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Competition as an Entry Barrier? Consumer and Total Welfare Benefits of Bundling

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Executive Summary

Bundling has been regarded as a highly ambiguous method for price discrimination or vertical control. Barry Nalebuff has recently proposed an alternative model of bundling as a highly suspect exclusionary tactic. A virtue of the model is that its exclusionary implications do not appeal to strategic considerations, e.g., threatening to charge a predatory price for the bundle now and recoup losses later. It involves two goods, A and B, each initially supplied by monopolies. If the A-monopolist sells an A-B bundle at the sum of those monopoly prices, the B-monopolist loses half of its profits and consumer welfare falls. Because those prices are not an equilibrium, we focus on three possibilities: sequential pricing, simultaneous pricing—both of which involve the B-monopolist remaining—and monopoly, i.e., where the bundler is the only seller of A or B.

In all cases, including B's departure followed by a monopoly price, total welfare *and* consumer welfare are greater after bundling than before. We cannot guarantee that bundling always increases welfare, but the results have intuitive support. By bundling, the A-monopolist provides previously non-existent competition with the B-monopolist in the latter's market. The B-monopolist's exclusion comes from the lost profits due to the A-monopolist's entry. Bundling is an entry barrier because competition reduces profits. Were bundling harmful, the *per se* proscription against market allocation should be lifted. It would presumably be beneficial for an erstwhile bundler and a single product firm to cut a deal in which the former *stops* bundling in order to preserve a monopoly for the latter. Our findings suggest, however, that the present antitrust rules promote welfare and, thus, that generic opposition to bundling remains unwarranted.

Is Competition the Entry Barrier?
Consumer and Total Welfare Benefits of Bundling

Timothy J. Brennan

1. Introduction

The economics of bundling has a long and complex history, characterized mainly by a set of results that focus on price discrimination.[1] As with the price discrimination literature generally, bundling has been regarded as a practice with highly ambiguous consequences. Analyses of bundling by monopolists are either indeterminate or depend heavily on virtually unobservable variables such as correlations of inframarginal valuations across the bundled products.[2]

A recent article by Barry Nalebuff[3] offers a possible breakthrough in this conceptual logjam, by placing bundling in a context where it has effects on the viability of a separate single-product monopolist. Numerous features of the model are notable and commendable. He sets out a compelling model of how a decision by a monopolist in one market to bundle its product with a second can drive down the profits of the second product's supplier. It offers a clear conclusion regarding the competitive effects of a practice long regarded as a means for benign price discrimination or efficient vertical control. An important secondary benefit of the model is that it derives its exclusionary implications without appealing to strategic considerations, e.g., threatening to charge a low price for the bundle in order to drive the other firm out of the market and then subsequently charge a high price for the bundle. In his view, this model provides ample evidence that bundling by one firm can deter entry or drive out firms that continue to sell single

[1] Stigler, George, "A Note on Block Booking," in G. Stigler, *The Organization of Industry* (Chicago: University of Chicago Press, 1968): 165-170.

[2] Adams, Walter and Janet Yellen, "Commodity Bundling and the Burden of Monopoly," *Quarterly Journal of Economics* 90 (1976): 475-98; Schmalensee, Richard, "Commodity Bundling by Single Profit Monopolies," *Journal of Law and Economics* 25 (1982): 67-71; McAfee, R. Preston, John McMillan and Michael Whinston, "Multiproduct monopoly, commodity bundling, and correlation of values," *Quarterly Journal of Economics* 114 (1989): 371-83.

[3] Nalebuff, Barry, "Bundling as an Entry Barrier," *Quarterly Journal of Economics* 119 (2004): 159-87

products. Bundling, in this model, may also be profitable even if the entrant remains in the market.[4]

The analysis of this model, however, is somewhat incomplete. The effects that provide the clearest intuitive appeal for the notion that bundling might drive out firms from the market are not as closely tied to equilibrium results as they might be.[5] A more important omission is the calculation of consumer and total welfare in the various equilibria that might ensue. Somewhat surprisingly, it turns out that in all of the equilibria that might be relevant—price leadership by the bundler, Bertrand pricing, and monopoly pricing following exclusion—consumer welfare and total welfare are higher than in the pre-bundling equilibrium.

These findings, particularly the last, could change with different specifications, but such as they are they suggest that the model presented by Nalebuff cannot support a generic suspicion of bundling. Incorporating fixed costs incurred by the bundler (and fixed costs saved by the exiting single product firm) could change the outcomes, but the recommendations following the bundling model do not take those effects (in either direction) into account.[6] These results lead one to look for reasons why bundling may be competitive, even if the result of that competition is, as in markets in general, the exclusion of firms that cannot remain competitive. We end by suggesting that using the Nalebuff model as a policy guide would reverse long standing *per se* antitrust rules against market allocation.

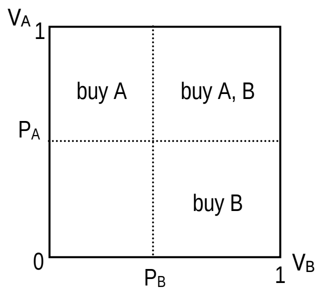
2. Model and reference calculations

Producers and consumers

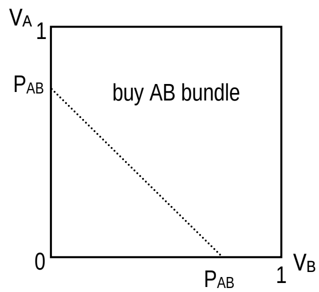
At the core of Nalebuff's analysis is a clear and clever model of consumers uniformly distributed on the unit square, where the ordered pair describing a consumer's position reflects his willingness to pay for two goods, A and B, each of which are produced at zero marginal cost by sellers we refer to as the A firm and B firm respectively.[7] He looks at three different settings,

[4] As such, this is a useful counter to the prevailing doctrine in monopolization law that a sacrifice of profits is a necessary condition for anticompetitive conduct. For a precursor, see Salop, Steven and David Scheffman, "Raising Rivals' Costs," *American Economic Review Papers and Proceedings* 73 (1983): 267-71.
[5] This may be more important in some of the ways the model has been presented rather than in the paper itself.
[6] Our objective is not to offer a fully-specified bundling model, but to show that the leading model provides insufficient bases for recommendations that antitrust policy against bundling be stricter.
[7] We use A and B to designate the names of the firms initially selling goods A and B. A will be the bundler, so sometimes "firm" A will sell "product" B. I hope this is not confusing.

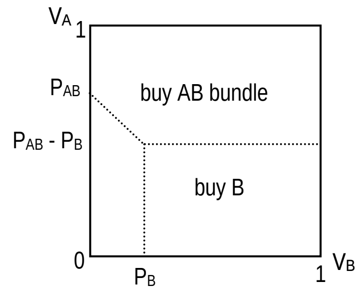
in which (i) A and B are sold separately, (ii) the A firm bundles A and B and the B firm leaves the market, and (iii) the A firm bundles A and B are bundled and firm B remains, selling B only. The following figures below display these three scenarios:



A, B unbundled



only AB bundle sold[8]



AB bundle, B sold

In these diagrams, V_A and V_B are respectively the values consumers place on A and B, distributed equally from 0 to 1; the bundle is valued at $V_A + V_B$.[9] The maximum total surplus is 1, net of any fixed costs associated with the production of A, B, or a bundle.

Without bundling, consumers buy a good if its price is less than the value they place on it, i.e., $V_i > P_i$ for i = A, B. With bundling and no independent sales of B, consumers buy if $V_A + V_B > P_{AB}$, the price of the AB bundle. If B is sold independently, these conditions determine whether a consumer would buy B or the bundle. Those who might choose either will choose the bundle (just B) if the surplus from buying the bundle is greater (less) than the surplus from buying just B.

$$V_A + V_B – P_{AB} >(<) V_B – P_B, \text{ implying when}$$
$$V_A >(<) P_{AB} – P_B.$$

No bundling

We begin with the first diagram. Prior to bundling, the A and B firms each set prices for their individually sold goods at .5 and sell .5 units, i.e., to half of the customers in the universe. Each firm obtains profits of .25; profits together are .5. The fraction .25 of consumers who value both goods at less than .5 buy nothing and obtain no surplus. The surplus for those from the .5

[8] The monopoly price of the bundle is less than 1, so we need not consider cases where $P_{AB} > 1$. See n. 8 *infra*.
[9] Nalebuff includes discussion of cases with more than two products, correlation (positive and negative) between V_A and V_B in the two good case, and complementarity and substitutability between A and B. Those merely present variations on the points illustrated by the case here and at the core of Nalebuff's article.

who buy just one and not the other is an average of .25, giving .125 for them. The average willingness to pay of those who buy both A and B is 1.5, implying a consumer surplus of .5 on average for the .25 who buy both of these, or .125. Hence, consumer surplus is .125 + .125 = .25, and total surplus is this .25 plus the .5 profits, or .75.

Bundling by A, B exits

Two settings are relevant after bundling: the A firm has the market to itself after bundling, and the A firm sells its bundle in competition with B sales from the B firm. Consider the first. We can restrict our attention to a bundle price $P_{AB} < 1$, as profits are greater there than with $P_{AB} > 1$.[10] At a price P_{AB} and no stand-alone B sales, the quantity purchased is given by the area above the diagonal in the second diagram. That area, Q_{AB}, is thus

$$Q_{AB} = 1 - P_{AB}^2/2.$$

Bundling profits Π_{AB} to the A firm are

$$\Pi_{AB} = P_{AB}Q_{AB} = P_{AB}[1 - P_{AB}^2/2]$$

The bundle price P_{AB}^* that maximizes profits is the solution to

$$1 - 3P_{AB}^2/2 = 0,$$

which gives, as Nalebuff reports,

$$P_{AB}^* = \sqrt{2/3} \approx .816.$$

and profits $\Pi_{AB} \approx .544$.

With no stand-alone B provider in the market, consumer surplus is the valuation given by the consumer to the bundle, less the price, $V_A + V_B - P_{AB}$. From the second diagram, the consumer surplus to bundle purchasers, CS_{AB}, is

$$CS_{AB} = \int_0^{P_{AB}} \left(\int_{P_{AB}-V_A}^{1} [V_A + V_B - P_{AB}] dV_B \right) dV_A + \int_{P_{AB}}^{1} \left(\int_0^1 [V_A + V_B - P_{AB}] dV_B \right) dV_A$$

The contribution to surplus for consumers with valuations $V_A < P_{AB}$ will be, on average $[1 + V_A - P_{AB}]/2$, from a density of $1 + V_A - P_{AB}$ consumers, leading to a contribution of $[1 + V_A$

[10] If $P_{AB} > 1$, then the only customers purchasing the product will be those in the triangle above the line $V_A + V_B = P_{AB}$. The number of those customers, given by the area of that triangle, will be $[2 - P_{AB}]^2/2$. Profits $\Pi_{AB} = P_{AB}[2 - P_{AB}]^2/2$; and d $\Pi_{AB}/dP_{AB} = 2 - 4P_{AB} + 3P_{AB}^2/2$. It is straightforward to show that in the range $1 < P_{AB} < 2$, d $\Pi_{AB}/dP_{AB} < 0$. Consequently, the firm's profit maximum will be where $P_{AB} < 1$.

$- P_{AB}]^2/2$. For consumers with valuations $V_A > P_{AB}$, the average surplus will be $[1/2 + V_A] - P_{AB}$ from a density of 1 consumers. Hence, consumer surplus CS_{AB} will be

$$CS_{AB} = \frac{1}{2}\int_0^{P_{AB}} [1 + V_A - P_{AB}]^2 dV_A + \int_{P_{AB}}^{1} [1/2 + V_A - P_{AB}] dV_A , \qquad (1)$$

which when solved yields

$$CS_{AB} = \frac{1}{6}\left[1 - [1 - P_{AB}]^3\right] + \frac{1}{2}\left[\left[\frac{3}{2} - P_{AB}\right]^2 - \frac{1}{4}\right].$$

At $P_{AB} \approx .816$, the monopoly price, consumer surplus $CS_{AB} \approx .274$, and total surplus is thus about .819. We will discuss further the observation that both consumer surplus and total welfare are higher in this post-bundling monopoly case (.274, .819) than in the equilibrium without bundling (.250, .750).

Bundling by the A firm; the B firm remains

More complex situations arise if the B firm remains in the market even after the A firm offers the AB bundle. The quantity of B sold stand-alone if the B firm remains in the market, Q_B, is the area of rectangle in the lower right corner of the third diagram above.

$$Q_B = [P_{AB} - P_B][1 - P_B]$$

The B firm's profits Π_B are thus

$$\Pi_B = P_B[P_{AB} - P_B][1 - P_B]. \qquad (2)$$

Because Π_B is a cubic function of P_B with a positive coefficient on P_B^3, the B firm's profit maximizing P_B, holding P_{AB} constant, will be the smaller of the two roots of

$$3P_B^2 - [2 + 2P_{AB}]P_B + P_{AB} = 0,$$

given by

$$P_B = \frac{1 + P_{AB} - \sqrt{1 - P_{AB} + P_{AB}^2}}{3}. \qquad (3)$$

If $P_{AB} = 1$, B's best response would be to set $P_B = 1/3$.

With the B firm remaining in the market, we will have surplus CS_B for the stand-alone B buyers, given by

$$CS_B = \int_0^{P_{AB}-P_B} \left(\int_{P_B}^{1} [V_B - P_B] dV_B \right) dV_A$$

The average valuation place on B among the buyers is $[1+P_B]/2$ for each unit sold, implying that CS_B is

$$CS_B = \frac{1 - P_B}{2} [P_{AB} - P_B][1 - P_B]. \quad (4)$$

The A firm's sales of the bundle, Q_{AB}, are given by the area above the lines where $V_A + V_B = P_{AB}$ and $V_B = P_B$. This area is

$$Q_{AB} = [1 - P_{AB}] + P_B\left[1 - \frac{P_B}{2}\right].$$

Consumer surplus CS_{AB} from sales of the bundle to these customers is the truncated integral in (1), where the first integral is calculated from $P_{AB} - P_B$, not 0.

$$CS_{AB} = \int_{P_{AB}-P_B}^{P_{AB}} \left(\int_{P_{AB}-V_A}^{1} [V_A + V_B - P_{AB}] dV_B \right) dV_A + \int_{P_{AB}}^{1} \left(\int_{0}^{1} [V_A + V_B - P_{AB}] dV_B \right) dV_A$$

From the substitutions in the previous section, we can recalculate this as:

$$CS_{AB} = \frac{1}{2} \int_{P_{AB}-P_B}^{P_{AB}} [1 + V_A - P_{AB}]^2 dV_A + \int_{P_{AB}}^{1} [1/2 + V_A - P_{AB}] dV_A .$$

This comes out to be

$$CS_{AB} = \frac{1}{6}\left[1 - [1 - P_B]^3\right] + \frac{1}{2}\left[\left[\frac{3}{2} - P_{AB}\right]^2 - \frac{1}{4}\right], \quad (5)$$

with the only difference from the earlier calculation being the replacement of the first P_{AB} by P_B. Profits Π_{AB} to the A firm from selling the bundle will be

$$\Pi_{AB} = P_{AB}[1 - P_{AB}] + P_{AB}P_B\left[1 - \frac{P_B}{2}\right]. \quad (6)$$

Calculating the value P_{AB} that maximizes Π_{AB} depends upon the pricing model. As with Nalebuff but in reverse order, we identify two scenarios. One is Bertrand pricing, where the bundling A firm takes the stand-alone price of B, P_B, as given. In that scenario, the profit maximizing P_{AB} given P_B is given by the solution to

$$1 - 2P_{AB} + P_B\left[1 - \frac{P_B}{2}\right] = 0,$$

yielding

$$P_{AB} = \frac{1}{2} + \frac{P_B}{2}\left[1 - \frac{P_B}{2}\right]. \quad (7)$$

We can find the Bertrand equilibrium by simultaneously solving (7) and (3) for P_{AB} and P_B. Using iterative numerical methods, we find that $P_{AB} \approx .607$ and $P_B \approx .245$.[11] At that point, the A firm's and B firm's profits can be calculated from (6) and (2) as $\Pi_{AB} \approx .369$ and $\Pi_B \approx .067$, with aggregate profits approximately equal to .436. From (5) and (4) consumer surplus from the buyers of the AB bundle and the stand-alone product B are respectively $CS_{AB} \approx .368$, and $CS_B \approx .103$. Aggregate consumer surplus is approximately .471, and total welfare rounds up to about .908. Relative to the no-bundling case, the Bertrand equilibrium has lower aggregate profit, but greater consumer and total surplus.

The main pricing model Nalebuff examines is one in which the bundling firm A sets price first and the stand-alone B seller, firm B follows. Analytically, this would involve maximizing profits Π_{AB} as defined in (6) with P_B endogenously determined by the bundler as defined by (3). Using numerical methods, we find (again with Nalebuff) that the profit maximizing price P_{AB} set by the bundler if it is a price leader is approximately .681. Since prices are strategic complements, the bundler now internalizes some of the negative (to it) externality from cutting price when B follows, so P_{AB} in the price leadership model will exceed the Bertrand price.

With a greater P_{AB}, P_B will be greater as well, calculated from (3) approximately .265. As above, we can use (5), (2), (6), and (4) to calculate profits and consumer surplus, finding $\Pi_{AB} \approx .374$, $\Pi_B \approx .081$, $CS_{AB} \approx .311$, and $CS_B \approx .112$.[12] Aggregate profits are about .455, aggregate consumer surplus is .423, and total welfare is .878. Market performance is not as good as under

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[11] Nalebuff reports Bertrand equilibrium prices for the bundle and the stand-alone product as .59 and .24 respectively. The difference arises because of an error in his derivation of the bundle price (what he calls "x"), n. 3 *supra* at 180. The last term on that page in the first expression under "Profits are maximized at" should be $p_b^2/2$, not p_b^2, using his notation.

[12] It may seem odd that consumer surplus for the B buyers is greater under price leadership than under Bertrand model, where the stand-alone price of B is lower (.245 under Bertrand compared with .265 under price leadership). However, under price leadership A's price is greater as well, so there are more customers purchasing B under price leadership, .305 compared to .274 under Bertrand. The per-customer surplus under Bertrand is greater, about .378 compared with about .367 in the price leadership equilibrium.

the Bertrand equilibrium, but this price leadership model implies that bundling reduces aggregate profits, but increases consumer and total surplus relative to the pre-bundling equilibrium.

3. Discussion

To assist in the assessment of the bundling policy implications, we combine these results and others we will mention into the following table, which we can then analyze case-by-case. The A firm's price is for the bundle and the B firm's is for its stand-alone product, unless indicated.

Setting	A firm's price	B firm's price	A firm's profit	B firm's profit	Cons. surplus	Total surplus
1) A, B sold by separate monopolists	.5 (just A)	.5	.250	.250	.250	.750
2) A firm sells bundle at 1, B firm stays at .5	1	.5	.375	.125	.208	.708
3) A firm sells bundle at 1, B firm optimizes	1	.333	.278	.148	.265	.691
4) A firm sets bundle price before B, knowing B firm stays	.681	.265	.374	.081	.423	.878
5) A firm sets bundle price where it does at least as well if B firm exits than if it stays	.408	n/a	.374	0	.603	.977
6) At the bundle price in (5), B firm stays	.408	.179	.374	.034	.623	.965
7) B firm leaves at maximum price leadership price in (4)	.681	n/a	.523	0	.372	.895
8) A firm bundles A and B, B firm stays, price set simultaneously (Bertrand)	.607	.245	.369	.067	.471	.908
9) A firm maximizes A-B bundle profit as monopolist, with no B seller	.816	n/a	.544	0	.275	.819
10) A firm sells A and B unbundled, B firm sells B, Bertrand competition	.5 (just A)	0	.25	0	.625	.875
11) Both firms sell A-B bundle	0 (both)	0 (both)	0	0	1	1

Rows 1-3: Initial moves from the no-bundling equilibrium

The first row is the initial no-bundling separate monopoly equilibrium. P_A and P_B are .5, aggregate profits are .5, consumer surplus is .25, and aggregate welfare is .75. Row 2 contains the case that conveys the exclusionary intuition of the model, where the A firm bundles A and B and sells the bundle for $P_{AB} = 1$ as the sum of the separate prices, while the B firm continues to sell at $P_B = .5$. The B firm's profits fall by half, providing the exclusionary effect. Aggregate profits remain the same as under the no-bundling equilibrium, but consumer surplus and aggregate welfare fall by .042.

From the consumer perspective, bundling is weakly Pareto-inferior. Everyone who was getting A and B before pays 1 with or without the bundling. Every consumer who valued A by more than .5 and B less than .5 loses. Those in this group who value the bundle at less than 1 do not buy when they did before and forego some surplus. Those who do buy the bundle at 1 pay .5 more but get less than .5 more value from the addition of B.

At this point, bundling appears worth prohibiting. However, unless the B firm is locked into selling its product at .5, it would want to change its price to respond to the A firm's offering of the bundle at $P_{AB} = 1$. Row 3 shows the B firm's optimal response, where it cuts P_B from 1/2 to 1/3. With that price cut, A's profits fall by .97, almost 26%, from .375 to .278. The B firm's profits slightly increase from .125 to .148. Consumer surplus increases also, from .208 to .265.

Consumer surplus is already above what it was in the no-bundling equilibrium, yet aggregate surplus falls relative to the no-bundling equilibrium. The net loss in profits to the B firm (.250 to .148, or .102) outweighs the .28 gain in profits to the A firm from bundling and the .15 gain in consumer surplus. A consumer surplus standard would support bundling in this case, but including producer profits, particularly losses to the bundler, would argue against bundling. We might also note here that even if consumers as a whole gain, some do lose. Those who have a relatively strong preference for A but value B by less than .5 will find that the increase in price of getting A (from $P_A = .5$ to $P_{AB} = 1$) outweighs the value of the B they now get as part of the bundle.

Rows 4-7: Bundling by the A firm as price leader

As Nalebuff notes, this last result is not an equilibrium. It does not allow the A firm to optimize in setting P_{AB}, either taking P_B as given (Bertrand-Nash) or realizing that the B firm will set P_B following the A firm's choice of P_{AB} (price leadership). Row 4 displays the above results of the calculations the main equilibrium he discusses, in which the A firm sets P_{AB} first and P_B follows. If the B firm remains in the market, the A firm's optimal response is to cut the price of the bundle. We found above that the A firm cuts the bundle price P_{AB} down to .681, with the stand-alone price falling to .265. Relative to Row 3, the A firm's profits are almost 50% greater than in the no-bundling equilibrium. The B firm's profits, however, are much lower, .081, losing 2/3 of its profit in the no-bundling equilibrium. Total profits fall relative to no bundling slightly, from .5 to .455.

With B's stand-alone price P_B only a little more than half of what it was in the no-bundling equilibrium, and the bundle price P_{AB} only .681 rather than 1, consumer surplus rises from .250 without bundling to .423, nearly a 70% increase.[13] The increase in consumer welfare exceeds the slight reduction in aggregate profit, leading to an increase in total welfare from .75 with no bundling to .878 with bundling, about a 17% increase. By either a consumer or total welfare standard, if the B firm remains in the market and follows the bundle price, bundling should be favored.

The B firm, however, need not remain in the market, if profits following observation of P_{AB} would be less than the costs of remaining. Two cases are immediately worthy of note, displayed in Rows 5 and 7. Row 5 reproduces a case Nalebuff identifies, looking at the smallest price the A firm would set for the A-B bundle knowing that the B firm would then leave. That price would be that lowest for which the A firm's profits, given the B firm's departure, equal the profit the A firm would have received if the B firm would have remained. Those profits, from Row 4, equal .374. As set out in Row 5, if the A firm were to set the bundle price P_{AB} = .408 and the B firm were to leave, the A firm would also obtain profits of .374. At any lower price, the A firm would make lower profits than it would if it chose the price-leadership equilibrium. Row 6 displays the B firm's profits, maximized at that bundle price by setting P_B at .179, as .034.

If profits of that magnitude are insufficient to keep the B firm in the market, it would leave. From Row 5, even with the B firm's departure, the bundle price is so low—lower than the stand-alone price of either A or B without bundling—that consumer welfare increases over 140% (from .25 to .603). Aggregate welfare is .977, 30% above the no-bundling level and nearly the theoretical maximum of 1. Intentional price-cutting to drive out the B firm appears to be an economic boon. Note also that, in this model, comparing Rows 5 and 6 suggests that holding P_{AB} constant, if the B firm remains in the market, consumer surplus rises but total welfare falls. The cost to the bundler, the A firm, of the B firm staying in the market, again holding price constant, exceed the profits to the stand-alone firm and the gain in consumer surplus from having the stand-alone alternative.

If the B firm leaves because .034 in profit is insufficient, presumably that entails a saving of whatever fixed costs it would have had to incur, exceeding .034, to remain. If so, on the other hand, the A firm presumably had to incur costs to provide B. Unless the A firm's costs of bundling B with A exceed the B firm's costs of continuing to produce B, bundling with exclusion substantially increases welfare. This serves as a reminder that the net benefits of bundling if the B firm stays would need to take into account the A firm's costs of bundling.[14] A would be willing to expend up to the gain in profits above the no-bundling level of .25 in order to do so. Looking at Row 4, however, if even all of A's profit gain relative to no bundling was wiped out by the cost to A of offering the bundle, total surplus be .754 (.878 – .124), still higher than the total welfare in the no-bundling equilibrium.

In addition, even if the A firm has to cut price all the way down to .408 to drive out the B firm, it still makes higher profits with the bundle (.308) than before it bundled (.250). This comparison holds for every scenario. Even if one were to believe that bundling were bad, the decision to bundle, at any predicted post-bundle price, can pass the profit sacrifice screen supposedly required for monopolization under present law,[15] and will do so net of any unspecified fixed costs. In general, scenarios that cause the B firm to leave, by definition, increase the A firm's profits, implying that exclusionary conduct in this setting will not involve a profit sacrifice.

The bundler need not have to cut the P_{AB} down to .408 to drive the B firm out of the market. From an aggregate welfare perspective, the worst case price-leadership scenario would be that the A firm would only have to set P_{AB} only just below .681. (This assumes the A firm's mere announcement of a bundle would not drive the B firm out; we come to that below in the Bertrand case.) Row 7 displays the case where the B firm leaves after the A firm sets the bundle price P_{AB} at .681. The B firm will exit if profits of .081 (from Row 4) are insufficient to cover its costs. Net of fixed costs, this still produces greater consumer surplus and total welfare (.372,

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[13] Again, not all bundle buyers are better off. Those who value A by at least .5 but do not value B by as much as .181 will either not buy a bundle when they bought A before, garnering some surplus, or will buy the bundle but lose surplus.

[14] A fully specified model including fixed costs would have to include a reason why the A firm and not the B firm is the bundler. Presumably this suggests that the A firm's costs of offering the bundle are not great, less than those of the B firm offering A.

.895) than with no bundling (.250, .750). Again, comparing Rows 4 and 7 suggests that holding the bundle price constant, the B firm's departure reduces consumer surplus but raises total surplus.

Row 8: Bundling by the A firm followed by Bertrand competition; the B firm remains

Perhaps a more likely scenario than price leadership is simultaneous pricing of the A-B bundle and B as a stand-alone product. Row 8 reproduces the calculations for the Bertrand equilibrium. Both P_{AB} and P_B are below their respective levels in the price leadership equilibrium. With simultaneous pricing, the A firm has no price response from the B firm to factor into its decisions and discourage price cutting. With lower prices, aggregate profits (.436) are below those in the price leadership equilibrium in Row 4 (.455).

Consumer and total surplus are greater under Bertrand (.471, .908) than under price leadership (.423, .878) as set out in Row 4. The most important reference point is the no-bundling case in Row 1. Compared to no bundling, the Bertrand equilibrium shows that bundling increases consumer surplus by 82% (from .250 to .455) and total welfare by 21% (from .750 to .908).

Row 9: Announced bundling by the A firm induces the B firm's exit

With simultaneous pricing, the A firm's announcement of the bundle itself to lead the B firm to exit prior to any prices being set, if the B firm's Bertrand profit of .067 (from Row 8) is insufficient to cover fixed costs of remaining in the market.[16] If such an announcement leads to the B firm's departure, we are left with the monopoly (no stand-alone B) equilibrium calculated above, where the A firm sets $P_{AB} = .816$. The A firm's profit more than doubles from the no-bundling case; gaining more (.294) than the B firm loses (.250) when the no-bundling equilibrium no longer holds.

However, under monopoly, consumer surplus also increases by about 10%, from .250 to .274. Hence, total welfare increases as well, from .750 to .816—even if bundling leads to exclusion and post-exclusion monopoly pricing. This result is likely not to be an artifact of the

[15] Verizon v. Trinko, 540 U.S. 398 (2004).

[16] This may be a price game analogue to the quantity commitment effect of bundling in Whinston, Michael, "Tying, Foreclosure, and Exclusion," *American Economic Review* 80 (1990): 837-59. I owe this observation to Ken Corts.

particular structure of the model and not general. Nevertheless, one cannot conclude the bundling that leads to exclusion and monopoly hurts consumers or the market as a whole.

Rows 10-11: Direct competition in stand-alone B or the bundle

Following Nalebuff, we should not restrict our attention to cases where the A firm offers the two goods A and B only as a bundle. Row 10 sets out the case where the A firm enters the B market but sells the products separately. P_A will be the stand-alone monopoly price of .5, and P_B will fall to marginal cost, which is 0. Consumer surplus becomes .625, the highest so far in the sample. This might suggest a rule requiring that if A enters the B market, it must do so on an unbundled basis. However, because these gains are predicated upon the B firm remaining in the market and selling at a price of 0, total welfare of .875 is below the welfare if the B firm remains under either price leadership (Row 4) or Bertrand (Row 8) equilibria, .878 and .908 respectively. Under a total welfare standard, unbundling even under the most optimistic scenario need not be beneficial.

A last case is worth mentioning—the B firm bundles as well. Row 11 sets out that scenario. With zero marginal production costs, the price of both bundles offered by the A and B firms will fall to zero. All consumers will get A and B, so that both consumer surplus and total welfare equal the theoretical maximum of 1. That both would bundle is not foreordained in this model, but neither should policy toward bundling be determined by assuming that only one firm is capable of bundling. A rule that bans bundling as exclusionary conduct would preclude firms from competing by each offering bundles, potentially generating considerable consumer benefits.

4. Summary: Should market allocation be *per se* legal?

This model has served as the basis for rekindling antitrust skepticism toward bundling.[17] Yet, the immediate inference from its results, when consumer and total welfare are explicitly calculated is that bundling is a good thing. In every plausible equilibrium—monopoly, Bertrand, and price leadership—consumer welfare and total welfare are greater than in the no bundling case. These gains do not represent Pareto improvements. The provider of the stand-alone

[17] For a recent example, see Edlin, Aaron and Daniel Rubinfeld, "Exclusion or Efficient Pricing? The 'Big Deal' Bundling of Academic Journals," *Antitrust Law Journal* 72 (2004): 119-157.

product loses, as do some consumers who place a relatively high value on A and little value on B, and are thus forced to take a bundle that they don't want. However, regardless of one's position on the question of whether consumer or total welfare should be the antitrust standard, bundling would appear to be beneficial.

The one exception appears to be where the A firm enters the B market, and sells it on an unbundled bases, leading P_B to fall to zero. Even in that case, because the B firm will not keep selling at $P_B = 0$ unless it has no fixed costs, then it would have remained in the market with bundling under either price leadership or Bertrand pricing. In both of those bundling scenarios, total surplus is greater than if A were forced to sell B on a stand-alone basis (although consumer surplus is greater with forced unbundling). Were the A firm forced to unbundle, its profits from offering B would be no greater than not. If it bears any costs of offering B, it will not do so, and one will be left with the no-bundling equilibrium, with lower consumer and total surplus than any of the bundling alternatives. Moreover, if B can bundle A's product, the equilibrium price of both bundles would fall to zero, maximizing attainable consumer surplus. So, even on its own terms, the model suggests, if anything, that we should force A to bundle.

Many of these welfare results favoring bundling, particularly that between the bundler-as-monopoly (Row 9) and the no bundling equilibrium (Row 1), may be artifacts of this specific model. Changes in the density of the distribution of consumer preferences, and substitution or complementarity among the products, may well switch the outcomes. We also neglect the possibility of supply-side economies of scope or other production complementarities. We cannot guarantee that bundling always increases welfare, despite its doing so in this particular model. As noted above, bundling does reduce the welfare of the non-bundling firm and some parties forced to pay more to get something they do not much want.

A more important aspect is that all of the analysis neglects fixed costs neglected, both the A firm's cost of adding B and the B firm's saved fixed costs if it exits. If the B firm exits, that is, if the A firm's bundling succeeds in being exclusionary, neglecting fixed costs may be more appropriate. Absent fixed cost asymmetries, the B firm's avoided fixed costs of remaining in the market would equal the A firm's costs of adding the second product to the bundle.

Bundling may be more problematic, consequently, if it is not exclusionary, and the A firm bears significant costs of entry. However, the net gains remain positive under all scenarios where the A firm profits net of fixed costs and the B firm remains. The only scenario where fixed costs matter is if the A firm's costs of bundling are substantially greater than the B firm's costs of staying in the market, yet the A firm's entry drives the B firm out and would lead to the monopoly bundle pricing in Row 9.

These findings indicate that while bundling may be an entry barrier or, more precisely, an exit facilitator, it will increase consumer and total welfare. Despite the use of this model to encourage stricter antitrust proscriptions against bundling, it provides more support for allowing it. However, perhaps the focus of this model is not overall welfare but on driving the single product seller out of the market. In all cases, bundling substantially reduces the stand-alone seller's profits. If the role of antitrust is to protect the profits of incumbent firms, perhaps this is all that is necessary for this model to guide policy, although it comes close to contradicting the aphorism that antitrust should be able protecting competition, not competitors.

We should ask why nominally exclusionary conduct—bundling—can increase total welfare *and* consumer welfare. Bundling drives the stand-alone single product firm out of the market not because a price is in any way predatory (especially under a profit sacrifice test). Rather, it is because one firm's decision to bundle creates competition against the second that it did not previously face. By bundling, the bundler provides previously non-existent competition with the B firm in its formerly monopoly market. The scenario in which the A firm offers B on an unbundled basis shows this most clearly—the B firm's price and profits are driven to zero. To condemn bundling for being exclusionary is to condemn competition for being exclusionary.

Were the anti-bundling argument valid, it would provide a rationale for allowing a bundler and a single product firm to cut a deal in which the former *stops* bundling in order to create a monopoly for the latter. For example, suppose we start out with the A firm offering a bundle against the B firm selling B alone with Bertrand competition. Suppose further that the A and B firms were to enter into a market allocation agreement, with the A firm selling only product A. Comparing rows 1 and 8 in the table, industry profits would rise (from .369 + .067 = .436 to .25 + .25 = .5), so the firms would find such a deal profitable. Yet, consumer and total surplus would fall (respectively from .471 to .250 and from .908 to .750).

The B firm need not have remained in the market for a market allocation agreement to be profitable. If the A firm has to cut its bundle price below .618 to get the B firm to leave in the price-leadership game, a price below the equilibrium of .681but above the Bertrand equilibrium, A's profits will be below .5. Hence, the A and B firm's joint profits would be greater under a no-bundle equilibrium. But if A sets a price at .618 and B leaves, consumer welfare would be .421 and total welfare .921, both considerably above what they would be following an agreement to go to the no-bundling equilibrium.

These results are consistent with standard antitrust practice. Under present antitrust law, such a deal would be *per se* illegal market allocation. If bundling is an anticompetitive entry barrier, the *per se* proscription against market allocation should be lifted. Such a policy recommendation, based on the exclusionary intuition, would be ironic and astonishing. A more careful examination of the consumer and welfare effects shows that the case against bundling, and these corollary implications, is exaggerated if not unwarranted. It would reflect a fundamental change in antitrust policy, that to provide only hypothetical improvements to future competition—dynamic benefits not modeled in Nalebuff's article—present welfare-increasing pro-competitive activities should be suppressed.