . N* are manufacturers), full-requirements contracts (where *A* is a non-durable intermediate product and *Y1 . . . N* are manufacturers), franchise agreements (where *A* is a final product and *Y1 . . . N* are wholesale or retail distributors), or licenses (where *A* is a patented process or idea). For example, if our hypothesis is correct, a final-product producer may be able to increase his profits by reducing the price he charges his distributors for his highly differentiated product in exchange for their agreeing to give him all of their patronage on another product which he sells to them for more than its market price.

Since our hypothesis is that full-requirements tie-ins may be employed to increase the profitability of non-marginal cost pricing, their importance will be directly related to the prevalence of this practice. Hence, before we proceed to analyze the way in which full-line forcing operates, it may be useful to demonstrate the profitability of non-marginal cost pricing.

(1) *The Rationale for Non-marginal Cost Pricing*

If *X* and *Y* were not different entities—i.e., if *X* were fully integrated forward into distribution, *X* would not have to be concerned about the way in which the transaction surplus he generated was divided between himself and his “customer,” for in such circumstances, this division would be entirely artificial, and his producer surplus would be equal to the producer and retailer surplus he generated. However, since the non-integrated firm will not benefit from the surplus its customers realize, it may not find it profitable to charge these buyers its actual and *TSM* marginal cost for their incremental purchases. In fact, re-

14. For a qualification, see note 23 *infra* and p. 1414.

ardless of whether such a firm employs a single or complicated pricing strategy, *i.e.*, regardless of whether it engages in single or lump-sum pricing, it will almost always find it profitable to charge non-marginal cost prices when it faces a negatively sloped demand.

(a) The Profitability of Charging Non-marginal Cost Single Prices

If *X* decides to engage in single pricing, *i.e.*, to charge his customers no basic fee and the same price for each unit of his product they purchase, his profit-maximizing price will always exceed his actual and *TSM* marginal cost whenever the slope of his demand is negative to the left of his *TSM* output, for when this condition prevails, *X*'s price will exceed his marginal revenue and hence his marginal cost where marginal cost and marginal revenue are equal. In other words, although marginal cost pricing will maximize the transaction surplus *X* generates, it will reduce his profits when demand is downward-sloped, for when marginal revenue is less than price, it will also be less than marginal cost when price and marginal cost are equal. Thus, although non-marginal cost price $cl = oj$ in Diagram I will reduce the transaction surplus (*TS*) *X* generates by lih , it will increase his producer surplus (*PS*) by $jltsthi$ since the loss it causes his independent customers— $jltis$ —will be completely external to him. In fact, price cl is *X*'s single "profit-maximizing" price, *i.e.*, it is the price at which his marginal revenue and marginal cost are equal, the price which generates more producer surplus than any other "single" alternative. Thus, whenever a firm that practices single pricing faces a negatively sloped demand curve, its optimal price will exceed its actual and *TSM* marginal cost, *i.e.*, will exceed the price which would maximize the transaction surplus it generates.

(b) The Profitability of Combining Lump-sum and Non-marginal Cost Pricing

Although it is generally assumed that sellers who charge their customers the single price that equates their marginal revenue and marginal cost are maximizing their profits, more complicated, lump-sum pricing strategies will often generate enough additional producer surplus to justify the additional pricing costs their employers must incur. Since most sellers who are in a position to employ full-requirements tie-ins—*i.e.*, who are engaged in substantial transactions with their individual customers—will also be able to increase their returns by charging their customers a lump-sum fee in addition to their per unit

price, the function with which we are now concerned would be relatively unimportant if firms that engaged in such lump-sum pricing did not usually charge non-marginal cost unit prices as well. Fortunately for our purposes, sellers that practice lump-sum pricing will almost always be able to increase their returns by reducing their basic fee and charging their customers more than their actual and *TSM* marginal costs for each additional purchase they make. In the text that follows, we will delineate the reasons why such firms typically find it profitable to engage in non-marginal cost pricing. The factors that determine the relative profitability of lump-sum and single pricing are discussed in Appendix A.

Since the producer surplus generated by optimal single pricing will necessarily be less than the maximum amount of transaction surplus that any seller who faces a negatively sloped demand curve could create, such producers will often find it profitable to engage in lump-sum pricing, *i.e.*, to reduce their per unit price and extract their customers' buyer surplus by requiring them to pay a lump-sum fee for the right to purchase their product at the price in question. In fact, if demand were certain, any producer who could engage in perfect marginal cost lump-sum pricing—*i.e.*, who could extract all of his customers' surplus in a lump sum, without charging them more than his marginal cost for their marginal purchases—would be able to raise his producer surplus to the maximum amount of transaction surplus he could generate. Thus, if instead of practicing single pricing, seller *X* in Diagram I (1) set his unit price equal to his *TSM* marginal cost ($os = bg$), (2) forced those buyers who did purchase from him to pay a lump-sum fee (rgs) equal to the value of the right to purchase his product at that price,¹⁵ and (3) prevented buyer arbitrage, he would increase his total producer surplus from $jlhe$ to maximum transaction surplus rie , *i.e.*, he would absorb the surplus his customers realized under optimal single pricing— rlj —and simultaneously generate and absorb the transaction surplus that his non-marginal cost unit price originally destroyed— lih .

Of course, in any given case, the additional surplus that lump-sum

15. A lump-sum fee of rgs would just equal the difference between the value that *X*'s individual customers would place on $sg = ob$ of *A* (the amount of *A* each would buy at price os per unit) and the total sum they would have to pay for sg of *A* if they could purchase this commodity at the unit price in question—*i.e.*, rgs equals the difference between the area under $dd_{XY1 \dots N}$ from *O* to $b - rgbo$ —and the area that represents the marginal fees that $Y1 \dots N$ would each have to pay under the arrangement in question—(sg) (os) = $sgbo$. Of course, *X* could accomplish the same result by offering to sell $Y1, Y2, \dots, YN$ sg of *A* for $rgbo$, but since demand is usually uncertain, the formulation used in the text will be far more typical.

pricing enables a producer to realize may not exceed the extra cost of devising, executing, and enforcing the associated agreements, but clearly, where the gain in surplus is substantial—*e.g.*, where demand is steeply sloped and the customers in question make large and repeated purchases—lump-sum pricing will frequently be profitable. Since, as we have seen,¹⁶ the full-requirements tie-ins we are now discussing will only be profitable if imposed on high-volume buyers, who are also likely subjects for lump-sum pricing, the explanatory value of our theory that full-requirements tie-ins can be used to increase the efficiency of non-marginal cost pricing depends on the profitability of combining this technique with lump-sum pricing. In fact, for several reasons, producers who charge lump-sum fees will almost always find it profitable to reduce their basic charge and set their per unit price above their actual and *TSM* marginal cost. Indeed, such a mixed pricing strategy will often be profitable where pure lump-sum pricing would not.

(i) *Imperfect Knowledge and the Profitability of Combining Lump-sum and Non-marginal Cost Pricing*

So far, we have assumed that both *X* and his customers will always find it possible and profitable to determine exactly what DD_{XAY} will be. Since *X*'s lump-sum offer will normally cover a considerable period of time, this assumption is clearly unjustified. In this subsection, we will delineate three ways in which imperfections of knowledge may increase the profitability of non-marginal cost pricing.

(a) *Uncertainty, Risk, and the Profitability of Non-marginal Cost Pricing*¹⁷

When $YI \dots N$ do not know themselves how much they will need *X*'s product during the period covered by his offer, they will rarely be willing to pay *X* the expected value¹⁸ of the right to purchase his

16. See p. 1405 *supra*.

17. Parts of this argument are based on Burstein's explication of meter pricing. See Burstein, *A Theory of Full-Line Forcing*, 55 NW. U.L. REV. 62, 69-71 (1960).

18. In order to determine the value of the right *X* is attempting to sell, $YI \dots N$ will have to (1) estimate the various possible shapes that their demand for *A* might take during the period under consideration, (2) attach probabilities to each of these possible demands, and (3) take the weighted average height of these demands at each relevant quantity. The curve connecting these points will represent $YI \dots N$'s "expected demand for *A*." The "expected value" of the right *X* is selling is equal to the area between expected DD_{XAY} and *X*'s unit price. Accordingly, the expected value of this right will be equal to its actual value only if $YI \dots N$'s actual demand for *A* "equals" their expected demand, *i.e.*, only

product at his *TSM* price. In general, the greater the risk that the actual value of *A* to *YI...N* will be less than its expected value¹⁹ and the greater *YI...N*'s aversion to taking such risks, the greater the difference between the expected value of the right to purchase *X*'s product at some specified price and the price that *YI...N* will be willing to pay *X* for this right, *i.e.*, the greater the difference between the expected value of this right and its certainty equivalent value.²⁰ Both these relationships will frequently contribute to the profitability of non-marginal cost pricing.

By engaging in non-marginal cost pricing, *X* can effectively transfer the risk that DD_{XAY} may be lower than expected from his customers to himself, for the smaller *X*'s lump-sum fee and the higher his per unit price, the more responsive *YI...N*'s payments to variations in their demand for *A* and the smaller the loss they will incur (and the greater the loss *X* will incur) if their demand is less intense than they anticipated. In many situations, this shift will improve *X*'s prospects—*i.e.*, will increase *X*'s certainty equivalent returns,²¹ for *X* will frequently

if the area between actual DD_{XAY} and *X*'s unit price equals the area between expected DD_{XAY} and *X*'s unit price. This result would obtain, for example, if actual and expected demand coincided.

19. Since the actual value of the right *X* is selling will be determined by DD_{XAY} , his customers will be able to associate a value with each of the demands they might have for his product. Thus, if probabilities can be attached to each of their possible demands, it will be possible to represent the different prospective values of the right to purchase *A* by a probability distribution. Broadly speaking, the greater the average variation in *YI...N*'s different demands for *A*, the greater the variance of the distribution, and the greater the risk that the actual value of the right to purchase *A* will be any given amount less than its expected value.

20. An example may help to clarify this point. If *Y* believes that there is a $\frac{1}{4}$ chance that the right *X* is selling will be worth \$20 to him, a $\frac{1}{2}$ chance that it will be worth \$40, and a $\frac{1}{4}$ chance that it will be worth \$48, the expected or weighted average value of this right will equal $\frac{1}{4}(\$20) + \frac{1}{2}(\$40) + \frac{1}{4}(\$48) = \37 . On the other hand, its certainty equivalent value will be equal to the price that *Y* is actually willing to pay for this right, *i.e.*, for a lottery ticket with the probability distribution of values described above. Thus, if *Y* is averse to taking risks, he will not be willing to pay \$37 for the right to purchase *A* at the specified price, *i.e.*, the certainty equivalent value of this right will be less than its expected value. In general, the greater *Y*'s risk aversion, the greater the difference between the price he will be willing to pay for this right and its expected value to him, *i.e.*, the greater the discount he will demand for taking the $\frac{1}{4}$ chance that its actual value will be \$17 less than its expected value.

21. Where DD_{XAY} cannot be easily determined, *X*'s maximand will be his certainty equivalent return rather than his actual profits, *i.e.*, given uncertainty, *X*'s optimal strategy will be to estimate a probability distribution of the possible demands for his product and adopt the particular pricing policy which, given this estimate, will produce the most attractive probability distribution of possible returns. In general, the greater the expected (weighted average or mean) value of the distribution, and the smaller its dispersion (assuming risk aversion), the higher its certainty equivalent value, *i.e.*, the higher the price that the seller would be willing to pay for a lottery ticket which offered the same distribution of possible returns. Thus, where demand is uncertain, the seller's calculations will be far more complicated than those required for conventional profit-maximization.

It should be noted as well that the introduction of uncertainty will also affect the

be less averse to taking risks than his (weighted) average customer and non-marginal cost pricing will often increase X 's risk less than it decreases $Y1 \dots N$'s.

Where A is either an intermediate good that $Y1 \dots N$ use to produce some final product D or a final good that $Y1 \dots N$ distribute in partial or total competition with each other, the gains that $Y1 \dots N$ will realize by exercising their right to purchase A at X 's *TSM* marginal cost will increase with their sales of D or A respectively. Under these circumstances, the extra risk that X will have to bear under non-marginal cost pricing will be less than the additional risk that $Y1 \dots N$ would have to run under marginal cost lump-sum pricing, for X will have to be concerned only with the possibility that the industry-wide demand for D or A might be less than had been expected while $Y1 \dots N$ will also have to consider prospective variations in their individual shares of industry sales.

Indeed, even if the extra risk to X under non-marginal cost pricing were as great as the additional (weighted average) risk to $Y1, Y2, \dots YN$ under marginal cost lump-sum pricing, $Y1 \dots N$'s uncertainty about their need for A might still increase the profitability of non-marginal cost pricing, for X will frequently be less averse to taking risks than his (weighted) average customer. Thus, to the extent that risk aversion is inversely related to the bearer's ability to sustain losses, large, well-financed companies will find that non-marginal cost pricing will reduce the discount demanded by the actual risk bearer even if it does not reduce the actual risk incurred. Accordingly, prosperous manufacturers may be able to increase their returns by reducing their lump-sum fees and charging their small, local distributors non-marginal cost prices for their incremental purchases.

In short, the existence of uncertainty will normally increase the profitability of non-marginal cost pricing, for to the extent that X 's risk and/or risk aversion are less than his customers', the extra discount they will demand for bearing the additional risk they must run under marginal cost lump-sum pricing will be greater than the cost to X of

producer's share of the transaction surplus that will be generated by perfect lump-sum pricing. As we have seen, when demand cannot be predicted with certainty, X 's customers will calculate the highest price that they will be willing to pay for the right to purchase A at his *TSM* marginal cost in precisely the same way that X determines his optimal pricing strategy, *viz.*, by calculating its expected value and discounting this sum to account for the risk that its actual value may be less than its expected value. Accordingly, given uncertainty, perfect lump-sum pricing will not equate producer and transaction surplus unless the expected value of the right X sells exceeds its actual value by the discount his customers demand for bearing the risk that DD_{XAY} may turn out to be lower than they expect.

reducing their risk by lowering his lump-sum fee and raising his per unit charge above his actual and *TSM* marginal cost.

(b) Seller Ignorance and the Profitability of Non-marginal Cost Pricing

Since it will usually be in $YI \dots N$'s interests to keep their demand prices secret, X will rarely be able to determine the (certainty equivalent) value they place on the right to purchase his product without incurring prohibitive market research expenses. Accordingly, non-marginal cost pricing may enable X to increase the percentage of the value of his product he can expect to collect, for by delaying his charges until $YI \dots N$ have actually exercised their rights, this technique will absorb much of the surplus that X 's ignorance would otherwise have allowed his customers to retain. Since it will be particularly difficult for X to determine $YI \dots N$'s demand prices where their expected demands differ significantly, non-marginal cost pricing will be especially profitable when it is likely to produce price discrimination, *i.e.*, when X 's total average (average lump-sum plus unit) price is likely to differ among his customers. However, although different buyers will normally be charged different average prices under non-marginal cost lump-sum pricing, such discrimination is not a necessary condition for the profitability of this practice. Thus, even if $YI \dots N$ have identical expected and actual demands for A , non-marginal cost pricing will decrease X 's need for market research, which is always expensive and somewhat inaccurate.

(c) Buyer Pessimism and the Profitability of Non-marginal Cost Pricing

In many situations, X may be able to increase his prospective returns by decreasing his dependence on the accuracy of his customers' estimates of DD_{XY} , *i.e.*, by reducing his advanced charge and increasing the price of actually exercising the right to purchase his product, for where $YI \dots N$'s estimates of their future demand for A are unduly pessimistic, the highest lump-sum fee that they will be willing to pay will not remove all the surplus they should expect to realize from purchasing A at X 's *TSM* price. Accordingly, to the extent that X believes that his customers are underestimating their probable need for A , he will find it profitable to substitute non-marginal cost prices for part or all of his lump-sum fee.

(ii) *Low Transference Costs, Buyer Arbitrage, and the Profitability of Non-marginal Cost Pricing*

Where X 's customers are not naturally separated by the cost of transferring his product, the possibility of arbitrage may make it profitable for him to reduce his lump-sum fee and increase his per unit price above his TSM marginal cost. Unless the cost of transferring A is prohibitive, those Y 's such as $Y1$ who actually do purchase from X will be able to increase their returns by reselling some or all of their A to other buyers for more than X 's TSM marginal cost, *i.e.*, for more than the additional charge they have to pay for their incremental purchases under marginal cost lump-sum pricing. Such cross-selling will reduce X 's returns by making it unnecessary for some of his customers to pay a lump-sum fee, *i.e.*, by depriving X of the lump-sum fee that those buyers who purchase from his own customers would otherwise have had to pay.²²

Of course, X may be able to prevent such resales by incorporating customer-allocation clauses into his sales contracts, by entering into resale price maintenance contracts which prohibit $Y1$ from supplying A to $Y2 \dots N$ for less than X 's average lump-sum plus unit price, by lobbying for the passage of RPM statutes that accomplish the same results, or by making the A he sells $Y1$ unsuitable for $Y2 \dots N$'s purposes. Clearly, however, none of these strategies will be foolproof, and all will be expensive.

Accordingly, where transference costs are relatively low, X may be able to increase his returns by decreasing his customers' incentive to engage in arbitrage by reducing the difference between his unit price and the average (lump-sum plus unit) price that buyers such as $Y2 \dots N$ would have to pay him for his product, *i.e.*, by reducing his lump-sum fee and increasing his unit price above his TSM marginal cost. In some cases, X may find it profitable to eliminate arbitrage altogether by raising his unit price and lowering his basic charge until this difference between his unit and average price is less than the cost of transferring his product, but even if he does not, he will probably choose to reduce cross-selling by engaging in some non-marginal cross pricing.

22. Indeed, even if X succeeds in forcing $Y1$ to surrender the profits he realizes on these resales, he will not be able to recover as much net surplus as he could have absorbed on his own, for $Y1$ will probably be less adept than X at exploiting $dd_{Y2 \dots N}$ and the sale and resale of A will always increase the transference costs of supplying the customers in question.

(c) Summary

Thus, there are several reasons why producers who engage in lump-sum pricing will usually find it profitable to combine this strategy with non-marginal cost pricing. In general, the lower a seller's risk and risk aversion in comparison to his customers', the greater his ignorance, the more pessimistic his customers, and the smaller the cost of transferring his product, the more profitable any given divergence between his unit price and *TSM* marginal cost, *i.e.*, the more profitable non-marginal cost pricing. Now that we have shown that regardless of the general pricing strategy they adopt, producers who face negatively-sloped demand curves will almost always find it profitable to charge their customers more than their *TSM* marginal cost for their incremental purchases, we can proceed to analyze the way in which full-requirements tie-ins may be used to increase the profitability of such non-marginal cost pricing.

(2) *The Pricing Function of Full-Requirements Tie-ins or Full-line Forcing: Increasing the Profitability of Non-marginal Cost Pricing*

We have already suggested that the function of the tie-ins we are now discussing is to increase the profitability of non-marginal cost pricing. In analyzing this possibility, we will be concerned with situations in which *X*'s optimal lump-sum fee—itsself an inverse function of the profitability of non-marginal cost pricing—is less than the (certainty equivalent) value that his customers place on the right to purchase his product at his *TSM* marginal cost, or more generally, is less than the difference between this value and the prospective profits that *Y1 . . . N*'s bargaining strength enables them to retain. Obviously, under these circumstances, *X* will always find it profitable to raise his price sufficiently above his *TSM* marginal cost to remove all of his customers' excess expected surplus. Our hypothesis will be that full-requirements tie-ins can enable *X* to increase the profitability of removing this surplus by shifting the locus of his non-marginal cost pricing to products that are better suited for this pricing technique, *i.e.*, to products on which *X* can absorb a greater percentage of his customers' excess surplus through non-marginal cost pricing. More precisely, *X* will search for a product which raises the ratio of the seller (producer) surplus that will be gained to the buyer (retailer) surplus that will be lost through non-marginal cost pricing, *i.e.*, the $\frac{SS+}{BS-}$ or $\frac{PS+}{RS-}$ ratio.

In order to be suitable for this purpose, the tied product B will have to possess three characteristics. First, B must be sold in a rather competitive market. Second, movements in $Y1 \dots N$'s demand for B must parallel shifts in their demand for A . And third, $Y1 \dots N$'s post-tie-in demand for B — $DD_{XBY1 \dots N}^{RO}$ —must be more suitable for non-marginal cost pricing than their demand for A , i.e., $\frac{PS+}{RS-}$ —the producer surplus gained to retailer surplus lost ratio—must be higher on $DD_{XBY1 \dots N}^{RO}$ above B 's prevailing market price (when DD_{XBY} is horizontal or above the highest price that X could charge for B under a full-requirements contract without losing his customers' patronage when DD_{XBY} is negatively-sloped)²³ than on $DD_{XAY1 \dots N}$ above A 's TSM marginal cost, at least over some relevant range.

We have already noted that by entering into full-requirements contracts, X can place his customers under a legal obligation to treat him as a monopolist, i.e., X can obligate $Y1 \dots N$ not to purchase any of his product or its substitutes from other suppliers. As we shall see, full-requirements tie-ins operate in a similar fashion—viz., by enabling X to price product B as if he were a monopolist within the limits set by the excess surplus his customers expect to realize on his tying product. Whether or not X produces B himself, the value of being able to price in this manner will be directly related to the competitiveness of industry B . In order for full-line forcing to enable X to increase his profits on B (and hence on $B + A$), his requirements contract must raise the demand he faces when selling B to $Y1 \dots N$ in such a way that he can earn additional profits on B by taking advantage of the tie-in's ability to enable him to raise the price he charges for this product without losing his customers' patronage. Where X produces B himself, the requirements contract will have no effect on DD_{XBY} if he has already monopolized its production, for obviously, where X is actually a monopolist, his customers will have to treat him as such regardless of whether they enter into requirements agreements. Accordingly, where X produces product B , the suitability of this good for full-requirements tie-ins will be directly related to the competition he faces in industry B , i.e., will

23. In the text, we will confine our analysis to situations in which DD_{XBY} is originally horizontal, i.e., to situations in which X either produces B in a perfectly competitive market or purchases B for resale from other manufacturers. The case in which DD_{XBY} is negatively sloped, i.e., in which B is either a differentiated product that X also produces or a standardized product that X sells in an oligopolistic market, is analyzed in Appendix B.

be directly related to the extent to which $DD_{XBY1 \dots N}$ and $DD_{XBY1 \dots N}^{RO}$ diverge.

In fact, the "competitive" requirement will even be justified (although for somewhat different reasons) when X does not produce B himself, for although $DD_{XBY1 \dots N}^{RO}$ will always exceed $DD_{XBY1 \dots N}$ above B 's prevailing market price if X purchases B in the open market, the tie-in will not enable X to raise his price profitably if his supplier is a monopolist. Where X 's supplier is the only producer of B and its substitutes, X will never find it profitable to use his ability to charge more than his supplier's price without inducing his customers to reject his offered tie-in, for his supplier's price will itself be the most profitable price that could be charged for B , i.e., will itself be the monopolistic price for B , the price at which $\Delta PS = 0$. Obviously, the greater the difference between his supplier's price and the price that a monopolist would charge for the product in question—i.e., the greater the competition his supplier faces in industry B , the more valuable the effects of the tie-in, and the greater the profitability of tying B to A . Thus, where X produces B himself, its suitability will be directly related to the competition he faces when selling B , and where X buys B from an independent producer, its suitability will be directly related to the competition this supplier faces when marketing his product. In either case, the profitability of tying B to A will increase with the competitiveness of industry B .

But even if industry B is competitive, B will not be an efficient tied product unless fluctuations in $Y1 \dots N$'s demand for B parallel shifts in their demand for A (either or both because variations in the final demand for B parallel those in the final demand for A and/or because movements in $Y1 \dots N$'s market share in the distribution of A and B and their substitutes are closely related). We have already shown that X will vary his lump-sum fee and unit prices on A and B until *inter alia* $Y1 \dots N$'s expected gain on A equals their expected loss on B minus (1) the discount they demand for taking the risk that their loss on B will exceed their gain on A , (2) X 's lump-sum fee, and (3) the expected surplus that their bargaining strength enables them to retain. Obviously, the greater the risk that $Y1 \dots N$'s loss on B will exceed their gain on A , the lower the unit prices and/or lump-sum fee that X will be able to charge, and the less suitable B for X 's purposes. Since $Y1 \dots N$'s actual loss on B and gain on A will increase and/or decrease with their demand for B and A respectively, B 's suitability will be directly related to the extent to which shifts in $Y1 \dots N$'s demand for B

parallel variations in their demand for *A*, *i.e.*, to the extent to which *YI...N*'s loss on *B* tends to increase (and decrease) with their gain on *A*.

Finally, no product *B* can serve as a new locus for non-marginal cost pricing unless *YI...N*'s post-tie-in demand for *B* is better adapted for the application of this pricing technique than $DD_{XAYI...N}$. In fact, since full-requirements tie-ins cannot be imposed without incurring substantial pricing costs, they will normally be employed only where they generate significantly more producer surplus than their employer could obtain by doing all his non-marginal cost pricing on his tying product.

As we have seen, if *X* single prices and charges his customers his *TSM* price—*i.e.*, a price equal to his marginal cost at his *TSM* output, the producer surplus he expects to realize will be equal to the area between his marginal cost curve and the horizontal line drawn from the *TSM* output-price point to the \$ axis. His immediate customers in turn will expect to realize retailer surplus equal to the area between this horizontal line and their demand curve. Any lump-sum fee his customers have to pay in addition to their per unit charge will simply add to *X*'s seller or producer surplus and subtract from their buyer or retailer surplus. Thus, if, in Diagram I, *X* charges *YI...N* *os* for each unit of *A* they purchase, his (expected) producer surplus will equal *sie* plus whatever lump-sum fee he extracts, and their (expected) retailer surplus will equal *ris* minus the basic charge in question. Thus, *X* will be able to remove this expected surplus minus the sum of the discount *YI...N* demand for bearing the attendant risk and the surplus their bargaining strength enables them to retain by non-marginal pricing without losing these customers' patronage. Obviously, the greater the percentage of this excess (expected) retailer surplus that *X* can recover by non-marginal cost pricing, the higher his profits will be—*i.e.*, given the maximum amount of retailer surplus that *X* can eliminate through non-marginal cost pricing (given *RS*—), *X*'s producer surplus will be directly related to $\frac{PS+}{RS-}$. Our contention is that by shifting the locus of his non-marginal cost pricing from *A* to some suitable product *B*, *X* will be able to convert more of this retailer surplus into producer surplus than he could by engaging in non-marginal cost pricing on *A* alone.

But what determines the suitability of various products for such non-marginal cost pricing? In general, the amount of producer surplus that

can be gained by eliminating any *given* amount of buyer surplus through non-marginal cost pricing will depend on the slopes of the practicing seller's demand and marginal cost curves over the relevant range (to the left of his *TSM* sales volume) and on the size of this *TSM* output itself. In particular, the steeper the (negative or downward) slope of the relevant demand curve to the left of the *TSM* sales volume, the greater the (positive or upward) slope of the corresponding marginal cost curve to the left of the output in question, and the larger the *TSM* output, the greater the effectiveness of this particular pricing procedure—*i.e.*, the greater the amount of producer surplus that the seller will be able to realize by eliminating any *given* amount of buyer surplus through non-marginal cost pricing on the product in question. Diagrams III A-C have been constructed to illustrate these relationships.

The effect of the slope of the demand curve on the producer surplus that can be gained by eliminating any given amount of buyer surplus through non-marginal cost pricing is manifest in Diagram III A. In this representation, the slope of the *MC* curve to the left of the *TSM* output and the size of that output itself have been held constant: only demand has been changed. In general, the steeper the slope of the demand curve, (1) the smaller the price rise necessary to eliminate any given amount of buyer or retailer surplus, (2) the smaller the reduction in sales and transaction surplus caused by any given increase in price, and accordingly, (3) the smaller the amount by which transaction surplus will be reduced when any given amount of retailer surplus is removed through non-marginal cost pricing. Since $(PS+) = (RS-) - (TS-)$ —*i.e.*, since the increase in producer surplus is equal to the difference between the retailer surplus lost and the transaction surplus lost, $(PS+)$ will be inversely related to $(TS-)$. Hence, for any given reduction in retailer surplus—*i.e.*, for any given $(RS-)$, $(PS+)$ and concomitantly $\frac{PS+}{RS-}$ will be inversely related to $(TS-)$ and directly related to the slope of the demand curve the seller faces.

Each of these relationships is manifest in Diagram III A. As you can see, the amount of buyer surplus that will be eliminated by any given price rise is directly related to the slope of the demand curve in question. For example, a seller who raises his unit price *AG* above his *TSM* marginal cost *OA* will reduce his customer's surplus by *GHFA* if he faces *DD₁*—the most gently sloped demand curve over the relevant range, by *GIFA* if he faces *DD₂*—which is somewhat more steeply sloped, and by *GJFA* if he faces *DD₃*—which is vertical between the

DIAGRAM III A

DIAGRAM III B

DIAGRAM III C

prices in question. Accordingly, although a seller who wants to eliminate $GJFA$ of his customer's surplus through non-marginal cost pricing will have to raise his price only to OG (i.e., only by AG) if he faces DD_3 , his counterparts facing DD_2 and DD_1 will have to increase their unit price to OK and ON respectively. Thus, $KMIG = IJF$ and $NPHG = HJF$ ($NPLK = LMF$)—i.e., the additional price rise of GK for DD_2 and GN for DD_1 will remove an added amount of buyer surplus that just equals the difference between the surplus that would be eliminated by a price rise of AG for DD_3 and the amount that such an increase would remove if the demand curves were DD_2 and DD_1 respectively.

The effect of this inverse relationship between the slope of the demand curve and the price rise necessary to remove a given amount of buyer surplus on the effectiveness of non-marginal cost pricing will be reinforced by the inverse relationship between this slope and the amount of transaction surplus that will be destroyed by any given increase in price. By definition, the steeper the slope of the demand curve (the higher $\frac{\Delta P}{\Delta Q}$), the smaller the loss in sales (ΔQ) for any given increase in price (ΔP). Since transaction surplus increases with sales until the TSM output is reached, the amount of transaction surplus that any given non-marginal cost price destroys will be directly related to the amount by which that price reduces sales and hence inversely related to the slope of the demand curve in question. In Diagram III A, for example, an increase in price of AG will reduce sales by FC if demand is moderately sloped like DD_1 , by FE if demand is steeply sloped like DD_2 , and not at all if demand—like DD_3 —is vertical over the range in question. The corresponding losses in transaction surplus are HFC , IFE , and zero respectively. Obviously, $FC > FE > 0$, and $HFC > IFE > 0$.

Clearly, since both the increase in price necessary to remove any given amount of buyer surplus and the amount of transaction surplus destroyed for any given increase in price are inversely related to the slope of the demand curve (averaged vertically) over the relevant range, the amount of transaction surplus that will be destroyed in the process of eliminating any given amount of buyer surplus through non-marginal cost pricing will also be inversely related to the slope of the demand curve in question. Since, for any given ($RS-$), ($PS+$) and hence $\frac{PS+}{RS-}$ will be inversely related to ($TS-$), the suitability of any given demand curve for eliminating a given amount of retailer sur-

plus through non-marginal cost pricing will be directly related to its slope (averaged vertically) over the relevant range. Thus, in Diagram III A, the seller who eliminates buyer surplus $NPFA = KMFA = GJFA$ through non-marginal cost pricing will destroy transaction surplus PFB if he faces DD_1 , MFD if he faces DD_2 , and zero if he faces DD_3 . Since $PFB > MFD > O$, the gain in producer surplus and the efficiency of non-marginal cost pricing $\left(\frac{PS+}{RS-}\right)$ will both be directly related to the slope of the demand curve in question. In Diagram III A, for example, $NPBA < KMDA < GJFA$ and $\frac{NPBA}{NPFA} < \frac{KMDA}{KMFA} < \frac{GJFA}{GJFA} = 1$.

The importance of the *TSM* output is revealed in Diagram III B. In this diagram, the slope of MC_1 always equals the slope of MC_2 and the slope of DD_1 always equals that of DD_2 . Only the *TSM* outputs have been changed. *Ceteris paribus*, the greater the *TSM* output, the smaller the increase in price required to eliminate any given amount of buyer surplus. As we have seen, the smaller the increase in price necessary to eliminate any given amount of buyer surplus, the smaller the associated reduction in transaction surplus and the larger the associated increase in producer surplus—*i.e.*, the more profitable non-marginal cost pricing. Thus, although the slopes of DD_1 and DD_2 are equal in diagram III B, the seller who faces DD_2 will be able to eliminate $GIFA$ buyer surplus by increasing his price by only AG while his counterpart facing DD_1 will have to raise his price by AJ to remove the same amount of buyer surplus: $JKHG = HIFD$. Since the slopes $\left(\frac{\Delta P}{\Delta Q}\right)$ of the two demand and marginal cost curves are equal to the left of the *TSM* outputs, identical increases in price along either curve will reduce sales and transaction surplus by the same amount. For example, in Diagram III B, a price rise of AG will cause equal reductions in both sales ($CD = EF$) and transaction surplus ($HDC = IFE$) along DD_1 and DD_2 . Since equal price rises reduce transaction surplus equally, the fact that the increase in price required to eliminate any given amount of buyer surplus is inversely related to the size of the *TSM* output implies a direct relationship between the *TSM* output and the profitability of removing any given amount of buyer surplus through non-marginal cost pricing—*i.e.*, implies a direct relationship between $(PS+)$ and $\frac{PS+}{RS-}$ and the size of the *TSM* output

for any given $(RS-)$. Thus, since in Diagram III B, $(TS-)$ along DD_1 (KDB) exceeds $(TS-)$ along DD_2 (IFE) by $KHCB$, both $(PS+)$ and $\frac{PS+}{RS-}$ will be higher along the latter than along the former for any given $(RS-)$.

The impact of the slope of the MC curve to the left of the TSM output on the effectiveness of non-marginal cost pricing is illustrated in Diagram III C. In this representation the TSM output and the slope of the demand curve do not vary. Only MC has been changed. As predicted, the greater the positive slope (up and to the right) of the MC curve at the TSM output, the less effective any given amount of non-marginal cost pricing—i.e., the smaller $\frac{PS+}{RS-}$ for any given $(RS-)$.

Thus, in Diagram III C, $\frac{PS+}{RS-}$ will be $\frac{FGDC - DEA}{FGEC}$ if marginal cost is steeply sloped (MC_3), $\frac{FGDC - DEB}{FGEC}$ if marginal cost is gently sloped (MC_2), and $\frac{FGDC}{FGEC}$ if marginal cost is horizontal (MC_1). Obviously, the steeper the slope of the marginal cost curve, the greater the reduction in transaction surplus that will be associated with any given loss in sales, and the greater $(TS-)$, the less effective non-marginal cost pricing, i.e., the lower $\frac{PS+}{RS-}$.

In short, for any given reduction in buyer surplus—i.e., for any given $(RS-)$, $\frac{PS+}{RS-}$ will vary directly with the TSM output of the good in question and the (negative) slope of the demand faced by its producer over the relevant range and inversely with the slope of his marginal cost curve between the outputs under consideration.²⁴ For the same reasons, the marginal $\frac{PS+}{RS-}$ ratio for further non-marginal cost pricing, $\frac{\Delta PS+}{\Delta RS-}$ —i.e., the ratio of the producer surplus that will be

24. It should be noted that the slope of the demand curve and the TSM output do not determine the elasticity of the seller's demand which equals $\frac{\Delta Q}{Q} / \frac{\Delta P}{P}$. Thus the effectiveness of non-marginal cost pricing does not depend on the elasticity of demand, since it will not be affected by the original or TSM price, if other things are equal.

gained to the retailer surplus that will be lost through a marginal reduction in retailer surplus caused by a marginal increase in the original disparity between price and *TSM* marginal cost—will also vary (A) directly with (1) the original output of the good in question and (2) the (negative) slope of the demand faced by its producer between the original and proposed prices and (B) inversely with (1) the original disparity between price and marginal cost and (2) the (positive) slope of the producer's marginal cost curve between the outputs under consideration.

Thus, to the extent that (1) the *TSM* (unit) output of *B* exceeds that of *A*, (2) *Y1 . . . N*'s operative post-tie-in demand for *B*— $DD_{BY1 \dots N}^{BO}$ —is sloped more steeply than their operative demand for *A* to the left of the *TSM* output, and (3) MC_{BX} is less steeply sloped than MC_{AX} between the outputs in question, *B* will be more suitable for non-marginal cost pricing than *A*. Accordingly, where some product *B* with the characteristics just delineated can be found, *X* will be able to increase his profits by charging his customers his *TSM* marginal cost for *A* and raising his price of *B* above its prevailing market price (or above his pre-tie-in profit-maximizing price if *B* is one among several differentiated substitutes) until (1) his customers' original buyer or retailer surplus is exhausted or (2) the marginal $\frac{PS+}{RS-}$ ratio for *B* falls below its counterpart for *A*. Obviously, where (2) occurs before (1), *X* will find it profitable to exhaust his customers' excess expected surplus by non-marginal cost pricing on *A* as well as *B*. In fact, in such circumstances, *X*'s optimal strategy will be to equalize $\frac{\Delta PS+}{\Delta RS-}$ for non-marginal cost pricing on each of his tied products.²⁵ Thus, when *Y1 . . . N* distribute several goods whose demands are directly related, *X* will find

25. In fact, in order to maximize his profits, *X* would have to equalize $\frac{\Delta PS+}{\Delta RS-}$ on non-marginal cost and lump-sum pricing as well. As we shall see, since the tie-in will enable *X* to raise $\frac{\Delta PS}{\Delta RS}$ for non-marginal cost pricing, it will reduce the size of his optimal lump-sum fee. The divergence between $(PS+)$ and $(RS-)$ for lump-sum pricing reflects the costs of employing this pricing technique—viz., the cost of preventing or allowing buyer arbitrage, the cost of creating additional risk or shifting risk to a party with greater risk aversion, and the cost of overcoming or suffering from seller ignorance and/or buyer pessimism. Obviously, to the extent that his ability to shift the locus of his non-marginal cost pricing induces *X* to reduce his lump-sum fee, he will proceed to eliminate more than his customers' original (based on the pre-tie-in lump-sum fee) excess buyer surplus through non-marginal cost pricing. See pp. 1427-29 *infra*.

Tie-ins

it profitable to tie more than one product in this way, *i.e.*, to engage in conventional full-line forcing. By doing so, he will minimize the transaction surplus lost and concomitantly maximize the producer surplus gained for any given amount (measured in terms of its costs to X 's customers) of non-marginal cost pricing, *i.e.*, he will increase his profits and decrease his optimal lump-sum fee.

In many situations, X will be able to identify some product to which he can transfer some or all of his non-marginal cost pricing profitably. In the text that follows, three such sets of circumstances will be described.

- (a) **Shifting the Locus of Non-marginal Cost Pricing to an Unrelated Product**
 (i) *Where the Effects of Advertising and Promotion Are Inconsequential*

Diagram IV has been constructed to illustrate the way in which full-requirements tie-ins can increase the profitability of non-marginal cost pricing by shifting its locus to an unrelated product where the effects of advertising are inconsequential. It should be emphasized at the out-

DIAGRAM IV

set that the validity of the argument of this section does not depend on any of the more restrictive assumptions on which the construction of Diagram IV has been based—*e.g.*, on the assumption that DD_{YBZ} is a kinky oligopoly demand curve or on the assumption that MC_{XAY} is rising. We have adopted these paradigmatic assumptions solely to facilitate our visual presentation of the argument. For our conclusion to follow, it is only necessary that $\frac{PS+}{RS-}$ on DD_{XBY}^{RO} be sufficiently above its

counterpart on DD_{XAY} over the relevant range to compensate X for incurring the additional cost of arranging and enforcing²⁶ the tying agreement. In the previous section, it was shown that this result could be obtained without making any unduly restrictive assumptions.

The construction of Diagram IV has been based on the following assumptions: (1) that X is the sole manufacturer of some product A , a successfully differentiated good with a well-defined, separate market; (2) that $Y1 \dots N$ are local retail distributors operating in different geographic markets who sell B and would like to market A to their customers $Z1 \dots N$ as well; (3) that the producers of good B — $W1 \dots N$ —operate in a perfectly competitive market while the distributors of good B — $Y1 \dots N$ and $V1 \dots N$ —operate in tightly oligopolistic markets; (4)

that DD_{XAY} and DD_{XBY}^{RO} represent $Y1 \dots N$'s expected demands for A and B (under a requirements contract) during the period covered by X 's offer; (5) that shifts in $Z1 \dots N$'s demand for B are expected with certainty to be proportional to and in the same direction as movements in their demand for A ;^{26A} and (6) that because of seller ignorance, buyer pessimism, the uncertainty of the demand for A , and/or the difficulty of preventing buyer arbitrage, the highest lump-sum fee that X would find profitable to charge $Y1 \dots N$ if his only alternative were to engage in non-marginal cost pricing on A would be NKJ minus the discount (NML) that $Y1 \dots N$ demand for taking the risk that DD_{XAY} may turn out to be lower than they expected—*i.e.*, that

26. Under the tying agreement, X 's per unit price will be lower on A and higher on B than it otherwise would have been. Accordingly, the tie-in may increase the probability that Y will engage in arbitrage on A and raise the possibility that Y may violate his contract by buying B on the open market at its prevailing market price. To the extent that the imposition of the tie-in increases the cost of allowing or preventing such arbitrage and contract violations, our textual argument overestimates the profitability of employing tying agreements to shift the locus of non-marginal cost pricing.

26A. To the extent that this assumption is not justified, the imposition of the tie-in will increase both X 's and Y 's risk—*i.e.*, will increase the discount Y demands for risk-bearing and independently decrease the certainty equivalent value of X 's expected producer surplus. Obviously, both of these effects will decrease the profitability of imposing the tie-in in question.

X 's optimal lump-sum fee would be $LMKJ$ if his alternative were non-marginal cost pricing on A alone. According to our hypothesis, X will be able to increase his returns in these circumstances by shifting the locus of his non-marginal cost pricing from A to B , *i.e.*, by tying his sale of the exclusive (in the market in question) right to purchase A at his TSM marginal cost²⁷ to his customers' entering into full-requirements contracts under which they agree to purchase all their B from X for more than its prevailing market price during the period under consideration. But before we investigate this possibility and delineate some of the actual commercial contexts in which it is likely to arise, it will be useful to analyze the way in which our assumptions are manifest in the accompanying diagram.

Since A is a significantly unique product and Y its sole distributor in the market in which he operates, DD_{YAZ} will slope downward throughout. Accordingly, the demand curve that X will face on his sales of A to Y — DD_{XAY} in Diagram IV—will also be negatively sloped over the range in question, for MR_{YAZ} will slope downward whenever DD_{YAZ} is negatively-sloped, and, as we have already noted, DD_{XAY} and MR_{YAZ} will be identical where X is a manufacturer, Y a single pricing distributor who incurs no non-cost-of-goods-sold marginal costs, and $ZI \dots N$ the ultimate consumers of the good in question.

For similar reasons, post-tie-in DD_{XBY}^{RO} will be discontinuous at Y 's pre-tie-in sales volume AB . As we have seen, the effect of the tie-in will be to convert DD_{XBY} from DD_{WBY} , v^{28} —the demand that would be faced by X on his sales of B to Y absent the tie-in and is faced by W on their sales of B to V —to DD_{WBY}^{RO} —the curve that indicates the full value of B to Y . Since DD_{WBY}^{RO} will in turn be equal to MR_{YBZ} (where Y is a single pricing distributor; $ZI \dots N$, the ultimate consumers of the good in question; and Y incurs no distribution costs in selling B), post-tie-in DD_{XBY}^{RO} will be discontinuous as shown where, as we have assumed, Y

27. Note that we have been assuming that it will be much easier for X to predict his marginal cost where DD_{XAY} and MC_{XAY} intersect than to determine the position of DD_{XAY} itself. However, since marginal costs tend to be constant over a considerable range before capacity is reached, this assumption does not seem unjustified. See J. MEYER AND E. KUH, *THE INVESTMENT DECISION* 192 (1957); P. SYLOS-LABINI, *OLIGOPOLY AND TECHNOLOGICAL PROGRESS* 26 (1962), and sources cited therein.

28. Since we have assumed that B is a standardized commodity that is produced by a competitive industry, DD_{WBY} will be horizontal at a price equal to the minimum average total cost of producing B .

sells B in a tightly oligopolistic market, *i.e.*, where Y faces a demand curve that is kinked like DD_{YBZ} at the prevailing market price.²⁹

The fact that MC_{XBY} —the marginal cost to X of supplying Y with B —is horizontal in Diagram IV is attributable to our assumption that B is a standardized commodity that is produced by a competitive industry. Regardless of whether X produces B himself or purchases B for resale to Y on the open market, this assumption justifies our construction of MC_{XBY} . If X produces B himself, the marginal cost of supplying B to Y will be the revenue he could have obtained by selling the goods in question to V , *i.e.*, $MC_{XBY} = DD_{XBY}$, which will be horizontal if the industry that produces B is perfectly competitive. If X buys B on the open market, his marginal cost will be equal to the marginal cost he incurs when buying B from W ,³⁰ which will also be horizontal where the supply of B is perfectly competitive.

We should now be in a position to demonstrate how a full-requirements tie-in will increase X 's profits by enabling him to shift the locus of his non-marginal cost pricing from A to B . Let us assume that Y has absolutely no bargaining power—*i.e.*, that X will be able to force Y to surrender all (but not more than all) his excess surplus without losing his patronage. Since X has already forced Y to pay a lump-sum fee equal to the difference between NKJ and the discount he demanded for risk bearing (NML), the largest amount of retailer surplus that X will be able to eliminate by non-marginal cost pricing without losing Y 's business will be $JKIG$. If the only technique that X could employ to convert this retailer surplus into producer surplus was to charge his customers more than his actual and TSM marginal cost for their incremental

29. The demand faced by the individual members of a tight oligopoly that sells standardized products tends to be kinked at the prevailing market price. Where only a few sellers operate in a given market, price increases by individual producers will frequently not be matched while price decreases will be met immediately. Thus, any seller who raises his price above the prevailing market level will suffer a drastic reduction in sales, while producers who reduce their prices will not increase their sales appreciably (since their price cuts will be matched by their competitors). Clearly, in these circumstances, demand will be gently sloped above the prevailing market price and steeply sloped below it, *i.e.*, demand will tend to be kinked at the price in question. Where such a kink does develop—*e.g.*, at point M on DD_{YBZ} in Diagram IV, marginal revenue will be discontinuous at the output in question—*i.e.*, the producer in question will gain significantly more additional revenue by reducing his price to the prevailing level than by reducing his price below the original market norm. *See contra* Stigler, *The Kinky Oligopoly Demand Curve and Rigid Prices*, 55 J. POL. ECON. 432-49 (1947). Stigler delineates several cases in which members of tight oligopolies increased their prices in response to a price hike by one competitor. However, since such examples may consist of cases in which the position of the kink was raised—perhaps by increases in demand or cost, which may serve as focal points for oligopolistic cooperation—I do not think that Stigler's evidence is dispositive. In any case, it should be re-emphasized that the argument contained in this section does not depend on our assumption of a kinky oligopoly demand curve.

30. We assume that the costs of transferring B are zero.

purchases of A , he would be able to increase his expected producer surplus ($JKHG - HIF$) by raising his price GJ above his marginal cost. The fact that this sum does not equal Y 's original excess retailer surplus—*i.e.*, that $\frac{PS+}{RS-}$ is less than one—is due to the negative impact of this non-marginal cost pricing on X 's sales and derivatively on the transaction surplus he generates. In short, this difference between ($PS+$) and ($RS-$) will be equal to the transaction surplus lost as a result of X 's non-marginal cost pricing.

Clearly, in the circumstances we have postulated, X will be able to convert a higher percentage of his retailer's excess expected surplus into producer surplus if, instead of raising his price of A above his TSM marginal cost, he agrees to charge his customers his marginal cost on their incremental purchases of A on condition that they purchase their full requirements of B from him as well for more than its market price. In fact, in the situation represented in Diagram IV, this shift in the locus of X 's non-marginal cost pricing will enable him to raise his $\frac{PS+}{RS-}$

ratio from $\frac{JKHG - HIF}{JKIG}$ to 1, for since DD_{XY}^{no} is vertical over the

relevant range, increasing the price of B will reduce neither Y 's purchases of B nor the transaction surplus generated by X on his sales of A and B , *i.e.*, will eliminate the difference between ($PS+$) and ($RS-$). Thus, if, in Diagram IV, X charges Y OC —*i.e.*, a price AC above the prevailing market price—for each unit of B he purchases where $CDBA = JKIG$, X will be able to convert all of Y 's remaining (expected) retailer surplus into (expected) producer surplus which he can enjoy. In short, in the circumstances we have posited, the tie-in will enable X to increase the profitability of removing his customers' excess expected surplus through non-marginal cost pricing by KIH minus the cost of devising, executing, and enforcing (or not enforcing) the agreement in question.

But the profitability of full-requirements tie-ins does not depend solely on this effect, for such agreements will also increase X 's returns by making it profitable for him to reduce his lump-sum fee below $LMKJ$ and increase his unit prices correspondingly. We have already noted that $LMKJ$ was determined to be optimal on the assumption that the only way that X could eliminate the additional retailer surplus that would be generated if he reduced his lump-sum fee would be to raise his unit price on A above OJS , *i.e.*, $LMKJ$ was determined to be optimal on the assumption that the cost of engaging in further non-marginal

cost pricing—*viz.*, the transaction surplus that such pricing would destroy—would be determined by $\frac{\Delta PS+}{\Delta RS-}$ at and above point K on DD_{XAY} . However, once the tie-in is imposed, the $\frac{\Delta PS+}{\Delta RS-}$ ratio that X will confront after exhausting $JKIG$ of his customers' retailer surplus through non-marginal cost pricing on B will be equal to $\frac{\Delta PS+}{\Delta RS-}$ either on DD_{XBY}^{RO} above point D or on DD_{XAY} above point I , whichever is higher. Thus, since $\frac{\Delta PS+}{\Delta RS-}$ will almost always be higher either on DD_{XBY}^{RO} above point D and/or on DD_{XAY} above point I than on DD_{XAY} above point K , the tie-in will usually make it profitable for X to reduce his lump-sum fee, for obviously the size of X 's optimal lump-sum fee will decrease with the cost of non-marginal cost pricing—*i.e.*, will be inversely related to $\frac{\Delta PS+}{\Delta RS-}$ and directly related to the relative amount of transaction surplus that further unit price increases would destroy. Accordingly, unless additional price increases on B make the cost of enforcing (or not enforcing) the tie-in prohibitive, the tying agreement will also raise X 's certainty equivalent returns by reducing his optimal lump-sum fee, *i.e.*, by making it profitable for him to lower his basic charge and eliminate the resulting surplus by engaging in additional non-marginal cost pricing. Obviously, X will find it profitable to continue this process until $\frac{PS+}{RS-}$ is equal to his lump-sum fee sufficiently to enable him to raise his unit price on B to OS ($AS = BP$), *i.e.*, by $SPDC$ minus the amount by which X 's reduction of his lump-sum fee lowers the discount Y demands for risk-bearing, for since DD_{XBY}^{RO} is vertical between D and P , such a policy will enable X to receive all of the benefits of additional non-marginal cost pricing without incurring any extra costs, *i.e.*, without destroying any additional transaction surplus. In fact, if $\frac{\Delta PS+}{\Delta RS-}$ is still higher on either DD_{XBY}^{RO} above P or DD_{XAY} above I than on DD_{XAY} above K , X will also find it profitable to increase his unit price either on B above OS and/or on A above OG and reduce his lump-sum fee correspondingly. Thus, full-requirements tie-ins will normally increase their employers' profits by making it profitable for

them to reduce their lump-sum fees as well as by increasing the amount of their customers' original expected surplus they can absorb through non-marginal cost pricing.

In many commercial contexts, actual business conditions approximate our assumptions sufficiently to justify the application of this analysis. In fact, many producers who manufacture one or more successfully differentiated products could and presumably do use full-requirements tie-ins to shift the locus of their non-marginal cost pricing to standardized goods that their distributors also market as members of tight oligopolies. The agricultural machinery industry, for one, appears to satisfy all our necessary conditions. All the major producers manufacture a few heavy machines which they have successfully differentiated—*i.e.*, which are demanded according to a downward-sloped schedule—and several small standardized items that are sold by a large number of short-line producers as well—and consequently are demanded according to a rather horizontal schedule. The demand for these small standardized tools tends to fluctuate in the same direction as the demand for the specialized, differentiated machinery. The exclusive dealers of each large manufacturer will usually be the only seller of the differentiated product in their local markets, which will normally be quite well-defined—*i.e.*, the demand they face when distributing the differentiated machinery will also be downward sloping throughout. Since, in addition to the exclusive dealers of the represented major companies, only a few local hardware stores will sell the standardized items as well, retail distribution of these goods will tend to be tightly oligopolistic, *i.e.*, the demand faced by the exclusive dealers when selling these smaller items will tend to be kinked at the prevailing market price. In actual fact, the available data confirms our hypothesis: full-line forcing (*i.e.*, full-requirements tie-ins) is commonly practiced by farm machinery manufacturers.³¹

Similar opportunities for increasing their profits by shifting the locus of their non-marginal cost pricing would seem to be available to firms that sell successfully differentiated lines of clothing, jewelry, electrical appliances or equipment, etc. to retailers who operate in fairly small local markets. In each of these cases, the dealer who holds an exclusive franchise on the successfully differentiated product will also distribute some other good produced by a competitive industry, distributed by a

31. See, *e.g.*, *United States v. J. I. Case*, 101 F. Supp. 856 (D. Minn. 1951). I have not been able to determine whether the companies in question sold their standardized products to their dealers for more than their prevailing wholesale price.

tight oligopoly, and demanded in proportion to the more expensive, successfully differentiated item. Thus, manufacturers of expensive clothing or jewelry could require their dealers to distribute their line of middle-priced imitations; and producers of successfully differentiated stereos could condition their sale of exclusive franchises on their distributors' agreeing to give them all their patronage on standardized accessories³² or other non-differentiated electrical equipment as well.³³ Examples could be multiplied, but the principle should be clear. In each of these cases, manufacturers of final products will be able to increase their returns by tying their differentiated goods to a standardized product that their distributors also offer for sale.

(ii) *When the Demand for the Unrelated Tied Product Is Less Dependent on Advertising and Promotion than the Demand for the Tying Commodity*³⁴

Frequently, DD_{YAZ} , MR_{YAZ} , and concomitantly the total producer and retailer surplus generated by X on his sales to his distributors $Y1 \dots N$ will be a direct function of the amount of promotion that A receives from X and Y . In this subsection, we will discuss the possibility that this relationship may make it profitable for X to shift the locus of his non-marginal cost pricing in situations in which DD_{XAY} would not be better suited for this technique than DD_{XAY} if promotional effects could be excluded.

Clearly, if X and Y were subdivisions of an integrated concern XY , both would find it profitable to promote good A so long as their incremental selling expenditures were less than or equal to the additional producer and retailer surplus they generated, for in such circumstances,

32. As we shall see, where accessories are involved, our analysis will be complicated by the interdependence of the demand for the tied and tying products.

33. The same analysis would apply if A were an irreplaceable input used by a manufacturer to produce a successfully differentiated product and B were an essential input used by the same manufacturer to produce an item which he sold in a tight oligopoly. In both of these cases, the demand that the manufacturer faced in distributing his final good would be reflected in the marginal revenue product of the inputs for him, i.e., in the demand faced by X on his sales to the manufacturer in question. Thus, where the buyer Y uses A to produce a successfully differentiated product and B to produce a good sold in a tight oligopoly, DD_{YAZ} , MR_{YAZ} , and accordingly DD_{XAY} will be downward-sloped throughout, while DD_{YBZ} will be kinked at B 's prevailing market price, and accordingly MR_{YBZ} and DD_{XBY} will be discontinuous at Y 's original sales volume.

34. In the text, we will consider a situation in which A and B are final products. The same analysis would apply if A and B were intermediate products used by manufacturer Y to produce C —a differentiated good—and D —a standardized commodity—respectively. In this situation, shifting the locus of non-marginal cost pricing from A to B would increase Y 's incentive to promote his own good C without affecting his expenditures on his standardized product D significantly.

any division between producer and retailer surplus would be purely artificial.

However, such behavior will not be profitable for X and Y when they do not belong to the same organization, for given independence, X will not benefit from the retailer surplus his promotional activities produce, and Y will not profit from the producer surplus generated by his marginal selling expenditures. Thus, to the extent that X realizes any profits from Y 's marginal promotional activities, Y will push good A less than his integrated counterpart, and to the extent that X 's sales campaigns increase Y 's returns, an independent X will advertise less than a manufacturing division of an integrated concern such as XY . Obviously, since this disparity will reduce the difference between X 's and Y 's producer and retailer surplus and promotional costs, it will decrease the amount of profits that X will be able to realize by producing A .

In order for X to be able to overcome this difficulty, he will have to be able to recover the non-consumer surplus that he and his distributors generate by promoting A without realizing any producer surplus on his customers' marginal promotional activities. Clearly, X will not be able to accomplish this result by single pricing, for this technique cannot increase his share of the producer and retailer surplus his promotional activities generate without decreasing $YI \dots N$'s share of the additional surplus they create by pushing A . Since X 's incentive to promote good A will be directly related to the disparity between X 's marginal cost and the price he charges his distributors, and Y 's inversely related to the difference in question, single pricing will inevitably reduce promotion below the joint optimum.

Of course, whenever lump-sum pricing is practicable, X will be able to overcome this difficulty by charging his distributors a basic fee equal to the non-consumer surplus that XY would realize given optimal promotion for the right to purchase successive units of A at his marginal cost. In fact, under a perfect lump-sum pricing system, $YI \dots N$'s incentive to push good A would be no different from their integrated counterparts', and X 's motivation to advertise his product would be only insignificantly lower than that of a manufacturing division in an integrated concern. Thus, since given lump-sum pricing, $YI \dots N$ will have to pay no more than X 's marginal cost for the marginal units of A they purchase, *i.e.*, since their lump-sum fee will not vary with their dollar sales of A , they will realize all of the additional non-consumer surplus their marginal sales effort generates, and hence their incentive to push product A will be no different from that of an integrated re-

tailer. Similarly, since the size of the lump-sum fee that X will be able to charge in the future will depend on his current promotional activities,³⁵ he will be able to recover almost all of the non-consumer surplus produced by his promotional activities, and hence his incentive to advertise his product will be nearly as great as a manufacturing division's in an integrated concern.

However, as we have seen, the cost of administering such a lump-sum pricing system will usually be too high to warrant its adoption. Thus, X will normally have to find some other more profitable means of maintaining his own and his distributors' incentive to promote his product. X may be able to achieve part of this objective by conditioning his sales on his distributors' agreeing to allocate more shelf space to his product than they would otherwise find profitable, but clearly this remedy and others like it will leave much to be desired. Hence, unless DD_{XBY}^{RO} is especially unsuitable for non-marginal cost pricing, X will find it profitable to duplicate the effect of the lump-sum offer by tying his differentiated product to some more standardized good whose buyers are less responsive to promotional activity.

By offering his distributors the right to purchase as much of his differentiated product as they like at his own marginal cost in exchange for their agreeing to purchase some other standardized good whose sales parallel those of A for more than its market price, X will be able to increase his own and his distributors' incentive to promote good A without incurring the costs associated with perfect lump-sum pricing. Since under the tying agreement, $Y1 \dots N$ will have to pay no more than X 's marginal costs for each additional unit of A they purchase, their incentive to push X 's product will be no different from their integrated counterpart's, and since X will be able to recover most of the non-consumer surplus his advertising generates by raising his lump-sum fee and/or the price he charges for B in future tying agreements, the tie-in will provide him with almost as much motivation to promote his product as a vertical merger. Thus, even if post-tie-in DD_{XBY}^{RO} would be no more suitable for non-marginal cost pricing than DD_{XAY} if promotional activity were held constant, X may find that he can increase his returns by shifting all or part of his non-marginal cost pricing from A to B where B 's buyers are less responsive to promotional activity than A 's.

35. Both because of the effect of future advertising on future demand and because of its impact on $Y1 \dots N$'s expectations regarding X 's future behavior. (Obviously, since the size of the lump-sum fee that $Y1 \dots N$ will be willing to pay will depend upon the amount of advertising that they expect X to undertake during the period covered by his offer, they will adjust their offer in light of this supplier's past performance.)

Tie-ins

DIAGRAM V

Diagram V illustrates this possibility. DD_{YAZ} , MR_{YAZ} , and DD_{XAY} have all been constructed on the assumption that X and Y engage in the amount of promotional activity that they would find profitable if X charged $YI \dots N$ SPN for the right to purchase as much A as they like at price ON per unit. On the other hand, DD_{YAZ}^* , MR_{YAZ}^* , and DD_{XAY}^* have been constructed on the assumption that X and Y engage in the

amount of promotional activity that they would find profitable if X charged $YI \dots N$ SPN for the right to purchase as much A as they like at price OJ per unit on condition that they also agree to purchase all their requirements of B at OG per unit, *i.e.*, for AG more than its prevailing market price during the period under consideration. Since the tie-in will increase X 's and Y 's incentive to promote good A , DD_{YAZ}^* , MR_{YAZ}^* , and DD_{XAY}^* will exceed DD_{YAZ} , MR_{YAZ} , and DD_{XAY} respectively whenever A 's buyers can be influenced by additional promotional expenditures. Obviously, in constructing Diagram V, we have assumed that A 's final consumers do respond to X 's and Y 's incremental sales effort.

However, this assumption has not been made about the final consumers of product B . Indeed, in constructing Diagram V, we have assumed that product B is a standardized good that neither X nor Y finds profitable to advertise. Accordingly, shifting X 's non-marginal cost pricing from A to B will not change DD_{YBZ} , MR_{YBZ} , or DD_{XBY} , *i.e.*, $DD_{YBZ} = DD_{YBZ}^*$ and $DD_{XBY} = DD_{XBY}^*$.

We should now be in a position to illustrate the way in which the effect of a tie-in on X 's and Y 's promotional activities may make it profitable for X to shift the locus of his non-marginal cost pricing from A to B . Let us assume at the outset that A 's sales are not a function of X 's and Y 's promotional activity, *i.e.*, that $DD_{XAY} = DD_{XAY}^*$. If, under these circumstances, the highest lump-sum fee that X will find profitable to charge $YI \dots N$ if his only alternative is non-marginal cost pricing on A is SNP minus the non-cost-of-goods-sold expenses that Y incurs when distributing A and the discount Y demands for risk-bearing, X will have to decide whether to absorb his retailers' remaining expected surplus $NPLJ = EFDA$ (1) by charging his customers ON for their marginal purchases of A or (2) by allowing his customers to purchase A at his TSM price OJ on condition that they also purchase all their requirements of B for EA above its prevailing market price OA . Clearly, since DD_{XBY} is much less steeply sloped than DD_{XAY} , $\frac{PS+}{RS-}$ will be much higher on A than on B over most of the range in question. In fact, although marginal $\frac{PS+}{RS-}$ may be higher on DD_{XBY} at price OA than on DD_{XAY} at price ON , the cost of devising, executing, and policing the tying agreement will probably exceed its potential benefits to X if other

things are equal. Thus, X would not find it profitable to force his customers to accept a tie-in if its imposition would not change DD_{XY} .

Clearly, however, this conclusion may no longer be justified if we relax our assumption that the tying agreement will not affect X 's and Y 's selling expenditures and Z 's demand for A , i.e., if we relax our assumption that $DD_{XY}^* = DD_{XY}$. If, for instance, a shift in the locus of X 's non-marginal cost pricing will generate expenditures that increase DD_{XY} to DD_{XY}^* , X may find it profitable to impose a full-requirements tie-in. Thus, in Diagram V, such an agreement would change X 's expected producer surplus from $SPKJ$ minus the sum of Y 's original non-cost-of-goods-sold expenses and the discount Y demanded for risk-bearing to SPN minus this sum plus the difference between $GHBA$ and the additional promotional costs that the switch led X to incur where $GHDA$ equals $NPLJ$ plus $TMLS$ minus the additional promotional costs that Y incurs as a result of the switch, i.e., when $GHDA$ equals Y 's expected retailer surplus on A after the tie-in is imposed. Since in any given instance the increase in X and Y 's joint return on A — $TMLS$ minus X 's and Y 's additional promotional costs—may more than outweigh the effect of the slope of DD_{XY} , the dependence of DD_{XY} on advertising and promotion may make it profitable for X to shift the locus of his non-marginal cost pricing in situations in which DD_{XY}^{BO} would not be better suited for this technique if promotional effects were excluded. (As before, the possibility of imposing such a tie-in will also increase X 's optimal lump-sum fee by increasing the profitability of non-marginal cost pricing.)

Of course, in many situations, this promotional effect will complement and not counteract the impact of such full-requirements tie-ins on the ability of a producer to absorb his retailers' excess expected surplus. Thus, in general, the greater the responsiveness of A 's sales to promotional activity relative to the sales of B , the greater the profitability of shifting the locus of non-marginal cost pricing.

(b) Shifting the Locus of Non-marginal Cost Pricing to a Related Product Used in Variable Proportions with the Differentiated Good³⁶

In this subsection, we will discuss how full-requirements tie-ins among related goods can enable X to increase the profitability of non-

36. This argument was suggested to me by Professor Ward Bowman's provocative analysis of *Tying Arrangements and the Leverage Problem*, 67 YALE L.J. 19, 25-27 (1957).

Diagram VI has been constructed to facilitate our exposition.³⁷ For convenience, we have assumed that D is a differentiated final good and accordingly that its producer Y ³⁸ will face a downward-sloping demand curve. On this basis, MR_{YDZ} has been represented to be negatively-sloped throughout. For similar reasons, Diagram VI has been constructed on the assumption that D is produced under conditions of constant returns to scale, *i.e.*, all of the marginal cost curves in the accompanying diagram have been represented to be horizontal throughout.

Once more, it will be convenient to establish the behavior of an integrated concern XY as a reference point for our subsequent analysis. $MC_I = MC_{D(XY)}$ represents the marginal costs that a profit-maximizing integrated firm such as XY would have to incur to produce successive units of final good D . Thus, MC_I indicates the cost of producing successive units of D with the most efficient production mix that XY could employ, *i.e.*, with the production mix in which the last penny spent on A produces the same amount of revenue as the last penny spent on B .³⁹

Where this condition does not obtain, *i.e.*, when $\frac{MRP_{A(XY)}}{MC_{A(XY)}}$ does not

equal $\frac{MRP_{B(XY)}}{MC_{B(XY)}}$, (when the ratio of the marginal revenue product of

A to its marginal cost to XY does not equal its counterpart for B), X will be able to increase his output, revenue, and profits without changing his total expenditures on A and B simply by varying the relative

amounts of these inputs he uses to produce D , *i.e.*, where $\frac{MRP_{A(XY)}}{MC_{A(XY)}}$

(read marginal revenue product of A to XY over marginal cost of A to

XY) $\neq \frac{MRP_{B(XY)}}{MC_{B(XY)}}$, the marginal cost that XY will incur will be

higher than MC_I in Diagram VI. Obviously, therefore, XY will always find it profitable to induce its final goods manufacturing division Y to employ an efficient production mix, *i.e.*, to use A and B in proportions

37. I should like to thank Dale Henderson, whose help enabled me to develop this diagrammatic presentation.

38. Under normal circumstances, D or a close substitute will be produced by a large number of local producers.

39. Since C is an irreplaceable input used in fixed proportions, the efficiency of the production mix will never be disturbed by under- or over-utilization of this particular input. Thus, since C is an essential input and D is produced under conditions of constant returns, $\frac{C}{D}$ will be fixed regardless of the price of C or the output of D .

that will equate $\frac{MRP_{BY}}{MC_{B(XY)}}$ with $\frac{MRP_{AY}}{MC_{A(XY)}}$.⁴⁰ Since Y —if instructed to maximize its separate returns—will do so by equating $\frac{MRP_{BY}}{MC_{BY}}$ with $\frac{MRP_{AY}}{MC_{AY}}$, XY will be able to effect this result by setting the shadow or accounting prices he charges Y for A and B proportional to their marginal cost to X , *i.e.*, by equating $\frac{P_{BY}}{MC_{BX}} = \frac{MC_{BY}}{MC_{BX}}$ (read price or marginal cost of B to Y over marginal cost of B to X) with $\frac{P_{AY}}{MC_{AX}} = \frac{MC_{AY}}{MC_{AX}}$.

Where this condition is satisfied, $\frac{MRP_{BY}}{MC_{BY}}$ will equal $\frac{MRP_{AY}}{MC_{AY}}$ where $\frac{MC_{BY}}{MC_{BX}} = \frac{MC_{AY}}{MC_{AX}}$, *i.e.*, $\frac{MRP_{BY}}{MC_{BX}}$ will equal $\frac{MRP_{AY}}{MC_{AX}}$ and Y will be producing its output with the most efficient production mix that XY could employ.

We have already noted that an integrated firm such as XY would maximize its returns by charging its final product manufacturing division Y its TSM marginal cost, for given integration any division of transaction surplus between sellers and buyers will be purely artificial. Accordingly, Y will be charged X 's TSM marginal cost for A , B , and C , and given these prices, will increase its expenditures on these inputs until $MRP_{AY} = MC_{AX}$, $MRP_{BY} = MC_{BX}$, and $MRP_{OY} = MC_{OX}$ respectively, *i.e.*, until $\frac{MRP_{AY}}{MC_{AX}} = \frac{MRP_{BY}}{MC_{BX}} = \frac{MRP_{OY}}{MC_{OX}} = 1$. The associated output— ac in Diagram VI—will therefore be optimal in two senses. First, since $P_{AY} = MC_{AY} = MC_{AX}$, $P_{BY} = MC_{BY} = MC_{BX}$, and $P_{OY} = MC_{OY} = MC_{OX}$, MC_{DY} will equal MC_{DX} and Y will produce the TSM output of D . Second, and relatedly, since $\frac{MC_{AY}}{MC_{AX}} = \frac{MC_{BY}}{MC_{BX}}$, Y will produce this TSM output with the most efficient production mix that XY could employ.

Correspondingly, deviations from our TSM conditions, *i.e.*, from marginal cost pricing, will reduce transaction surplus in these same

40. We assume that X , the division of XY that manufactures A , also supplies Y with B and C , which it buys on the open market. This assumption is not critical, for if X does not supply Y with B and C , *i.e.*, if Y buys B and/or C itself, X 's and XY 's costs and revenues will be reduced by an equal amount. However, its adoption will simplify our diagrammatic exposition.

two related ways, *i.e.*, both by causing Y to reduce his output of D below XY 's TSM volume and by inducing Y to produce the output of D he does manufacture with a production mix that is inefficient for the firm as a whole, *i.e.*, along a marginal cost curve that is greater than MC_1 . Thus, for example, if X charges his manufacturing division Y a price sufficiently above his marginal cost for C to raise MC_{DY} (read marginal cost of D to Y) from MC_1 to MC_s ⁴¹ in Diagram VI, XY will only lose transaction surplus gcb , for since input C is used in fixed proportions, non-marginal cost pricing will not induce Y to produce output fg with a different production mix than XY would find optimal, *i.e.*, X 's decision to non-marginal cost price on C will not raise his marginal cost of supplying the A , B , and C that Y will order to produce various amounts of D above MC_1 . For similar reasons, if X raises his shadow price on A and B proportionately above their marginal costs sufficiently

to raise MC_{DY} from MC_1 to MC_s , XY will lose only gcb , for since $\frac{P_{AY}}{MC_{AX}}$

will still equal $\frac{P_{BY}}{MC_{BX}}$, the change in question will not cause Y to use a

production mix that XY would find inefficient, *i.e.*, X 's decision to non-marginal cost price proportionately on A and B will not raise his marginal cost of supplying Y with the inputs he demands above MC_1 . If, on the other hand, X follows neither of these procedures but raises his shadow or accounting price solely on A sufficiently above his marginal cost to raise MC_{DY} to MC_s , the associated loss in transaction surplus will

be equal to $(gcb + deba)$, and not to gcb alone, for since $\frac{P_{AY}}{MC_{AX}} =$

$\frac{MC_{AY}}{MC_{AX}}$ will exceed $\frac{P_{BY}}{MC_{BX}} = \frac{MC_{AY}}{MC_{AX}}$, $\frac{MRP_{AY}}{MC_{AX}}$ will exceed $\frac{MRP_{BY}}{MC_{BX}}$,

i.e., Y 's production mix will not be optimal for XY and X 's cost of supplying A , B , and C to Y will increase from MC_1 to MC_s . Thus, whenever X non-marginal cost prices one replaceable input, transaction surplus will be lost by inefficient production as well as by a reduction in the output of the final good in question.

Having established this paradigm, we should now be able to demonstrate the profitability of using a full-requirements tie-in to shift the locus of non-marginal cost pricing to a related input used in variable proportions with the differentiated input A . Let's assume (1) that X is a manufacturer of a successfully differentiated input A ; (2) that Y —an

41. We assume that the only costs that Y incurs are the costs of inputs A , B , and C .

independent manufacturer—uses A , B , and C to produce final good D ; (3) that MR_{YDZ} is Y 's expected marginal revenue curve during the period covered by X 's offer; (4) that both X and Y can purchase B and C on the open market for ok and ol respectively; (5) that both B and C are produced by perfectly competitive industries and accordingly that MC_{BX} and MC_{BY} are horizontal throughout; (6) that om is X 's TSM marginal cost on A and that MC_{AX} is also horizontal throughout;⁴² (7) that C is an irreplaceable input while A and B are imperfect substitutes; (8) that MC_1 is the MC curve that Y would face if X sold him A , B , and C at his own marginal cost;⁴³ and (9) that MC_4 is the marginal cost curve Y would face if he produced D without using any A at all. Since D is produced under conditions of constant returns, all the marginal cost curves in Diagram VI are horizontal, and since the production mix that Y will employ when A is not available to him is far less efficient than XY 's optimal combination of inputs, MC_4 will be considerably higher than MC_1 .

If, in this situation, X could engage in perfect lump-sum pricing, he would be able to realize seller surplus equal to the difference between $hica$ and the discount Y demands for risk bearing by agreeing to supply Y with all the A he demanded at X 's own TSM marginal cost $rq = om$. This sum represents the certainty equivalent value of A to Y given marginal cost pricing, *i.e.*, it represents the certainty equivalent value of the difference between the surplus Y would expect to realize if he did not use any A at all (jih) and the surplus he would expect to realize (jca) if he could use A at X 's TSM marginal cost rq without paying any lump-sum fee to X . Let us assume, however, that because of his own ignorance, Y 's pessimism, uncertainty, and/or the cost of preventing buyer arbitrage, the largest lump-sum fee that X finds profitable to charge Y (assuming that his alternative is non-marginal cost pricing on A alone) is the difference between $higf$ and the discount Y demands for risk-bearing. Accordingly, X 's problem will be to absorb as much of Y 's remaining expected buyer surplus $fgca$ by non-marginal cost pricing as he possibly can. Our contention is that by tying his sales of A to Y 's acceptance of a non-marginal cost full-requirements contract on B or C , X will be able to increase the percentage of this excess expected buyer surplus that he can recover through non-marginal cost

42. This assumption is not critical. However, its adoption will simplify our analysis.

43. The units of A , B , and C have been defined so that one unit of these inputs will be used to produce one unit of D when XY charges Y its TSM marginal cost for each of the inputs in question.

pricing, *i.e.*, X will be able to reduce the amount of transaction surplus lost concomitant to the elimination of expected buyer surplus *fgca*.

If we make the immaterial⁴⁴ assumption that X supplies Y with all his inputs—even those not covered by the tying agreement, *i.e.*, even those that Y buys from X at the prevailing competitive market price, Diagram VI will enable us to demonstrate the validity of this conclusion. As we have already noted, since the seller surplus that will be gained by non-marginal cost pricing will be equal to the difference between the buyer surplus lost and the transaction surplus lost, *i.e.*, since $(SS+) = (BS-) - (TS-)$, the smaller $(TS-)$ relative to $(BS-)$, the larger $\frac{SS+}{BS-}$, *i.e.*, the higher the returns to non-marginal cost pricing.

Thus, X 's task will be to reduce $\frac{TS-}{BS-}$.

On our assumptions, X will be able to reduce Y 's expected buyer surplus by non-marginal cost pricing by *fgca* without losing his patronage, *i.e.*, X will be able to raise Y 's marginal costs from MC_1 to MC_3 before Y will reject X 's offer. Obviously, since A , B , and C are closely related inputs, the demand for each will be monotonically related to the demand for D and tie-ins will be particularly easy to enforce, *i.e.*, cheating on B and C will be particularly easy to detect. Thus, in order to prove our contention, we only have to show that by imposing a tie-in, X will be able to reduce the transaction surplus that will be lost by raising MC_{DY} from MC_1 to MC_3 . Since this increase in Y 's marginal cost curve will reduce Y 's output by *bc* and accordingly transaction surplus by *gcb* regardless of the way in which it is effected, we will have to search for some reason why the set of prices that X will charge Y for A , B , and C under a tying agreement will distort Y 's production mix less than non-marginal cost pricing on A . Fortunately, though not coincidentally, our analysis of the paradigm of the integrated firm has already provided this reason.

As we saw when discussing the effects of different accounting or shadow prices on the returns of the putative integrated firm XY , non-marginal cost pricing on a replaceable input such as A alone will reduce transaction surplus not only by reducing Y 's output of D but also by inducing Y to produce this lower output with more B and less A than

44. Once more, this assumption is not critical for our analysis since it will not change the seller surplus X realizes on his sales to Y . This conclusion follows from our assumption that the markets for B and C are competitive, for when this condition prevails, X could replace his untied sales to Y with sales to other customers at the prevailing market price.

XY or X would have found profitable. Thus, if X in Diagram VI does not impose a tie-in but charges Y some price sufficiently above his TSM marginal cost on A to raise MC_{DY} to MC_3 , he will also raise his own cost of supplying Y with the inputs he demands to produce various amounts of D from MC_1 to MC_2 . Thus, if X does not impose a tie-in, his non-marginal cost pricing on A will decrease expected transaction surplus by $gcb + deba$ and accordingly will increase his expected seller surplus by only $fged$. Clearly, if X reduces his price on A and eliminates the resultant buyer surplus by requiring Y to purchase his full requirements of B or C from him as well for more than its prevailing (competitive) market price, he will be able to improve his position. Thus, if X charges Y his TSM marginal cost rq for A but requires him to purchase his full requirements of C from him as well for a price sufficiently above its TSM marginal cost (*i.e.*, its market price) rn to raise MC_{DY} to MC_3 , he will increase his expected returns from non-marginal cost pricing from $fged$ to $fgba$, for since C is an irreplaceable input, raising its price will not induce Y to employ a production mix that XY would find inefficient, and the cost X must incur to supply Y with his inputs will equal MC_1 and not MC_2 . As we have seen, X will be able to accomplish the same result by tying A to B and raising the prices of both proportionately and sufficiently above their marginal costs to raise MC_{DY} to MC_3 , for where $\frac{P_{AY}}{MC_{AX}} = \frac{P_{BY}}{MC_{BX}}, \frac{MRP_{AY}}{MC_{AX}}$ will equal $\frac{MRP_{BY}}{MC_{BX}}$ in equilibrium, *i.e.*, Y will produce with the same production mix that XY would have employed and the cost that X will have to incur to supply Y will be equal to MC_1 . (Once more, our basic analysis underestimates the profitability of imposing such tie-ins, for by increasing the profitability of non-marginal cost pricing, these agreements place X in a position to increase his returns by lowering his lump-sum fee and increasing the extent to which he engages in non-marginal cost pricing.)

Thus, wherever A is a replaceable input, X will be able to raise his profits by employing a tie-in to shift the locus of his non-marginal cost pricing to an essential input such as C or to an imperfect substitute used in variable proportions with his differentiated product. Precisely the same factors will make it profitable for X to impose a tying agreement where A is a final good; Y , a distributor or final consumer; and B and C related products used in variable proportions with X 's differentiated commodity.⁴⁵

45. Admittedly, X could accomplish the same result through endproduct royalties. In many situations, however, the royalty scheme will be more difficult to enforce than a full-requirements tie-in. See p. 1444 *infra*.

(c) Summary

In short, regardless of whether X 's customers use or distribute goods that are related to his differentiated product, X will often be able to employ full-requirements tie-ins to increase the profitability of non-marginal cost pricing. By so doing, X will reduce the extent to which his not being vertically integrated limits his ability to take advantage of the negative slope of DD_{XY} . Of course, in some situations, X may be able to employ other means short of actual integration (which will often be prohibitively expensive) to reduce the amount by which his efforts to increase his own returns take him and his customers away from their joint optimum positions. Frequently, however, the ability of full-requirements tie-ins to reduce the amount of transaction surplus destroyed by any given amount of non-marginal cost pricing will make such agreements the most profitable or cost-effective weapon for combatting the problems posed by non-integration.

2. *Measuring the Value of a Differentiated Durable Machine (or Patented or Secret Process or Idea) to Its Individual Purchasers, i.e., Implementing a Meter Pricing System*

Before we can understand why tie-ins might be used as metering or counting devices we will have to establish the value of meter pricing to producers of differentiated durable products or ideas. Accordingly, this subsection has been divided into two parts. In the first, the advantages of meter pricing are explored. In the second, the metering potential of tie-ins is explained.

A. The Value of Meter Pricing

If we conceptualize an outright sale of a machine as the sale of the right to use the machine at the seller's TSM marginal cost (zero), the equivalence of such sales with pure lump-sum pricing should be apparent. Similarly, if we conceptualize meter pricing as the sale of a service (the service provided by an intended use of the machine) whose marginal cost is zero, its equivalence with non-marginal cost pricing becomes patent. Thus, meter pricing performs the same function for producers of durable products or ideas that non-marginal cost pricing performs for manufacturers of less durable commodities. In particular, by making $Y1 \dots N$'s payments depend on how often they use his durable product or idea, meter pricing may be able to reduce the amount of surplus X loses through his own ignorance as well as through his customers' pessimism, uncertainty, risk aversion, and

ability to engage in buyer arbitrage—*i.e.*, to use the machine to perform services for some of its other potential buyers. It should be noted that although the importance of some of these functions may be increased by differences in $YI \dots N$'s demands—*i.e.*, by the possibility that meter pricing may produce price discrimination (since such differences in demand will increase the importance of seller ignorance and perhaps the likelihood of buyer arbitrage as well), meter pricing may still be profitable where X 's customers' demands are equal. Of course, the advantages of this strategy will be more or less offset by its tendency to reduce the extent to which X 's customers use his machines—*i.e.*, to reduce the transaction surplus X generates, but clearly, the benefits of this practice will often outweigh its costs.

B. Tie-ins as Counting Devices

In many situations, meter pricing systems can be implemented simply by attaching a meter to the differentiated machine in question. However, this solution will not always be satisfactory. Even in the best of circumstances, meters may be tampered with and for many products (*e.g.*, riveting machines) and all patented or secret processes or ideas, meters will be unsuitable.

Of course, where conventional counting devices are unsatisfactory, producers such as X may be able to obtain variable rentals by charging their customers endproduct royalties. However, this alternative will not always be viable. In many situations, the tying product's contribution to $YI \dots N$'s sales will be neither constant nor predictable. Where it is not, endproduct royalties will obviously be unsuitable. In any case, such royalties will not be effective unless X can determine whether his customers are reporting their sales accurately. This problem will always be difficult, but it is likely to be particularly acute (1) when $YI \dots N$ would not otherwise have recorded their relevant sales—as, for example, when $YI \dots N$ normally do not charge their customers for the product in question (toilet paper in rest rooms) or where the variability of the price of Y 's endproduct forces X to peg his royalties to unit rather than dollar sales—or (2) when $YI \dots N$ can reduce their nominal dollar sales of A by selling it in conjunction with some tied, over-priced item. Thus, X will often find that endproduct royalties are not a satisfactory method of measuring how intensively his customers use his product.

Accordingly, in many situations, tie-ins may be the most efficient metering device available to X . Thus, if X 's machine is used in fixed proportions with some other input B , X may find it profitable to

convert this input into a counting and rent collecting device by requiring users of A to purchase their full requirements of B from him as well at some margin (equal to the effective meter rate) above its prevailing market price. Since it will often be easier to determine whether $Y1 \dots N$ are purchasing B from other suppliers than to determine whether $Y1 \dots N$ have reported their sales accurately, such tie-ins will frequently increase the profitability of meter pricing.

Although a large number of the tie-ins that have led to antitrust litigation have involved durable machines and complements used in fixed proportions,⁴⁶ not all can be explained by this metering hypothesis. As we shall see, if under the tying agreement the tied product is sold for its prevailing market price, it is likely that the tie-in is being used to prevent losses that would otherwise result from (1) the fact that the tied product's prevailing market price exceeds its marginal cost of production and/or (2) the possibility that a technologically inferior tied product may be used in conjunction with A . In fact, even where the tied product is sold for more than its prevailing market price, the metering function of the tie-in may not be exclusive, *i.e.*, the tie-in may also have been imposed to prevent the use of unsatisfactory complements. Thus, it will be safe to conclude that the tie-in is serving solely as a metering device only if the tied product is perfectly standardized and is priced above its prevailing market level.

3. *Increasing the Profitability of Price Discrimination*

Whenever the elasticities⁴⁷ of $Y1 \dots N$'s demand curves are different at X 's uniform single profit-maximizing price, X will be able to increase the difference between his total revenue and the cost of the goods he sells by practicing price discrimination, *i.e.*, by forcing his various customers to pay different per unit prices for his product. Diagrams VII A-C have been constructed to illustrate this possibility. The scale of each of these diagrams is identical, and all points with the same label have the same coordinates. Thus, OF (and correspondingly MC_{AX}) in

46. Thus, for example, toilet paper has been tied to toilet paper dispensers, *Morgan Envelope Co. v. Albany Perforated Paper Co.*, 152 U.S. 425 (1894); buttons to button-fastening machinery, *Heaton-Peninsular Button-Fastener Co. v. Eureka Specialty Co.*, 77 F. 288 (6th Cir. 1896); staples to stapling machines, *Rupp and Witgenfeld Co. v. Elliott*, 131 F. 730 (6th Cir. 1904); mimeograph supplies to mimeograph machines, *Henry v. A. B. Dick Co.*, 224 U.S. 1 (1912); punch cards to computers, *International Business Machines Corp. v. United States*, 298 U.S. 131 (1936); salt to salt-dispensing machinery, *Morton Salt Co. v. G. S. Suppiger Co.*, 314 U.S. 488 (1942); steel strapping to applying machines, *Signode Steel Strapping Co. v. FTC*, 132 F.2d 48 (4th Cir. 1942); rivets to riveting machines, *Judson L. Thomson Mfg. Co. v. FTC*, 150 F.2d 952 (1st Cir. 1945); and cans to can-closing machinery, *United States v. American Can Co.*, 87 F. Supp. 18 (N.D. Cal. 1949).

47. The point elasticity of demand at any given price is equal to $\frac{\Delta Q}{Q} / \frac{\Delta P}{P}$.

DIAGRAM VII A

DIAGRAM VII B

DIAGRAM VII C

Diagram VII A equals OF in Diagram VII B equals OF in Diagram VII C. The demand and marginal revenue curves in Diagram VII C equal the sum of their counterparts in Diagrams VII A and B, *i.e.*, $DD_{XA(Y1+Y2)} = dd_{XAY1} + dd_{XAY2}$ and $MR_{XA(Y1+Y2)} = mr_{XAY1} + mr_{XAY2}$. As indicated, MC_{AX} has the same value in each of the accompanying diagrams.

Tie-ins

Clearly, since X 's single overall profit-maximizing price ON ⁴⁸ is higher than the single price that will maximize his returns on his sales to $Y2$ (OL)⁴⁹ and lower than his single profit-maximizing price to $Y1$ (OT)⁵⁰, X will be able to increase his gross profits if he can raise the price $Y1$ pays him for A while lowering his charge to $Y2$. Thus, by forcing $Y1$ to pay him OT rather than ON for A , X will increase his gross profits by GHW . Similarly, by lowering his price to $Y2$ from ON to OL , X will increase the difference between his total revenue and the cost of the goods he sells by VJI .

However, despite its potential profitability, price discrimination will often be impracticable and/or prohibitively expensive to implement. Thus, in order to practice price discrimination, X will have to identify relevant differences in his customers' demands, prevent buyer arbitrage, force some of his customers to pay higher prices than others, and risk prosecution under the Robinson-Patman Act. Obviously, to the extent that X can increase the efficiency with which he performs these tasks, his ability to earn profits through price discrimination will be enhanced.

A. Increasing the Profitability of Price Discrimination When the Tied and Tying Products Are Not Related

In this subsection, we will consider the possibility that tie-ins may enable X to practice price discrimination more effectively in the general case in which the tied and tying products are unrelated. We have already noted that where A is a durable product or patented or secret process or idea, X will be likely to use tie-ins to implement a meter pricing system to reduce the cost of determining his customers' demands when $dd_{XAY1}, dd_{XAY2}, \dots, dd_{XAYN}$ differ significantly. As we shall see, tie-ins can serve prospective price discriminators in several other capacities as well. In fact, tying agreements may help such firms overcome all of the other obstacles to successful price discrimination.

By concealing the fact that X is charging some of his customers less for his product than others, a properly devised tie-in can reduce the risk of prosecution under the Robinson-Patman Act and decrease the

48. ON is the demand price that corresponds to the output at which $MR_{XA(Y1+Y2)}$ and MC_{AX} intersect in Diagram VII C.

49. OL is $Y2$'s demand price at the output at which mr_{XAY2} intersects MC_{AX} in Diagram VII B.

50. OT is $Y1$'s demand price at the output at which mr_{XAY1} intersects MC_{AX} in Diagram VII A.

probability that customers such as *Y1* will demand to be charged the same price as *Y2*. Thus, if instead of charging *Y1* *OT* and *Y2* *OL* for *A*, *X* charges both *OT* and offers *Y2* an equal amount of some product *B* which *Y2* also uses for *LT* less than its prevailing market price,⁵¹ he may be able to camouflage his price discrimination sufficiently to prevent its detection by the antitrust enforcement agencies and/or customers such as *Y1*. Clearly, to the extent that tie-ins succeed in concealing such discrimination, they will increase *X*'s prospective returns by reducing the risk of antitrust prosecution and depriving *Y1* of a useful bargaining point in his negotiations with *X*.

Second, where *B* is less transferable than *A*, such a tie-in may also decrease the ability of *Y1* and *Y2* to engage in buyer arbitrage, for although the tie-in will not affect *A*'s *de facto* price to *Y2*, it may force him to purchase more *B* than he can use himself whenever he buys *A* for resale to *Y1*. Since, on our assumption of non-transferability, *Y2* will not be able to resell this *B* without taking a loss, such a tie-in will reduce and may eliminate his incentive to engage in buyer arbitrage.

Thus, tie-ins can be used in many capacities to increase the profitability of price discrimination. In various situations, suitably devised tying agreements can be employed to identify relevant differences in individual or sub-group demands, to conceal price discrimination from antitrust enforcement agencies and high-price customers, and to prevent buyer arbitrage.

B. Increasing the Profitability of Price Discrimination When the Tied Product Is a Related Good Whose Prevailing Market Price Exceeds Its Marginal Cost of Production

Where *X* produces some good *B* that is complementary to *A* and sells for more than its marginal cost of production, tie-ins may enable him to increase his returns by decreasing the cost of preventing the losses that would otherwise result from *B*'s non-marginal cost price. In order to simplify our analysis and differentiate this function from those already discussed, we will assume (1) that *A*—a differentiated product—and *B*—a standardized good—are inputs used by *Y* in fixed proportions to produce some final good *D* and/or (2) that *X* can engage in perfect

51. *X* could also camouflage his discrimination by offering to sell *A* to both *Y1* and *Y2* for *OL* per unit but conditioning his sales to *Y1* on *Y1*'s agreeing to purchase an equal amount of *B* for *LT* more than its prevailing market price. However, since under these terms *Y2* would not have to purchase more *B* than he needed in order to buy *A* for resale to *Y1*, this tie-in will not enable *X* to prevent buyer arbitrage.

lump-sum pricing on his differentiated product *A*. Under either of these assumptions, *X* will have no reason to shift the locus of his non-marginal cost pricing from *A* to some other product. However, if *B* is sold for more than its marginal cost, *X* may still find it profitable to force buyers of *A* to purchase the *B* they use in conjunction with his differentiated product from him as well.

DIAGRAM VIII

Diagram VIII illustrates this possibility.⁵² In constructing this diagram, we have assumed (1) that *D* is produced by combining *A* and *B* with *L* (labor); (2) that *D* is produced under conditions of constant returns; (3) that *A*, *B*, and *L* are used in fixed proportions; (4) that the units of *A*, *B*, and *L* are defined so that one unit of *A*, one unit of *B*,

52. Most of this argument was originally made by Burstein, *supra* note 17, at 66-67, citing Friedman, unpublished lecture.

and one unit of L are used to produce one unit of D ; (4) that Y could make returns equal to UVW by using some inferior input instead of A ; (5) that X can engage in perfect lump-sum pricing on A without incurring prohibitive costs; and (6) that X also produces B , whose prevailing market price exceeds its marginal cost of production.

Before proceeding with our analysis, it may be useful to discuss the way in which these assumptions are manifest in the accompanying diagram. MC_{BX} and MC_{AX} indicate the marginal cost X must incur to produce successive units of the inputs in question. Since A and B are used in fixed proportions and D is produced under conditions of constant returns, MC_{BX} , MC_{AX} , MC_1 and MC_2 are horizontal throughout, and since we have defined the units of Y 's inputs so that one unit of each is used to produce one unit of D , $MC_1 = MC_{AX} + MC_{BX} + MC_L$ and $MC_2 = M_{AX} + P_B + MC_L$.

We should now be in a position to determine why X might find it profitable to condition his sales of A on his customers' agreeing to purchase the B they use in conjunction with A from him as well. If B were produced by a perfectly competitive industry—i.e., if $P_B = MC_B$, X would not have an incentive to impose a tying agreement under our present assumptions. Given our supposition that X can engage in perfect lump-sum pricing, he would simply charge Y $UVRN$ for the right to purchase his requirements of A at the TSM price OM . $UVRN$ represents the difference between the returns Y would earn if he could purchase A for price OM without paying a lump-sum fee (the area between his marginal revenue [MR_{YDZ}] and marginal cost [$MC_1 = MC_{AX} + MC_{BX} + MC_L$] curves) and the profits he would realize if he did not use A at all—i.e., $UVRN$ is equal to the difference between WRN and UVW . In what follows, it will be convenient—though not realistic—to assume that UVW equals zero, i.e., that Y cannot make any profits without using A . Under this assumption, if B 's price is perfectly competitive, X will be able to earn returns NRW by engaging in perfect lump-sum pricing.

However, to the extent that B 's price exceeds its marginal cost, X 's returns on A will be lower than they otherwise would have been. Thus, if B is sold for some price OI (FI above its marginal cost) X will be able to charge Y only WTS (on our assumption that WUV equals zero) for the right to purchase A at X 's TSM marginal cost. Accordingly, if X does not produce B , his net loss from the non-competitive price of B will equal $STRN = TRP + IKHF$. Of this amount, TRP will equal the transaction surplus lost as a result of the reduction in Y 's output of D from NR to NP and $STPN = IKHF$ will equal the surplus that X

Tie-ins

loses to suppliers of *B*. Of course, if *X* produces *B* in addition to *A*, his loss will be reduced to the extent that *YI . . . N* buy *B* from him as well. Thus, if *YI . . . N* buy *FG* of their total requirements of *B* (*FH*) from *X*, *B*'s non-marginal cost price will reduce the producer surplus he realizes on his transactions with *Y* by $TRP + JKHG$, and not by $TRP + IKHF$.

Indeed, if *X* produces *B*, he will be able to eliminate this loss altogether by charging *Y* his marginal cost for the *B* he uses with *A*. In fact, if *X* manufactured only enough *B* to supply *YI . . . N*, he could accomplish this result without incurring any costs at all, for since *A* and *B* are complementary inputs, *X* could simply match his reduction in the price of *B* with an identical increase in his lump-sum fee (or his single price if *X* uses that method of pricing *A*). In Diagram VIII, for instance, if *X* reduced his price of *B* from *OI* to *OF*, he could increase his lump-sum charge on *A* from *WTS* to *WRN*.⁵³ Clearly, the associated reduction in the producer surplus *X* gains when selling *B* to *Y* (*IKHF*) will be more than offset by the resultant increase in his surplus on *A* (*STRN*).

In practice, however, *X* will frequently sell *B* to buyers who do not use this product in conjunction with *A*. To the extent that such sales are significant, two factors will offset the positive effect of this strategy on the profits *X* realizes on his sales to *Y*. First, since *X* will presumably continue to sell *B* to other buyers at its prevailing market price (*FI* above its marginal cost),⁵⁴ the prospective profitability of making a selective price reduction to *Y*—i.e., of engaging in overt price discrimination—will be reduced by the possible costs of being prosecuted under the Robinson-Patman Act. Second, since *X*'s original price cut to *Y* will tend to reduce the price he can obtain in the general market for *B* both by inducing his competitors to retaliate and by giving his other customers an incentive to bargain more intensively, the profitability of such concessions will be reduced to the extent that *X* sells *B* to buyers who do not purchase *A*. Clearly, in any given case, either or both of these effects may be sufficient to make it unprofitable for *X* to charge *Y* his marginal cost for *B*.

53. To the extent that *B* is a differentiated product, *X*'s speed of service is lower than his competitors', or *Y* has valued business connections with his original supplier, *X*'s ability to raise his lump-sum fee will be reduced.

54. Clearly, if *X*'s sales of *B* to producers other than *Y* are substantial, he will not find it profitable to charge *Y* his marginal cost for *B* if in order to do so he has to reduce his price to his other customers as well, for the positive effect of the strategy on the profits he earns on his sales of *A* and *B* to *Y* will be more than offset by its negative impact on the returns he realizes in the general market for *B*.

But even if such price cuts are profitable, X will probably not choose to overcome the effect of B 's non-marginal price in this way, for by employing a tie-in, X will be able to duplicate the effect of a direct price cut on the profits he earns on his sales to Y without incurring so great a risk of antitrust prosecution, competitive retaliation, and/or intensified bargaining. For example, if in Diagram VIII, X offers to sell Y his full requirements of A at price OL per unit (*i.e.*, at a price LM below his own marginal cost) in exchange for Y 's agreeing (1) to pay a lump-sum fee equal to WRN and (2) to purchase all the B he uses in conjunction with A from X as well at the prevailing market price $OI - FI = LM$ above its marginal cost OF —he will accomplish the same result that a direct price cut would have effected ($WRN + I\beta\alpha F - M\Sigma\Delta L = WRN$ since $LM = FI$ and $F\alpha = L\Delta = NR$) without giving the appearance of having made a discriminatory and/or competitive price reduction on B .

Since under this agreement Y will appear to be paying X the going rate for B , the antitrust enforcement agencies and X 's other customers will be less likely to detect his *de facto* price discrimination than they would had he made an overt price reduction. Although X 's competitors in the market for B will probably not be deceived by this technique, there are two reasons why their reaction to the tie-in will also tend to be less severe than their response to a series of comparable price cuts to $Y1 \dots N$. First, while the conventional price reductions might be interpreted to be part of an unlimited competitive campaign, X 's competitors will realize that the tie-in is restricted to $Y1 \dots N$, *i.e.*, while price concessions might make X 's competitors think that their whole market for B was being placed in danger, they will understand that tying agreements will not affect their share of the general market for B , but will only affect their ability to make sales to $Y1 \dots N$. Obviously, since tie-ins will pose less of a threat to X 's competitors, they will be less likely to retaliate to this maneuver than to direct price concessions, *ceteris paribus*. Second, while X 's competitors may not realize that X has a competitive advantage when selling B to Y if he simply cuts his price to these buyers, the tie-in will make it clear that he can offset his price cuts on B by raising the price he charges for A . Since the tie-in will be more likely to make X 's competitors understand that they are at a distinct disadvantage when selling to Y , they will be less likely to defend against the tying agreement than against an overt price concession.

Thus, whenever X produces some complement B whose price exceeds its marginal cost, he may profit by employing tie-ins rather than overt

Tie-ins

price concessions to prevent the losses that would otherwise result from B 's non-marginal cost price.⁵⁵ Since it appears that tie-ins are frequently

55. Precisely the same analysis will apply where X single prices rather than lump-sum prices. Diagram IX illustrates this possibility. Once more, our construction is based on the assumption that D is produced under conditions of constant returns and that the units of A , B , and L are defined so that one unit of each is required to produce one unit of D . We also continue to suppose that Y cannot produce D profitably without using input A .

DIAGRAM IX

Under these assumptions, the demand curve that X will face when selling A to Y — DD_{XAY} —will be equal to the difference between the marginal revenue curve Y faces when selling D to Z — MR_{YDZ} —and the marginal cost to Y of the other factors he uses to produce good D — $MC_{(B+L)Y}$. Thus, if B 's price is perfectly competitive, i.e., if $MC_{BY} =$

OH in Diagram IX, X will face DD_{XAY}^* when selling A to Y . ($\Delta - \beta = \phi - \theta = OG + OH$.) X 's corresponding single profit-maximizing price for A —determined by the intersection of MR_{XAY}^* and MC_{AX} —will be OW , and his associated returns will be $W\theta TR$.

However, to the extent that B 's price exceeds its marginal cost, Y 's demand for A and

imposed by firms that produce the tied product in a non-perfectly competitive market,⁵⁶ this function is probably quite significant.

C. Simulating the Effect of Price Discrimination by Combining Demands to Increase the Efficiency of Apparently Uniform Pricing

In Appendix A, we note that the efficiency of single pricing is directly related to the extent to which the demand faced by the seller is "bowed upward" to the left of his *TSM* output. Where buyers who place a relatively high value on one or more of a seller's products are likely to place a relatively low value on some of his others, the demand that the seller faces when marketing a group of his products together

X's returns on *A* will be lower than they otherwise would have been. Thus, if the price of *B* equals P_B in diagram IX—i.e., if P_B is *HL* above the marginal cost of *B* to its producer, *OL*, and not $OG + OH$.) *X*'s corresponding single profit-maximizing price—determined by the intersection of MR_{XAY} and MC_{AX} —will be *EV*, and his corresponding returns will

ducer, *X* will face DD_{XAY} and not DD_{XAY}^* when selling *A* to *Y*. ($\Delta - \alpha = \phi - \Sigma = OG +$ be *UVSR*, *WATSVU* less than before. Of this loss, *LNJH* represents the surplus earned by *B*'s suppliers and the remainder the transaction surplus lost as a result of *Y*'s reducing his output of *D* from *OF* to *OE*. Of course, if *X* produces *B* in addition to *A*, the negative impact of *B*'s non-marginal cost price on the profits he realizes on his sales to *Y1 . . . N* will be reduced to the extent that *Y1 . . . N* buy *B* from him as well. Thus, if *Y1 . . . N* buy *HI* of their total requirements *HJ* of *B* from *X*, the effect of *B*'s non-marginal cost price on the profits *X* earns on his transactions with *Y* will be reduced by *LMIH*.

Indeed, if *X* produces *B* as well as *A*, he will be able to raise his profits on his sales to *Y* back to *WθTR* simply by charging *Y* his marginal cost for product *B*. Although this strategy will eliminate the profits he originally earned by selling *B* to *Y*—*LMIH*—this effect will be more than offset by its positive impact on *Y*'s demand for *A* and correspondingly on *X*'s returns from selling *A* to *Y*. Thus, given his marginal cost price on *B*, *X* will once more charge *OW* for *A* and realize surplus *WθTR* on his sales of this product to *Y*.

However, to the extent that *X* sells *B* to other buyers than *Y*, the positive effects of this strategy on the profits *X* earns on his sales to *Y* will be more or less offset by the costs of whatever Robinson-Patman Act prosecutions, competitive retaliations, and additional buyer bargaining his overt price concessions to *Y* engender. Clearly, in any given case, these costs may be prohibitive. Indeed, even when they are not, *X* will most likely not choose to make such overt price cuts on *B* to *Y*, for by employing a tie-in, he will be able to duplicate the effect of such concessions on the profits he earns on his sales to *Y* at much less cost to himself. Thus, instead of charging *Y* *OH* for *B* and *OW* for *A*, *X* will offer to sell *Y* all the *A* he wants for some price *Oq* per unit ($qW = HL$) in exchange for *Y*'s agreeing to purchase all the *B* he uses in conjunction with *A* from *X* as well as its prevailing market price *OL*.

Since $qW = HL$, the tie-in will enable *X* to realize the same returns on his sales to *Y* as he would by the overt price concession, i.e., $q\theta\text{STR} + LPKH = W\theta\text{TR}$ where qW equals *HL* and $W\theta\text{SQ}$ therefore equals *LPKH*. However, since the nominal price *X* charges *Y* for *B* under the tying agreement is the same as the price he charges other buyers of this product, this device is less likely to attract the attention of the antitrust enforcement agencies and *X*'s other customers than the overt price concession. And since this competitive maneuver manifests *X*'s advantage when selling *B* to *Y* more clearly and is more obviously limited in scope than overt price concessions, *X*'s competitors will be much less likely to retaliate to the imposition of tie-ins than to selective, overt price reductions. Thus, regardless of the pricing technique *X* employs on product *A*, he will profit by using tie-ins rather than overt price concessions to prevent the losses that would otherwise result from *B*'s non-marginal cost price.

56. In general, see Burstein, *supra* note 17, at 67-68.

Tie-ins

may be more suitable for single pricing than the separate demands for the individual products in question, *i.e.*, single pricing may be better adapted to some demand $DD_{X(A+B+O)Y}$ than to the weighted average of DD_{XAY} , DD_{XBY} , and DD_{XOY} . In effect, by combining the group's demand for his individual products, the tie-in will enable the seller to simulate the effect of charging different members of the group different prices for the goods in question, *i.e.*, by converting his customers' surplus (at the pre-tie-in uniform price) on the products on which they place a relatively high value into *de facto* price cuts on the products on which they place a relatively low value, the tie-in will simulate the effect of price discrimination.

Before proceeding to illustrate this possibility graphically, it may be useful to work through an arithmetic example. Tables I and II describe a situation in which X sells three products A, B, and C to four customers Y1, Y2, Y3, and Y4. As you can see, buyers who place a relatively high value on one of X's products tend to place a relatively low value on one of his others. If we assume that X's marginal cost for each of these goods is zero, X's producer surplus will equal his total revenue. X's optimal pricing strategy can then be determined from the information provided by Table II. Since a price of \$2 generates more revenue

TABLE I
THE VALUE OF X'S PRODUCTS TO HIS INDIVIDUAL CUSTOMERS

Customer Product(s)	Y1	Y2	Y3	Y4
A	\$3	\$2	\$1	\$2
B	2	3	2	2
C	1	1	3	2
A + B + C	6	6	6	6

TABLE II
THE TOTAL REVENUE GENERATED BY VARIOUS SINGLE PRICES
(Equals the Total Producer Surplus Where $MC = 0$)

Price Product(s)	\$1	\$2	\$3	\$6	Price Discrimination
A	\$ 4	\$ 6	\$ 3	\$ 0	\$ 8
B	4	6	3	0	8
C	4	6	3	0	8
$\Sigma(A + B + C)$ priced individually	12	18	9	0	24
A + B + C package priced	4	8	12	.24	—

on each of his products than any single alternative, \$2 is X 's optimal single price for A , B , and C . However, since $Y1 \dots 4$ place different values on X 's products, X will be able to increase the producer surplus he realizes by engaging in price discrimination, *e.g.*, by changing $Y3$ \$1 for A , $Y2$ and $Y4$ \$2, and $Y1$ \$3 for the product in question. Thus, the total amount of producer surplus that X will realize if he practices price discrimination—\$24—exceeds the maximum surplus uniform single pricing can generate—\$18. In fact, since buyers who place relatively high values on one of X 's products place relatively low values on others, the maximum surplus that X can realize by uniform single pricing on each individual product will also be less than the surplus that he can earn by setting a uniform single price on all three products taken together. Indeed, since in our example, each buyer places the same value on $(A + B + C)$, X 's optimal uniform package price (\$6) will generate the same amount of producer surplus as perfect price discrimination—\$24.

We have already noted that this superiority of uniform package pricing to uniform single pricing should be reflected graphically in the slope of the associated demands. The information in Table I has been represented in Diagram X on the assumption that the data are continuous. As you can see, $DD_{X(A+B+C)Y}$ is far more bowed upward to the left of X 's TSM output than DD_{XAY} , DD_{XBY} , and DD_{XCY} . Thus, our arithmetic demonstration that uniform package pricing will generate more producer surplus in the circumstances described is confirmed by our diagrammatic analysis.

Of course, X could have generated as much producer surplus by practicing price discrimination in the conventional manner. Nevertheless, for three reasons, package pricing will tend to be more profitable than conventional price discrimination. First, since the value that their users place on the several products taken together will tend to be more homogeneous than the value they place on the individual products taken separately, the tie-in will reduce the cost of price discrimination by eliminating the necessity of identifying which buyers value particular products relatively highly (and lowly). Second, since under the tie-in buyers will have to purchase all the tied products to obtain one good for resale, package pricing will reduce the profitability of buyer arbitrage, for, frequently, the original buyer will not need additional units of the remaining products and transference costs will be high. Third, the tie-in will reduce the probability of prosecution under the Robinson-Patman Act, for since each buyer will pay the same price for the package X offers, price discrimination will be more difficult to

Tie-ins

DIAGRAM X A

DIAGRAM X B

detect and prove. Accordingly, whenever a seller suspects that buyers who place a relatively high value on one or more of his products place a relatively low value on some or all of his others, he may be able to employ a tie-in to gain the benefits of price discrimination without incurring all the costs.⁵⁷

Tie-ins seem to be used as part of a package pricing scheme in many industries. For example, since the relative values placed on various types of movies by individual cinema clientele will differ significantly, the movie industry adopted the practice of block-booking or package

⁵⁷ For expositional reasons, we have confined our textual analysis to the case in which $Y1 \dots 4$ buy only one unit of A , B , and C . Precisely the same reasoning will apply where each customer has a normal, downward-sloping demand curve.

pricing. Similarly, since individual advertisers tend to place different relative values on morning, afternoon, and evening advertising space, many newspapers tie the sale of advertising space in each of their papers together.⁵⁸ Thus, the function we are now discussing is more than a theoretical possibility.

4. *Concealing Violations of Maximum and Minimum Price Regulations*

Whenever a producer is prohibited from charging his profit-maximizing price by a maximum or minimum price regulation, he will be able to increase his gross profits by violating this legal constraint. Thus, if producer *X* in Diagram XI successfully evades a regulation that establishes a maximum price of *OE* (or a minimum price of *OH*), *i.e.*, if he chooses to charge his customers his single profit-maximizing price *OG—GE* above the legal maximum (or *GH* below the legal minimum)—he will be able to increase his returns by *BDC* (or *FBA* respectively). Of course, these prospective gains will not necessarily make it profitable for *X* to disregard the relevant regulations, for they will always be more or less offset by the possible costs of detection and prosecution. Naturally, the lower the probability that such violations will be discovered, the greater the profitability of setting an illegal price.

We have already noted that tie-ins may be used to camouflage price discrimination. In precisely the same way, such agreements may enable producers to conceal violations of maximum or minimum price regulations, *i.e.*, to reduce the probability that such violations will be detected. Thus, by agreeing to sell his customers all the *A* they want at the legal maximum price *OE* (at the legal minimum price *OH*) on condition that they also purchase an equal amount of some product *B* which they use as well for *GE* more (*GH* less) than its prevailing market price, *X* will be able to charge his single profit-maximizing price without losing the appearance of legality. Obviously, to the extent that such an arrangement prevents enforcement agencies from detecting *X*'s violation, it will increase the profitability of evading the regulations in question. Undoubtedly, in many situations, the certainty equivalent return to violations undertaken by means of evasive tie-ins will be positive. Where they are, the possibility that tie-ins may be employed to evade such price regulations will arise. Thus, wartime whiskey purchasers were sold price-controlled whiskey at the maximum legal price

58. See *Times-Picayune Publishing Co. v. United States*, 345 U.S. 594 (1953).

DIAGRAM XI

on condition that they also buy unregulated rum and/or wine for more than their prevailing market price.⁵⁹

II. Non-Pricing Functions

1. Preventing the Use of Inferior Complements

X may also employ tie-ins to prevent his customers from using or selling the tying commodity in conjunction with one or more complements that reduce the transaction surplus it generates. Buyers may pur-

59. See Bowman, *supra* note 36, at 22-23.

sue such behavior either out of ignorance or because their interests conflict with their supplier's. Thus, purchasers of mimeograph machines may mistakenly use ink that impairs their proper functioning,⁶⁰ and automobile dealers may install substandard parts that injure the performance and reputation of the cars they sell.⁶¹ In all such cases, X's customers' returns as well as his own will suffer.

However, this result will not obtain universally. In many situations, X's individual customers will find it profitable to use or sell some complement that reduces the overall transaction and producer surplus the tying product generates. Howard Johnson's restaurant chain may serve as an example. In general, local Ho-Jos are run by independent proprietors who serve both local residents and interstate travellers. Local residents—who will tend to be repeat buyers—will be attracted by the quality and price of the restaurant's food, while interstate travellers—who will normally not be repeat buyers—will base their patronage on Howard Johnson's reputation. Accordingly, Ho-Jo restaurateurs in relatively poor areas may find it profitable to lower the price and quality⁶² of their non-differentiated products, for by doing so, they may be able to increase their local patronage without reducing their sales to non-repeat interstate buyers significantly. However, although the local proprietor will not have to be concerned with the effect of its quality on the future purchases of interstate customers who prefer higher quality, Howard Johnson's sales of its ice cream and other differentiated products will suffer if such buyers decide not to patronize its restaurants in other parts of the country. Thus, a complement that increases the returns of local Ho-Jo outlets may reduce the chain's overall profits, for since the effect of the individual proprietor's decision on other outlets' sales will be external to him, he will not consider this consequence of his price-quality decisions. Accordingly, if Howard Johnson wants to prevent such losses, it will have to require its outlets to sell complements of specified quality. Tie-ins are one way of implementing such a requirement.

60. This argument was offered in defense in *Henry v. A. B. Dick Co.*, 224 U.S. 1 (1912).

61. This argument was offered in defense in *Pick Mfg. Co. v. General Motors Corp.*, 80 F.2d 641 (7th Cir. 1935). See also *International Business Machines Corp. v. United States*, 298 U.S. 131 (1936), and *United States v. United States Shoe Mach. Co.*, 247 U.S. 32 (1918).

62. Although we have assumed in the text that the local outlet is selling an inferior price-quality combination, the same analysis will apply where a local proprietor finds it profitable to sell superior goods at higher prices to interstate travellers who would prefer a lower price-quality combination. Admittedly, this argument assumes that economies of scale make it unprofitable for the restaurateur to offer both the high and the low price-quality combinations.

Tie-ins

Of course, tie-ins are not the only way of accomplishing this objective. For example, the seller could simply send his customers detailed specifications for the complements they use. Clearly, however, this technique will be neither costless nor completely effective. Even where there is no conflict of interest, purchasers may not follow their supplier's instructions, particularly if they are offered an apparently "good buy" on a complement whose deviations from the standard seem minor to them. Where the interests of the seller and his customers diverge, the need to police such requirements will rise accordingly. By insuring the buyer's compliance,⁶³ the tie-in will eliminate inspection costs and increase the profitability of preventing the use of inferior complements.

2. Reducing the Aggregate Taxes, Royalties, and/or Franchise Fees Due on the Tying Firm's Profits or Sales.

We have already seen that tie-ins can help producers conceal violations of anti-price discrimination statutes or maximum or minimum price regulations. In precisely the same way, such agreements can be used to reduce the taxes, royalties, and/or franchise fees that the tying firm must pay on its profits or sales. Let's assume (1) that in addition to X 's product A , $Y1 \dots N$ also consume some product B and (2) that the marginal tax, royalty, or variable franchise fee rate applied to X 's profits on or sales of A are higher than their counterparts for B .⁶⁴ Under such conditions, X may be able to reduce these assessments by conditioning his sale of A at less than his profit-maximizing price on his customers' agreeing to purchase a specified amount of B at a correspondingly higher price, for by reducing X 's nominal profits on or sales of A , such a tie-in will lower the base to which the higher rate(s) are applied. Of course, this transaction amounts to no more than a normal price reduction on A coupled with an under-the-table rebate from Y , but in some circumstances the tie-in may increase the probability that X 's fraud will not be detected.

Conclusion

Thus, seller-imposed tie-ins can perform several functions that appear to be totally unrelated to the leverage theory adopted by the

63. We assume that the cost of transferring the complement is sufficiently high to deter the buyer from reselling the tied product and using an inferior good in its place. In any case, where the tied product is also branded, such resales will be fairly easy to detect.

64. For instance, B may be a quasi-capital or capital asset while A is part of X 's ordinary inventory, i.e., X 's profits on B may be taxed at the capital gains rate and not as ordinary income. See INT. REV. CODE OF 1954 §§ 1221, 1231. Alternatively, A may be produced with a patented machine, leased under an endproduct royalty agreement.

courts. Given the functional flexibility of such agreements, it would certainly be surprising if the Supreme Court's monolithic analysis were entirely satisfactory. After delineating the functions of buyer-imposed tie-ins and reciprocity in Part II, we will examine the adequacy of the Court's reasoning and the desirability of its rulings in the concluding section of this article.

APPENDIX A: THE PROFITABILITY OF LUMP-SUM PRICING

In general, the profitability of charging lump-sum fees will be (A) directly related (1) to the inefficiency of single pricing—*i.e.*, to the percentage of maximum transaction surplus that the seller cannot recover through single pricing; (2) to the size of the transactions involved—*i.e.*, to the amount of transaction surplus involved;⁶⁵ (3) to the seller's relative bargaining power; (4) to the extent to which the demand for the seller's product responds to his immediate customers' advertising and promotion⁶⁶ and (B) inversely related (5) to the (positive) difference between the seller's size and liquidity and the financial strength of his (weighted) average customer—*i.e.*, to the extent to which the seller is less averse to taking risks than his (weighted) average customer;⁶⁷ (6) to the variability of his customers' market shares—*i.e.*, to the (positive) difference between the amount of additional risk his customers will have to bear under lump-sum pricing and the extra risk he would have to bear under single pricing;⁶⁸ (7) to the costs of devising and executing the agreements in question;⁶⁹ (8) to the costs of enforcing (or not enforcing) the agreements in question—*i.e.*, to the costs of preventing (or not preventing) buyer arbitrage (*i.e.*, directly related to the cost of transferring the seller's product);⁷⁰ (9) to the extent of the seller's ignorance—*i.e.*, to the costs to the seller of determining (or not determining) his customers' expected demands—and, derivatively, to the extent to which his customers' demands differ from each other;⁷¹ (10) to the extent to which the seller's customers are unduly pessimistic about the size of their expected demands and/or about the probability that their actual demands will be lower than expected;⁷² and (11) to the extent to which suitable products are available for increasing the efficiency of non-marginal cost pricing.⁷³ Since the relevance of most of these factors should be apparent from the text,⁷⁴ we will confine our

65. See p. 1405 *supra*.

66. See pp. 1430-35 *supra*.

67. See p. 1410 *supra*.

68. *Id.*

69. See p. 1405 *supra*.

70. See p. 1412 *supra*.

71. See p. 1411 *supra*.

72. *Id.*

73. *Id.*

74. See references in notes 65-73 *supra*.

present analysis to the two variables that have not yet been explicitly considered: the overall "efficiency" of single pricing and the strength of the seller's bargaining position.

Obviously, the higher the ratio of the producer surplus that can be generated by single pricing to the maximum transaction surplus the seller could create (the $\frac{PS}{MTS}$ ratio), *i.e.*, the more efficient single pricing, the smaller his incentive to engage in lump-sum pricing, other things being equal. In general, the more bowed upward the demand faced by a given seller to the left of his *TSM* sales volume (*i.e.*, the greater its absolute slope, averaged vertically) and the less bowed downward his marginal cost curve, the more efficient single pricing.

Diagrams XII A-C illustrate these relationships. Their shaded portions indicate the producer surplus a seller would realize if he set the single "profit-maximizing" price in the situations represented. In these diagrams, identical labeling indicates that the curves in question are also identical. Thus, MC_1 in Diagram XII A is identical to its counterpart in Diagram XII B, and DD_2 in Diagram XII B is identical to its counterpart in Diagram XII C.

The impact of the shape of the demand curve on the effectiveness of single pricing is manifest in Diagrams XII A and B. Marginal costs are equal in both situations. Only demands have been changed. Thus, the sole difference between Diagrams A and B is that DD_1 is bowed somewhat upward while DD_2 is bowed in the opposite direction—*i.e.*, DD_1 is sloped relatively steeply near the *TSM* output and relatively gently near the $\$$ axis while these relations have been reversed in the construction of DD_2 . The impact of this disparity should be apparent. $\frac{BEDA}{CFA}$

$= \frac{PS}{MTS}$ is much higher in situation A than in situation B, *i.e.*, single pricing is much more effective when demand is bowed upward than when it is bowed downward. Speaking broadly, this result can be accounted for by two facts. First, the steeper the slope of the demand curve near the *TSM* output relative to its average slope throughout, the smaller the percentage reduction in sales caused by single price "profit maximization." Thus, $\frac{DF}{AF}$ in Diagram XII A is smaller than its coun-

terpart in Diagram XII B. Second, the gentler the slope of the demand curve near the $\$$ axis, the smaller the amount of buyer (*i.e.*, consumer or retailer) surplus that will escape the single profit-maximizing price if other things are equal. Of course, the *ceteris* need not always be *paribus*, but taken together, these two factors do establish our conclusion that the effectiveness of single pricing will increase with the extent to which demand is bowed upward.

Diagrams XII B and C illustrate the effect of differing marginal cost curves on the ability of single pricing to generate and absorb transaction surplus. In these diagrams, demand has been held constant and

DIAGRAM XII A

DIAGRAM XII B

DIAGRAM XII C

Tie-ins

marginal cost has been allowed to vary. Obviously, marginal cost is far more bowed downward in Diagram XII C than in Diagram XII B. The effect of this disparity is apparent: $\frac{PS}{MTS}$ is far greater in Diagram XII

B than in Diagram XII C, *i.e.*, $\frac{BEDA}{CFA}$ in Diagram XII B is far greater

than $\frac{DHG - BDA}{CHGB}$ ($BDA = DFE$ by construction) in Diagram XII C.

Downward-bowed marginal cost curves militate against single pricing in two ways. First, the more positive the slope of the *MC* curve to the left of the *TSM* output, the greater the transaction and producer surplus that non-marginal cost pricing will fail to generate, other things—*e.g.*, the output at which *MC* and *MR* intersect—being equal. Second, the more negatively-sloped the marginal cost curve to the left of the single price “profit-maximizing” output, the smaller the transaction and producer surplus that will be generated on the sales that are actually made. Thus, roughly speaking, the profitability of lump-sum pricing will be inversely related to the extent to which demand is bowed upward and directly related to the extent to which marginal cost is bowed downward.

The profitability of engaging in some lump-sum pricing will also be directly related to the strength of the seller's bargaining position, *i.e.*, to the extent to which his market power enables him to take away his customers' original surplus and keep the additional transaction surplus his lump-sum offer generates for himself. Even if *X* could devise a perfect lump-sum offer, there would be no reason to expect that he would be able to force his customers to accept these terms, for just as *X* realizes that *Y1 . . . N* would rather pay their demand price for successive units of *A* than do without the product in question, *Y1 . . . N* realize that, other things being equal, *X* would rather make additional sales at his marginal cost than lose their patronage altogether. Thus, *X* and his customers *Y1 . . . N* will play a mixed non-zero sum game—*i.e.*, a game in which neither the total pay-off (here the transaction surplus minus *X*'s pricing and *Y*'s buying costs) nor the individual players' share is fixed. Although the outcome of this sport cannot be determined without a considerable amount of additional information (if it can be determined at all),⁷⁵ *X*'s incentive to incur the additional pricing costs of engaging in lump-sum pricing will obviously increase with the extent to which he can take advantage of its ability to generate additional transaction surplus and convert his customers' original surplus into producer surplus, *i.e.*, will increase with the relative strength of his bargaining position.

Thus, in addition to the factors discussed in the text, the profitability

75. See T. SCHELLING, *THE STRATEGY OF CONFLICT passim* (1960).

of lump-sum pricing will depend on the shape of the demand and cost curves faced by the seller and the power he can exercise when dealing with his customers.

APPENDIX B: FULL-LINE FORCING WHERE THE SLOPE OF DD_{XBY} IS NEGATIVE TO THE LEFT OF X'S TSM OUTPUT

In the text, we assumed that DD_{XBY} was horizontal to the left of X's TSM sales volume, *i.e.*, that X either produced B himself in a perfectly competitive market or purchased B from other manufacturers at its prevailing market price. Clearly, however, full-line forcing may be profitable where these conditions do not prevail. In fact, our previous explanation of full-requirements tie-ins applies equally as well when DD_{XBY} is negatively-sloped to the left of X's TSM sales volume. Nevertheless, the shape of DD_{XBY} does affect the mechanical explication of full-line forcing sufficiently to justify our treating this situation separately.

Where the Tied Product is Differentiated and Pricing is Competitive

Diagrams XIII and XIV have been constructed to illustrate the way in which full-requirements tie-ins operate where X faces a downward-sloped demand in a market in which prices are set competitively,⁷⁶ *i.e.*, where X produces some differentiated product B1 that competes with a large number of similar brands B2 . . . M. We have already noted that where DD_{XBY} is horizontal to the left of X's TSM marginal cost, single pricing will generate as much producer surplus as X can possibly obtain directly on B. Accordingly, where these conditions prevail, X will have no incentive to enter into full-requirements contracts unless they are incorporated into suitable tying agreements. On the other hand, where, as in Diagram XIII, the slope of DD_{XB1Y} is negative, X may find it profitable to enter into full-requirements contracts without imposing a tying agreement.

In order to simplify our analysis and isolate this function from those which increase the profitability of price discrimination, we will assume that $dd_{XB1Y1} = dd_{XB1Y2} = \dots dd_{XB1YN}$. Since, under this assumption, no member of Y will reject X's optimal full-requirements offer,⁷⁷ DD_{XB1Y}^{RO}

76. Where B1 is differentiated, X will not lose all his customers if he charges more than the prevailing market price, for even where prices are not set cooperatively, some buyers will prefer X's product sufficiently to be willing to pay the higher charge. See E. CHAMBERLIN, *THE THEORY OF MONOPOLISTIC COMPETITION* 71-100 (6th ed. 1950).

77. If Y1 . . . N did not have identical demands, DD_{XB1Y}^{RO} would have to be adjusted to take account of the possibility that some members of Y might reject X's optimal uniform full-requirements offer altogether. If some did, it is conceivable that DD_{XB1Y}^{RO} and DD_{XB1Y} would intersect. (It should be noted that we are defining DD_{XB1Y}^{RO} to represent the amount of B that those members of Y1 . . . N who accept X's requirements offer would purchase

DIAGRAM XIII

will be greater than or equal to DD_{XB1Y} . In general, the greater the patronage that $Y1 \dots N$ would otherwise have given X 's competitors —i.e., the more of B 's substitutes $B2 \dots M$ that Y would otherwise have used, the greater the effect of the requirements contract on DD_{XB1Y} .⁷⁸

at different prices.) In Diagrams XIV A and B, both DD_{X1Y} and DD_{XB1Y}^{RC} would have to be adjusted to take this possibility into consideration.

78. Presumably, the higher the price of B , the greater the amount of B 's substitutes that $Y1 \dots N$ would purchase if not constrained by a full-requirements contract if other things are equal. Accordingly, we have constructed DD_{XB1Y} and DD_{XB1Y}^{RC} so that the disparity between them decreases as they approach the quantity axis. Admittedly, in many

Obviously, $Y1 \dots N$ will not be willing to accept an offer which leaves them with negative surplus. Accordingly, X 's price must permit his customers to realize as much surplus on the units they would have purchased independent of their contracts as they lose by being forced to fill the rest of their requirements with $B1$ rather than $B2 \dots M$. In Diagram XIII, for instance, the highest price that X will be able to charge under an independent full-requirements contract without losing his customers' patronage is OE where KGE —the surplus $Y1 \dots N$ realize on their first EG units of $B1$ —equals GHA —the surplus they lose because of their inability to fill their remaining requirements with $B2 \dots M$ (rather than with GH of $B1$). X 's optimal requirements price (OE in Diagram XIII) will generate more producer surplus than his non-requirements single profit-maximizing price (OI in Diagram XIII). Thus, in Diagram XIII, $EHDB$ is greater than $IJCB$, i.e., $FHDC$ is greater than $IJFE$. Hence, if the cost of devising, executing, and enforcing (or failing to enforce) the contracts in question is less than $FHDC - IJFE$, X will find it profitable to enter into such agreements even if an advantageous tie-in cannot be arranged.

Of course, if X also produces a differentiated product A such that $\frac{PS+}{RS-}$ is lower on DD_{XAY} than on DD_{XBY}^{RO} over some relevant range, a full-requirements tie-in will be more profitable than a straightforward requirements contract. Diagrams XIV A and B have been constructed to illustrate this possibility. Let us assume at the outset (1) that the unpredictability of DD_{XAY} , X 's own ignorance, and the cost of preventing buyer arbitrage would make it unprofitable for X to charge his customers a higher lump-sum fee than $\theta\phi\Sigma$ if his only alternative were further non-marginal cost pricing on A and (2) that the differentiation of this product makes it unprofitable for X to enter into full-requirements contracts on A .⁷⁹ If, in addition to this fee, X charges his customer his single profit-maximizing price for A — $O\varepsilon$ — $Y1 \dots N$ will realize buyer surplus $\Sigma\phi\theta\varepsilon$ on A . Obviously, since $O\varepsilon$ is X 's single profit-maximizing

markets, some customers will have such strong preferences for individual brands that although price increases will reduce their purchases, they will not be induced to shift their patronage to another product variety. Obviously, to the extent that $Y1 \dots N$ fall

within this category, DD_{XBY}^{RO} and DD_{XBY} will be nearly identical, and the profitability of full-requirements tie-ins will be reduced correspondingly.

79. Thus, if X has a perfect monopoly of A —i.e., if there are no substitutes for A at all— $Y1 \dots N$ would have to purchase their full requirements of this product from X even if they were not under a contractual obligation to do so. (It should be noted that this analysis would apply even if buyers other than $Y1 \dots N$ could substitute against product A .) In general, the more acceptable the available substitutes for A , the greater the potential gain from entering into full-requirements contracts, if other things are equal. Of course,

if $\frac{\Delta PS+}{\Delta BS-}$ is higher at the highest price that X could charge Y for A under an inde-

pendent requirements contract than it is at the comparable price for B , X might still find it profitable to shift the locus of his non-marginal cost pricing by conditioning his requirements offers on A on the offeree's accepting a requirements contract on B .

DIAGRAM XIV A

DIAGRAM XIV B

price on A , $\frac{\Delta PS+}{\Delta BS-}$ will be negative above $O\epsilon$, and X will not be able

to increase his producer surplus by eliminating his customers' remaining surplus through further non-marginal cost pricing on A .

However, if $YI \dots N$ also use X 's product B in approximate proportion to A , X may be able to increase his total producer surplus by conditioning his sales of A on his customers' agreeing not to purchase any of B 's substitutes $B2 \dots M$. Since ΔPS will be positive at X 's optimal pre-tie-in requirements price—i.e., since OI , X 's optimal pre-tie-in requirements price ($JMA = ZJI$), is less than OW , the price

below which MC_{BIX} exceeds MR_{XB1Y}^{RO} , X will be able to increase his producer surplus by using his buyers' remaining surplus to induce them to enter into a full-requirements contract on B at a higher price than they would otherwise have been willing to accept. Thus, although OI is the highest price that X could extract under an independent requirements contract, $YI \dots N$ would be willing to enter into a full-requirements contract at price OQ if X conditions his sale of A (at price $O\epsilon$ plus lump-sum fee $\theta\phi\Sigma$) on their accepting these terms on B , for although $YI \dots N$ would lose $QSMI = RSG - ZRQ$ on B under such an agreement, this loss would be offset by their concomitant gain on A ($\Sigma\phi\theta\epsilon$), i.e., $\Sigma\phi\theta\epsilon = QSMI = RSG - ZRQ$. Accordingly, although X could not increase his producer surplus by eliminating his customers' remaining surplus on A through further non-marginal cost pricing on this product (since further price increases above $O\epsilon$ —the single "profit-maximizing" price—will reduce producer surplus), he will be able to convert some of this otherwise inappropriable surplus into producer surplus by imposing a full-requirements tie-in. In Diagram XIV, for instance, if X leaves his price on A ($O\epsilon$) unchanged and raises his price on B sufficiently to remove the remaining surplus—i.e., if he raises his price by IQ —the full-requirements tie-in will increase his aggregate surplus by $QSLI - LMFE$. In fact, since ΔPS will most likely still be

positive on DD_{XB1Y}^{RO} after Y 's original surplus has been exhausted—i.e., since OQ will probably be less than OW — X will be able to increase his aggregate surplus still further by lowering his price on A below the single profit-maximizing level (at which $\Delta PS = 0$) and eliminating the resultant surplus by further increases in the price of B . Thus, given a lump-sum fee of $\theta\phi\Sigma$, X 's optimal combination of prices in Diagram XIV⁸⁰ is OT and $O\Delta$, not OQ and $O\epsilon$, and the additional producer surplus generated by X 's optimal tie-in is $(TVKI - KMFD)$ ⁸¹—($\epsilon\theta\mu\Delta - \mu\tau\gamma\beta$).⁸² Once more, however, this analysis underestimates the profita-

80. I.e., the combination at which $\frac{\Delta PS+}{\Delta BS-}$ on DD_{XAY} equals $\frac{\Delta PS+}{\Delta BS-}$ on DD_{XB1Y}^{RO} .

81. The gain on B .

82. The loss on A . Y will be willing to accept this offer since his loss on $B = TVMI = UVH - ZUT$ will be just offset by his gain on $A + \Sigma\phi T\Delta$.

bility of imposing such tie-ins, for by increasing the profitability of non-marginal cost pricing, the agreements in question will place X in a position to raise his returns by lowering his lump-sum fee and increasing the extent to which he engages in non-marginal cost pricing.

Obviously, in many situations, the difference between the cost of devising, executing, and enforcing a tying agreement and an independent requirements contract will be sufficiently low to make the tie-in arrangement more profitable than a straightforward requirements contract. Accordingly, even if the cost of entering into an independent requirements contract is prohibitive—*i.e.*, even if these costs exceed the associated gains ($IMFB - NPCB$ in Diagram XIV B), X may find it advantageous to implement a policy of full-line forcing.⁸³ Of course, in many situations, the effect of the tie-in will complement and not counteract the impact of independent full-requirements contracts on X 's profits. Thus, full-requirements tie-ins may be profitable where DD_{XNY} is not horizontal.

Where Pricing Is Somewhat Cooperative

So far, we have assumed that X 's imposition of a full-requirements tie-in would not provoke any retaliation from his competitors in the tied product market. Obviously, this assumption will not always be justified. Where X produces the tied commodity in an industry in which production is concentrated and/or cross-elasticities are unequal, his competitors will be likely to respond to any aggressive move he initiates. Accordingly, since the overall effect of full-requirements tie-ins will normally be to increase X 's market share, his incentive to substitute such agreements for straightforward single pricing will be reduced by their potentially disruptive effect on the tied product market.

However, although X 's competitors' retaliation will reduce the profitability of such agreements by lowering both the profits he earns on his sales to Y and the returns he earns on his sales to other buyers of his tied product,⁸⁴ the importance of this possibility should not be exaggerated. In fact, there are two reasons why their response to such full-requirements tie-ins will tend to be less severe than their reaction to any comparable series of competitive maneuvers, *e.g.*, to any series of simple price reductions or independent requirements contracts that have the same potential effect on their market shares. First, while the more con-

83. In the text, we calculated the profitability of the tie-in by comparing the producer surplus it generated with the *additional* costs it entails. Since the additional cost of enforcing a tie-in given a full-requirements contract will be lower than the total cost of policing the tying agreement, *i.e.*, since the tie-in and contract have joint costs, the requirements contract may contribute to the profitability of the tie-in even if it would have been unprofitable in itself.

84. X 's competitors will probably attempt to counter his aggressive behavior by insisting on full-requirements contracts themselves and/or by offering more favorable terms to both $Y1 \dots N$ and other buyers in the tied product market. Of course, if X succeeds in executing his full-requirements tie-ins before his competitors discover his behavior, they will not be able to compete for $Y1 \dots N$'s patronage until the tying agreements expire.

ventional maneuvers might be interpreted to be part of an unlimited competitive campaign, X 's competitors will realize that the tie-ins are restricted to $YI \dots N$, *i.e.*, that these agreements will not affect their share of the general market for B (or $BI \dots M$ when X 's tied product is differentiated). Obviously, to the extent that tie-ins pose less of a threat to X 's competitors, they will be less likely to retaliate to such agreements than to other aggressive initiatives. Second, the tie-in will make it clear that X is at a distinct advantage when selling to $YI \dots N$, *i.e.*, that he can give them relatively costless *de facto* price reductions. In Diagram XIV A, for example, it would have cost X absolutely nothing to give $YI \dots N$ concessions equal to $\Sigma \phi_{\rho\epsilon}$ in the tied product market (if lump-sum pricing were unprofitable on A). Since the tie-in will make X 's competitors understand that they are in a comparatively unfavorable position when selling to Y , they will be less likely to try to counter the tying agreement than to oppose comparable competitive maneuvers. Thus, although the existence of cooperation in the tied product market will affect the overall profitability of imposing full-requirements tie-ins, this factor will not be so important as might be expected.

Moreover, if we separate the consequences of the tie-ins from those of the full-requirements contracts, the possibility of retaliation will not affect their independent profitability, for unless X would not otherwise have found it profitable to enter into full-requirements contracts on B , the tie-ins will reduce X 's sales and leave his competitors' sales and incentive to retaliate unchanged. Thus, although in Diagram XIV B, X 's unit sales under the full-requirements tie-in (TV) exceed his non-requirements output (NP), they are less than the sales he would have obtained under an independent requirements contract (IM). Of course, to the extent that the possibility of retaliation makes the requirements contract unprofitable, it will reduce the profitability of the requirements tie-in as a whole. Admittedly, in many situations, this effect will deter X from entering into the type of tying agreements that we have been considering.

DIAGRAM I

DIAGRAM II

DIAGRAM III A

DIAGRAM III B

DIAGRAM III C

DIAGRAM V

DIAGRAM VI

DIAGRAM VII A

DIAGRAM VII B

DIAGRAM VII C

DIAGRAM VIII

DIAGRAM IX

DIAGRAM X A

DIAGRAM X B

DIAGRAM XI

DIAGRAM XII A

DIAGRAM XII B

DIAGRAM XII C

DIAGRAM XIII

DIAGRAM XIV A

DIAGRAM XIV B