Complex Bundled Discounts and Antitrust Policy

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INTRODUCTION

A bundled discount occurs when a seller conditions a discount or rebate on the buyer's purchase of two or more different products from that seller.[1] Bundled discounts come in many varieties. For example, the seller might offer a 10% discount to a buyer who takes product A from the buyer, provided that the buyer purchases product B as well. The seller might offer the discount on each purchase of one unit of A, provided that it is accompanied by one unit of B. Alternatively, it might condition the discount or rebate on purchases of both A and B, but without specifying the proportion, leaving the customer to determine its needs for the two products. It might do this by stipulating a "market share" percentage rather than a requirement of all purchases. For example, it might provide for a 10% discount to buyers who agree to take at least 70% of their needs of both A and B from the seller, but without specifying the percentage of each. Or it might do the same thing but with three, four or even a dozen products rather than two. The terms can vary widely, but the most obvious variables are (1) the number of goods in the bundle; (2) the proportion of the goods in the bundle, and whether the proportion is specified in an any sense or left completely up to the customer; and (3) the percentage share of its needs that the customer must purchase from the seller in order to obtain the discount.

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1. Erik Hovenkamp & Herbert Hovenkamp, *Exclusionary Bundled Discounts and the Antitrust Modernization Commission*, 53 ANTITRUST BULL. 517, 517 (2008); *see also* 3A PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW ¶ 749 (3d ed. 2008).

Here we consider "complex bundles," or bundles that include more than two goods, or more than one unit of at least one bundled good, or that permit the customer to determine the proportion of the various goods in the bundle that it purchases. Such complex bundling is a common practice and can be found, for example, in markets for medical supplies or devices brokered by Group Purchasing Organizations (GPOs) and sold from the device manufacturers to health care providers such as hospitals.[2] Indeed, the bundle that is most generally the subject of study—one monopoly good and one competitive good—is a relative rarity. The bundle at issue in the Ninth Circuit's important *Cascade* decision was also complex in this way. There, the defendant gave a discount conditioned on the buyers' agreement to take a bundle of three products, primary, secondary and tertiary medical care, from the seller.[3] The proportion of services in each component of the bundle was not known when the arrangement was created, but was determined later by post-agreement patient demand.

Bundled discounting is an exceedingly common practice in commercial contracts involving suppliers of multiple interrelated products. Unquestionably, a great majority of such discounting practices are competitively harmless and should be lawful. However, bundled discounts have one characteristic that has brought them under antitrust scrutiny: the discount must be "amortized" over the range of products that the seller offers. If a rival producer sells some subset but less than all the goods in the dominant firm's bundled discount offering, it will have a smaller range of goods over which to amortize the discount.[4] As a result, the

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2. *See* HERBERT HOVENKAMP, HEALTH INDUS. GROUP PURCHASING ASS'N, GROUP PURCHASING ORGANIZATION (GPO) PURCHASING AGREEMENTS AND ANTITRUST LAW (2004), http://www.higpa.org/pdf/2004HovenkampGPOsandAntitrustLaw.pdf.

3. *See* Cascade Health Solutions v. PeaceHealth, 515 F.3d 883, 892 (9th Cir. 2008); *see also* LePage's Inc. v. 3M, 324 F.3d 141, 145 (3d Cir. 2003) (en banc); Info. Res., Inc. v. Dun & Bradstreet Corp., 359 F. Supp. 2d 307, 307-08 (S.D.N.Y. 2004); Virgin Atl. Airways Ltd. v. British Airways PLC, 69 F. Supp. 2d 571, 580 n.8 (S.D.N.Y. 1999), *aff'd on other grounds*, 257 F.3d 256 (2d Cir. 2001); Ortho Diagnostic Sys., Inc. v. Abbott Labs., Inc., 920 F. Supp. 455, 467-70 (S.D.N.Y. 1996).

4. *See infra* apps. 1-2.

proportionate discount it needs to give on each product in the bundle in order to capture the sale must be larger.

To illustrate, suppose that a dominant firm produces goods A and B at a cost of $5 and $7, respectively. It sells the two goods separately for $10 each per unit but offers a 20% discount to anyone who will take a bundle of one A good and one B good. Note that this discounted price, $16, is well above the firm's costs, which are $12. However, a rival sells only B, for which its production costs are also $7. If a customer wants the rival's B good it loses the discount from the dominant firm on the A good. As a result, the customer must pay $10 for the dominant firm's A, and at least $7, the cost price, for the rival firm's B. The rival will be unable to capture the sale of B even though it is equally efficient, in the sense that its production costs for B are the same as those faced by the dominant firm.

The important things about this illustration are, first, that at all times the dominant firm is selling its goods above cost. Even the fully discounted $16 price for the A-B bundle is well above the firm's $12 costs for producing the two goods. Second, the rival is "equally efficient" in the sense that it has the same costs for producing B that the dominant firm has; it simply does not make good A. Third, the practice is nevertheless "exclusionary" in the sense that the rival cannot profitably compete with it, at least to those customers who wish to purchase As and Bs together and in equal amounts.

The practice thus has some, but not all, of the characteristics of predatory pricing, which is condemned only when the dominant firm's overall price structure is below a relevant measure of cost.[5] The practice is similar in the sense that it is a pricing practice that is capable of excluding an equally efficient rival, which is also a defining characteristic of orthodox single-product predatory pricing as the Supreme Court defined that practice in the *Brooke Group* case.[6] Second, the practice is fully "sustainable" in

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5. Weyerhaeuser Co. v. Ross-Simmons Hardwood Lumber Co., 549 U.S. 312 (2007) (developing requirements of Sherman Act predatory pricing law under § 2, in case involving buyer alleged predation); Brooke Group Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209 (1993) (developing requirements of Sherman Act predatory pricing law under Robinson-Patman Act); *see also* AREEDA & HOVENKAMP, *supra* note 1, at ¶¶ 720-21.

6. On the equally efficient rival test for monopolistic pricing practices generally, see AREEDA & HOVENKAMP, *supra* note 1, at ¶ 651b2. On the test as

the sense that the dominant firm's prices are always above its costs. Indeed, in our example the fully discounted price is 25% above the dominant firm's costs, a situation that one would not find even presumptively suspicious.

Third, because the price is profitable it likely has a perfectly good explanation that has nothing to do with the suppression of competition: the price might be profitable because the dominant firm sells more units of output at the 20% bundled discount than it does when it charges the higher separate prices for the two products. That is to say, the practice can be fully profitable for the dominant firm without regard to its impact on competition. And indeed, that has to be the case because bundled discount pricing is commonly used even in highly competitive markets where exclusion of rivals is not generally possible. For example, a high school basketball team might sell a season ticket with ten games at a lower price than the sum of ten individual game tickets. Or a restaurant in Manhattan might offer a *prix fixe* dinner that includes five courses at a lower price than the individual menu price of the five items. Destruction of rivals cannot be the explanation for these pricing practices in these markets.

In these two examples exclusion of an equally efficient rival is probably not a possibility because it is so easy for a rival high school basketball team to combine its events into a single season ticket, and just as easy for a rival restaurant to combine its courses and offer a lower bundled price. To the extent that a competitive problem arises, it must be because the rival firm is unable, at least in the short term, to match the dominant firm's combination. What the antitrust cases involving bundled discounts[7] have in common is that the rival makes only a subset of the goods in the bundle and cannot readily add in the extra goods that would enable it to produce the full range. Nor can it readily form joint ventures with others, which would have the same effect.[8]

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used in bundled discount cases see Hovenkamp & Hovenkamp, *supra* note 1, at 520-34, and Daniel A. Crane, *Mixed Bundling, Profit Sacrifice, and Consumer Welfare*, 55 EMORY L.J. 423, 447-62 (2006).

7. See decisions cited *supra* note 3.

8. On this point, see Hovenkamp & Hovenkamp, *supra* note 1, at 525-28. *See also* Thomas A. Lambert, *Evaluating Bundled Discounts*, 89 MINN. L. REV. 1688 (2005).

Much of the recent case law and commentary on bundled discounts has dealt with the formulation of cost-based tests for determining when a bundled discount is "exclusionary" in the sense that it keeps rivals out of the market. In order to have antitrust significance a bundle must not merely keep one rival out of the market; it must exclude all of them. That is to say, a firm's aggregate discount of product A, B, and C might very well exclude a rival who produces only B and C, but not A. However, if there are other rivals in the market who also make the full range of A, B, and C, then the practice is not exclusionary, although it may limit the range of effective competition to those firms capable of competing across the full range of goods.

The term "bundle-to-bundle" discount competition refers to competition among two or more firms that offer the full range of goods in the bundle.[9] In general, if bundle-to-bundle discount competition can occur in a market, then a particular firm's bundled discount cannot be exclusionary unless its *overall* price is below its costs. Otherwise an equally efficient firm exists that would be able to match the discounted price and earn a profit.[10] Further, the other rival need not offer the defendant's full product line. If two or more competitors collectively produce the entire contents of the bundle, they will be able to match the dominant firm's pricing.[11] However, this result may not hold if the bundling firm observes significant cost savings as a result of producing the bundle's entire contents simultaneously (e.g., joint cost savings, scope economies). In that case, rivals who produce only a subset of the bundle may not be able to attain those savings. As a result, the dominant firm's price, while above its own costs, may be too low for any coalition of rivals to compete with it.

When the fully discounted price of a dominant firm's bundle is above cost, the most obvious explanation for the

9. *See, e.g.*, Barry Nalebuff, *Competing Against Bundles*, *in* INCENTIVES, ORGANIZATION AND PUBLIC ECONOMICS 327-28 (Peter J. Hammond & Gareth D. Myles eds., 2000).

10. *See* AREEDA & HOVENKAMP, *supra* note 1, at ¶ 749b; Hovenkamp & Hovenkamp, *supra* note 1, at 524-25; *see also* Timothy J. Muris & Vernon L. Smith, *Antitrust and Bundled Discounts: An Experimental Analysis*, 75 ANTITRUST L.J. 399, 428 (2008).

11. *See infra* text accompanying note 28.

bundle is that it results in more sales—such as the *prix fixe* menu in a highly competitive restaurant market. Further, this is likely to be the case even if rivals do not produce all bundled goods and cannot match the discount. As a result, a bundled discount practice might be "exclusionary" in the sense that rivals cannot match the bundled price, but the practice still does not warrant condemnation because it is fully justified by the dominant firm's attempts to increase its own output. We reserve the term "predatory" for bundled discount practices that are profitable *only* because they are able to exclude equally efficient rivals and create or sustain a monopoly. In sum, a bundle is *exclusionary* if it would force an equally efficient rival to price below cost in order to compete with it.[12] A bundle is *predatory* if it is profitable only if one or more rivals are excluded.

Every predatory bundle is exclusionary, while presumably very few exclusionary bundles are predatory. This suggests that a test for whether a bundle is exclusionary can offer safe harbor, but only that. If a dominant firm's bundled discount passes this test then no further investigation into its discount practice is warranted; the practice does not exclude in the antitrust sense. However, if the dominant firm's bundled price flunks this test, then the bundle is "exclusionary" and further investigation is warranted in order to determine whether it is also predatory. The bundling strategy's short run profitability must be compared to its potential for harming rivals, which can help determine whether it is "unreasonably exclusionary," or designed with only that purpose in mind.

I. THE ATTRIBUTION TEST AS A SAFE HARBOR

In 2007 the Antitrust Modernization Commission (AMC), a government created commission created to study the antitrust laws and recommend improvements,[13] proposed the following test for unilaterally imposed bundling when challenged as an exclusionary practice:

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12. For our purposes, we will assume that to "compete with the bundle," an equally efficient rival must set a price such that consumers are indifferent between buying the bundle and buying individually the goods that comprise it.

13. *See* Symposium, *The Antitrust Modernization Commission*, 53 ANTITRUST BULL. 475 (2008).

> Courts should adopt a . . . test to determine whether bundled discounts or rebates violate Section 2 of the Sherman Act. To prove a violation of Section 2, a plaintiff should be required to show each one of the following elements (as well as other elements of a Section 2 claim): (1) after allocating all discounts and rebates attributable to the entire bundle of products to the competitive product, the defendant sold the competitive product below its incremental cost for the competitive product; . . . .[14]

The Ninth Circuit, in the *Cascade* decision, subsequently adopted a variation of this test, under which one attributes the entire discount to the product upon which exclusion is claimed (sometimes called the "competitive" product). Then, if the resulting price of the competitive product is lower than the defendant's average variable cost,[15] the test is failed, and the discount is deemed to be "exclusionary" and may be unlawful in some cases.

Significantly, the cost portion of the AMC test is *not* a test for anticompetitive effects as such: it simply asks the question whether the bundle is structurally capable of excluding some hypothetical rival who produces only a subset of the goods in the bundle. How little the test shows needs to be clear, because some regard it as a mantra for anticompetitive pricing.[16] For example, suppose that Manhattan has 1,000 restaurants that offer discounted *prix fixe* menus that include wine, but that one of these 1,000 restaurants has lost its liquor license and as a result cannot

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14. ANTITRUST MODERNIZATION COMM'N, REPORT AND RECOMMENDATIONS 99 (2007), http://govinfo.library.unt.edu/amc/report_recommendation/amc_final_report.pdf [hereinafter AMC REPORT]. The test went on to include two additional elements: "(2) the defendant is likely to recoup these short-term losses; and (3) the bundled discount or rebate program has had or is likely to have an adverse effect on competition." *Id.*

15. On the use of average variable cost as the number see Hovenkamp & Hovenkamp, *supra* note 1, at 520-21. The *Cascade* decision explicitly adopted an average variable cost test:

> To prove that a bundled discount was exclusionary or predatory for the purposes of a monopolization or attempted monopolization claim under § 2 of the Sherman Act, the plaintiff must establish that, after allocating the discount given by the defendant on the entire bundle of products to the competitive product or products, the defendant sold the competitive product or products below its average variable cost of producing them.

Cascade Health Solutions v. PeaceHealth, 515 F.3d 883, 910 (9th Cir. 2008).

16. *See generally Cascade*, 515 F.3d at 900-02.

include wine in the bundle. The bundled prices of the remaining 999 restaurants might all flunk the attribution test because the one restaurant without wine cannot match the foregone wine discount in its own *prix fixe* menu without running its prices below its costs. But the restaurant market in Manhattan remains robustly competitive.

Once a firm's bundle flunks the attribution test, a full analysis of market structure, competitive effects, and rationales for the profitability of the defendant's bundle remain to be examined. Applied alone, the attribution test is significantly over-deterrent, particularly when the firm observes cost savings in production or distribution. For example, a firm with joint costs distributed over A and B will always be able to offer an A-B combination at a lower price than could two different firms that each produce only one of those goods, but match the bundling firm's efficiency in producing them *individually*.[17] Because joint costs can be *any* relevant cost distributed over multiple goods, including costs such as distribution, transportation, and order processing, such cost-savings very likely explain the vast majority of bundled discounting practices, including those that flunk the attribution test.

In sum, the attribution test simply asks whether a bundle is exclusionary. Any bundle that is not exclusionary cannot be predatory. But the important question is not whether a bundle can exclude, but whether it is predatory. If the defendant can show that a bundling strategy does not reduce short run profits, then immediate gains from increased sales is the dominant explanation, and one cannot show that the strategy is profitable only because it destroys a rival. Suppose a monopolist in the market for good A decides to sell a discounted bundle of goods A and B, where B is sold in a moderately competitive market. As in the previous illustration, assume that A and B are sold individually for $10 each, while costs are $5 for A and $7 for B. A rival firm produces only B. The monopolist then offers a 20% discount on the bundle, yielding a bundled price of $16. If there are no joint costs, the attribution test is effective. It subtracts the nominal value of the discount ($4) from the price of B. The result, which is $6, defines the maximum price the rival can charge for a unit of B in order

17. *See* Hovenkamp & Hovenkamp, *supra* note 1, at 525-28; *infra* app. 2.

to compete with the bundle (i.e., the price of B that reduces the value of the bundle's discount to zero). The example fails the attribution test. Further, the given information does not guarantee that total profits will not fall in the short run before any exclusion occurs. As such, the bundle does not presently warrant safe harbor, and so other evidence must be considered before we can determine if the bundle is also predatory.[18]

However, if this example is modified to include joint costs, the attribution test becomes overreaching and ineffective. Suppose that there is a joint cost savings of $3 that results from the simultaneous production of A and B. Hence, the cost of producing individual units is $5 for A and $7 for B, as before, while the cost of producing both goods simultaneously is $9. The monopolist again gives a 20% discount, so that the price of the bundle is $16. To apply the attribution test, the nominal value of the discount ($4) is subtracted from the price of B (or, equivalently, the price of A is subtracted from the bundle price), which leaves us with $6. This amount is less than the cost of producing an individual unit of B, so the attribution test is failed. However, the incremental cost of producing the bundle (i.e., the cost of the bundle less the cost of A) is $4. Conversely, the incremental price of selling B with A (i.e., the price of the bundle less the price of A) is $6. Thus, the incremental price of the bundle exceeds its incremental cost, so the bundle yields a greater per-unit profit than an individual unit of A.[19] Any consumers who switch from buying A to buying the bundle will contribute more profits to the bundling firm as a result.

This is strikingly different from the practice of predatory bundling, which forfeits short-term profits in order to exclude a rival, and which inevitably harms consumers in a later period of recoupment. Rather, what the bundling firm has effectively done is pass its efficiency gains on to consumers, while still increasing short term profits.

18. For example, if output increased significantly in response to the discount, the dominant firm might sell many more units at the bundled discount price, earning $4 more in profits on each bundle than it earns by selling the units separately and earning $8 in profits on each sale of an A + B pair. On the other hand, if output did not increase that significantly, then there must be some other explanation for the bundled discount's profitability.

19. In the preceding case of no joint costs, the profits earned by selling the bundle were strictly less than those earned by selling A individually.

Moreover, these efficiency gains leave the bundle with a significantly larger profit margin, so that it could easily afford to slash prices further if its goal were to exclude a rival. Indeed, the bundling firm in our example could price the bundle at \$9.50, which would be above cost, yet could not be matched by a rival at *any* price—let alone a sustainable one. So, while this bundle is indeed exclusionary, it is clearly not the sort of bundled discount that merits antitrust intervention. As this example shows, there can be many applications of discounted bundling that are pro-competitive and welfare-increasing, despite having an adverse impact on a rival.

With some minor adjustments, the attribution test can be modified so that it yields the correct outcomes, even in the presence of joint costs.[20] The improved test, called the "Incremental Cost Test" (ICT), works by offering safe harbor to any bundle whose incremental price (over the primary good) is at least as great as its incremental cost. The ICT is based on the assumption that total profits will not fall if the bundled sales are at least as profitable as individual sales of the primary good.[21] Such would imply the bundling strategy is profitable regardless of its impact on rivals, indicating that the bundle is not predatory. As an example of this improved test, suppose that a dominant firm prices A and B separately at \$10 each, but prices them together in a bundle for \$16. In that case, the ICT queries whether the \$6 increase in price when good B is added into the bundle is sufficient to cover B's incremental cost. If the answer is yes, then the bundle passes the ICT and offers a safe harbor. Unlike the AMC's attribution test, this test takes joint costs into account.

One implication of the improvements gained through the ICT is that the concept of an "equally efficient rival" has limited significance when rivals do not produce every good in the bundle. The condition of "equal efficiency" normally takes a firm as it is found and looks at all relevant costs. For example, suppose that individual production costs of A and B are \$5 and \$7, respectively, but that producing them together costs only \$9. To call a firm an equally efficient rival simply because it produces B alone at a cost of \$7 is inaccurate—the firm would reduce its costs by adding in

20. *See* Hovenkamp & Hovenkamp, *supra* note 1, at 525-28.

21. For an explanation of this assumption, see *infra* app. 3.

product A and attaining the joint cost savings as well. In principle, that is no different from observing that, in the presence of scale economies, a firm making 100 units per month might reduce its per-unit costs by increasing output to 200 units. In that case, the 100 unit firm is less efficient than the 200 unit firm. In one situation, the firm reduces its costs by making more of the same product; in the other, it reduces its costs by adding in an additional product subject to joint production costs. Indeed, if the monopolist sells only the bundle and individual units of good A, and if joint cost savings are observed, then the monopolist has no units of output with production technologies comparable to those of rival producers of B. That is, there is no production process at which the monopolist and a B-market rival could be equally efficient. Rather, the joint cost savings make the technology used for producing individual units of B fundamentally different from that used for creating the bundle, and the idea of "equal efficiency" loses most of its meaning.

A bundle is predatory (not merely exclusionary) only if its ability to maintain or increase total profits requires the exclusion of one or more rivals. Hence, a pass of the ICT guarantees that the bundle is not predatory, though it may be exclusionary in the presence of joint costs. This is because the ICT simply asks whether the per-unit profits achieved by the bundle are as great as those achieved by individual sales of A. If the bundled discount simply passes on a discount that is no greater than the joint cost savings, then per unit profitability on the bundle will be at least as high as profits earned on the primary component of the bundle. Such a bundle cannot be predatory, for it is profitable even when no rivals are excluded. This result illustrates the real difference between the attribution test and the incremental cost test. Namely, the attribution test asks whether a bundle is exclusionary, while the ICT goes further to ask whether it is *potentially* predatory. Of course, many bundles that are *potentially* predatory (i.e., many that fail the ICT) are pro-competitive, but these tests are only designed to provide safe harbor; they cannot be used to identify an unlawful bundle outright.

II. COMPLEX BUNDLES

The competitive effects of bundled discounts are more difficult to assess when we consider bundles that are more complex than simply 1 unit of product A and 1 unit of product B. In general, taking prices as given, a bundle is defined by (i) a set of bundled goods; (ii) a set of bundled quantities or proportions; and (iii) a discount factor. Complex bundling occurs when the set of bundled goods is greater than 2, when the bundled quantities of one or more goods exceed 1, or when the proportions of the goods can be varied. A bundle may not contain 2 products, only 3 or more, and the additional products may or may not be produced by the rival(s), or one secondary product might be produced by one rival while another is produced by a different rival. Fortunately, the principles that apply to bundled pairs of goods also apply to complex bundles. However, if the number of goods within a bundle changes or the quantities of each good are changed, then the bundle's impact on rivals may change as well. Indeed, as this section will illustrate, the competitive effects of similar-appearing bundles can, in fact, be strikingly different.

The analysis that follows focuses on two situations: first, bundles that contain more than 2 products and second, bundles that contain multiple units of 1 or more bundled goods where the customer is entitled to vary the proportions of the goods in the bundle.

A. *Bundles with More than Two Products*

Bundling introduces a new element of competition into the markets of each bundled good. We consider firms in these markets to be rivals, despite the fact that they may produce only a subset of those goods within the bundle. This sort of pricing affects different rivals in different ways, depending on which bundled goods they can produce, as well as the combinations of goods that customers purchase.

We can use much of the same reasoning to analyze large bundles as is applied in the simple case of bundled pairs. Significantly, a bundle encompassing many different goods and quantities can still be considered as a union of two parts with opposing competitive effects, just as A and B in a bundled pair. However, when bundles include more than two different goods, these opposing parts are perceived differently by different rivals, depending on which parts they offer. For example, suppose a dominant firm offers a bundle of the three goods, A, B, and C, where A is produced exclusively by the bundling firm. Assume that rival 1 produces only B, while rival 2 produces only C. Rival 1 perceives good C no differently from good A, though good C is in fact sold by both the dominant firm and rival 2. By contrast, rival 2 does not perceive good C in this way, but rather perceives good B as a second monopoly good. As a result, discussion of a given bundle must be relativized to a particular rival before we can understand how that rival stands to be affected.

Building on the previous example,[22] suppose that a bundle contains exactly one unit of both A and B, but also includes 1 unit of a third good, Y. Assume that Y is produced by both the monopolist and its B-market rivals. The standalone price of Y is $10, while its production cost is $6. Products A and B are sold separately for $10 each, and production costs are $5 for A and $7 for B. The monopolist sells individual units of A and also the A-B-Y bundle, which it discounts by 20% for a bundled price of $24. If we apply the ICT, we see that the bundle's incremental cost over good A is $13, while its incremental price is $14. Hence, the ICT is passed and the bundle is granted safe harbor. This stands in contrast to the A-B bundle presented in the last section, which failed the ICT. To generalize, the addition of goods to the bundle that *both* the dominant firm and the rival produce makes exclusion less likely, provided the discount factor is unchanged.[23]

Alternatively, suppose we add a third good X to the A-B bundle, but assume that the rival does not produce X. Good X has a price of $10 and a cost of $6; that is, it is identical to good Y in price and cost. As before, A and B are sold for $10 each, and have costs of $5 and $7 respectively. As with the A-B-Y bundle, the 20% discount applied to the A-B-X bundle results in a bundled price of $24. However, unlike the preceding case, the ICT now measures incremental prices and costs with respect to both A and X, as these constitute the primary component of the bundle in this case (i.e., the component not produced by the rival). The bundle's incremental price is $4, while its incremental cost is $7, so that the A-B-X bundle fails the ICT. Hence, the addition of good X to the A-B bundle has the reverse effect obtained by the addition of good Y. In general, the addition of goods not

22. *See supra* Part II.A.

23. *See infra* apps. 2-3.

produced by a rival makes exclusion of that rival more likely, provided the discount factor is unchanged.[24]

The two examples simply illustrate the proposition that in order for the rival to compete with an "incomplete" bundle it must apply a series of price cuts to the bundled goods *it* can produce. As the number of bundled goods not produced by the rival increases, the rival is forced to employ larger price cuts on the ones that it does produce in order to compete. Put differently, excluding a rival is easier when a bundle includes more goods that the rival cannot produce. By contrast, the addition of goods that are produced by both the bundling firm and the rival makes exclusion less likely, as the rival can compete with the bundle using relatively smaller price cuts.[25]

The addition of the third good (X or Y) into the bundle has a differential impact on rivals depending on whether they also sell the third good. If they do, exclusion becomes relatively more difficult. If they do not, exclusion becomes relatively easier. As a result, the addition of another good to a bundle may benefit one rival, who makes the third good, but it may burden or even exclude a different rival who does not make the third good. One important corollary of this observation is that the rival can compete more easily by adding additional goods to the bundle, whether or not they are the dominant firm's monopolized goods.

Thus, for example, suppose a bundle offered by the dominant firm aggregates discounts across 5 products, A, B, C, D, and E. *Ceteris paribus*, the more of these products that the rival produces, the more easily it will be able to match the discount. This also means that if many rivals compete with the dominant firm, their individual ability to compete will depend greatly on how many and which of the goods in the bundle they produce. A firm that produces goods B, C, D, and E will be able to compete more readily than a rival that produces only C, D, and E. When proportions of the

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24. It should be noted that a bundled good need not be a "monopoly good" in order to make competing with the bundle more difficult for rivals in a secondary market. Rather, any bundled good that is not produced by those rivals makes competing with the bundle more difficult, regardless of whether or not that good's production is unique to the bundling firm. For a more detailed explanation, see *infra* apps. 1-3.

25. For an explanation and proof of how various aspects of a bundle contribute to its potential for exclusion, see *infra* apps. 1-3.

goods in the bundle can be varied at the request of the customer, the analysis becomes even more complex.[26]

To simplify discussion, we offer some terminology to help identify the significant components of a bundle. These must be relativized to a particular rival because, as the last paragraph illustrates, different rivals may be impacted in different ways. For a given rival, we say that a bundled good is a *competing good* if the rival has the ability to produce that good. Conversely, we say that a bundled good is an *excluding good* for a particular rival if that rival does not (and perhaps cannot) produce that good. Accordingly, we define a rival's *competing share* of a bundle to be the set of all bundled units of that rival's competing goods. Likewise, a rival's *excluding share* of a bundle is the set of all bundled units of that rival's excluding goods.[27] Importantly, these shares must be computed for each particular rival—we cannot merely look at the shares produced by the dominant firm, or defendant, as is typically done in antitrust analysis.

We can think of these shares as undiscounted baskets of goods, the quantities of which are the same as they are within the discounted bundle. A rival's competing share, for instance, includes all of the rival's competing goods, and at the same quantities in which they appear within the discounted bundle. For example, suppose a bundle includes 3 units of A, 2 units of B, and 1 unit of Y. Assume that a rival produces only B and Y. Then B and Y are competing goods for the rival, while A is the only excluding good. Likewise, the rival's competing share consists of 2 units of B and 1 unit of Y, while its excluding share consists of 3 units of A. Hence, we see that for any rival, the union of both shares observed by that rival is equivalent to the entire contents of the bundle.

With these definitions, it is easier to describe the steps that a rival must take in order to compete with a bundle. Our preceding examples[28] that considered bundles of three goods demonstrate how a rival's competing and excluding shares of the bundle work against one another. In particular, a rival must amortize over its own output the nominal value of the dominant firm's discount in order to

26. *See infra* text accompanying notes 35-37.

27. *See infra* apps. 1-2.

28. *See supra* Part II.A.

compete with it. To do this, the rival must attribute a series of price cuts to its competing goods so that the undiscounted value of its competing share falls by an amount no less than the bundle's nominal discount. Intuitively, this just says that the rival must eliminate the discount provided by the bundle, which it accomplishes by reducing the prices of one or more competing goods.

To see how a bundle's impact may vary among rivals, consider another example. Suppose a firm produces a bundle that consists of 1 unit of each of the goods A1, A2, and A3, in addition to 2 units of B1 and 1 unit of B2. Hence the bundle includes 6 units of 5 different goods. Rival 1 sells only B1, rival 2 sells only B2, and the bundling firm sells only the bundle and individual units of the 3 A-goods. For simplicity, assume that each of the 5 goods in the bundle is priced at $10 and costs $6 to produce. The bundling firm offers a 10% discount on the full bundle, so the price of the bundle is $54. With this, we will first consider the bundle from the perspective of rival 1. According to the definitions given above, 2 units of B1 comprise the competing share of this bundle for rival 1, while its excluding share includes 1 unit of each of the goods A1, A2, A3, and B2. It should be noted that a rival's excluding and competing shares are analogous to the primary and secondary goods (respectively) that characterized our examples of bundled pairs. Hence, we apply the ICT by measuring incremental prices and costs with respect to this rival's excluding share. Specifically, the bundle's incremental price is the bundle's price less the market price of rival 1's excluding share, $14. The bundle's incremental cost is therefore the cost of the bundle less the cost of rival 1's excluding share, $12. Hence, the ICT is passed with respect to rival 1. If we consider the bundle from the perspective of rival 2, our results change. To begin, we note that rival 2's competing share is 1 unit of B2, while its excluding share is 1 unit of each of the goods A1, A2, and A3, as well as 2 units of B1. If we use the same process to apply the ICT using rival 2's bundle shares, we find an incremental price and cost of $4 and $6 respectively. Thus, the ICT is failed with respect to rival 2.

This example, as well as previous ones,[29] illustrates a number of important implications. First, a bundle's

29. *See supra* Part II.A.

exclusionary potential[30] can differ significantly from one rival to the next. This can be seen in the two different outcomes that resulted when we applied the ICT to two different rivals. This demonstrates that the bundle is exclusionary within the market for B2, but not within the market for B1. Second, bundled goods produced exclusively by the bundling firm are not the only sort that can contribute to a bundle's exclusionary potential. Rather, any bundled good not produced by a particular rival contributes to the bundle's potential to harm or exclude that rival, even if the good is produced by one or more other rivals. Indeed, the excluding share of each rival in our example included a good produced by the other rival. Hence, we see that not only so-called "monopoly goods" can contribute to a bundle's exclusionary potential. In fact, if a bundle consists of only competitively-sold goods and if a rival produces only a small subset of those goods, then we have no reason to believe this bundle has any less exclusionary potential than one dominated by monopoly goods.

A bundled discount can injure a rival even if the bundling strategy is undeniably pro-competitive. In particular, a rival who produces only 1 of the goods within a large bundle may be completely excluded regardless of how competitive the goods in the bundle are. Suppose a bundle includes 1 unit each of 10 different goods, but the rival produces only 1 of those 10 goods. Because the rival's excluding share is so much larger than its competing share, the rival likely cannot compete with the bundle at any price, above cost or not. However, this would be true even if many other rivals produced the full range of bundled goods, in which case predation would not be a viable strategy. Often, exclusion of a single firm rival (or rival who makes only a subset of goods in a bundle) results from nothing more than price competition among other rivals who make either the full range, or at least a larger range, of goods in the bundle.[31]

The excluding share of a bundle contributes to its potential for harm, while the competing share detracts from

30. A bundle's "potential for harm" is simply the extent to which rivals are obliged to cut prices in order to compete with the bundle. This is an ordinal notion, as we can only use it to make comparisons among bundles.

31. For example, if 10 firms produce goods A, B, C, D, and E, all of which are priced close to cost and offer even a modest bundled discount, the firm that produces only one of these goods will be unable to compete.

it. But we have still not determined what specific characteristics of these shares actually yield harmful effects or how we can use these characteristics to evaluate the competitive effects of bundled discounting. In general, the potential of a bundle to harm or exclude a rival increases as the undiscounted value of that rival's excluding share grows larger. Conversely, this exclusionary potential decreases as the total number of bundled *units* (as opposed to *goods*) in the rival's competing share is increased.[32] That is because a rival's competing and excluding shares have opposing effects on a bundle's potential to harm that rival. In fact, a rival's competing share of a bundle is analogous to good B in the simple case of bundled pairs, while its excluding share is analogous to good A. Additionally, a bundle's potential to harm a particular rival will tend to increase as the value of the discount provided by the bundle increases. In general, a bundle's potential to harm or exclude a given rival will increase as:

- the number of excluding goods facing the rival increases;
- the bundled quantities of 1 or more of the rival's excluding goods increase;
- the prices of 1 or more of the rival's excluding goods increase;
- the number of competing goods facing the rival decreases;
- the bundled quantities of 1 or more of the rival's competing goods decrease;
- the profit margins of 1 or more of the rival's competing goods decrease;
- or the discount provided by the bundle (in terms of markdown percentage) increases, ceteris paribus.33

One important implication is that if a dominant firm makes a large product line and a rival only a very small one, then relatively small bundled discounts can exclude. For example, suppose that the dominant firm makes 10 products that cost $9 each and sell individually for $10 each, but offers a 2% discount to those who take a full set, resulting in a price of $98. The rival makes only product

32. For a proof, see *infra* app. 2.

33. *See infra* app. 2.

number 10, which it can sell to the customer for $9, but then the customer will have to pay $90 for the other 9 products from the dominant firm, for a total of $99. The bundle flunks the attribution test and the ICT. Indeed, in this particular example any discount above 1% will exclude the rival from the trade of those customers who want the entire package; but such trivial discounts are almost certainly justified by cost savings in contracting or delivery, if not in production.

This brings us back to our earlier observation about the definition of an equally efficient firm.[34] When a multi-product firm enters the market, any multi-product cost savings can justify a multi-product discount. This includes transaction and transportation cost savings as well as strict production cost savings. Indeed, for a multi-product firm not to have *any* scope economies would be exceptional. All it takes is one input or production process whose costs can be distributed over multiple goods. In these cases, the discount is merely a mechanism by which these cost savings can be passed on to consumers.

Finally, our results imply that if the profit margins of a rival's competing goods are relatively small, then the bundle is more likely to fail the attribution test with respect to that rival. This produces the ironic result that the less monopoly power a bundling firm has in the markets for a rival's competing goods, the more likely its bundle will fail the test. That is, as the market price of the competing good approaches marginal cost, a smaller discount is needed to exclude.[35] On the other hand, the profit margins of a rival's excluding goods will generally not impact the bundle's potential to exclude that rival. For example, suppose a bundle includes 1 unit each of the 3 goods, A, B, and C, and a rival produces only the goods B and C. Assume that each good has a price of $10, and that the bundle offers a 20% discount, yielding a bundled price of $24. First, suppose that production costs are $6 for all 3 goods. Then, measured with respect to this rival's excluding share, a single unit of A, the bundle's incremental price and cost are $14 and $12 respectively. Hence, the attribution test is passed. Now,

34. *See supra* text accompanying notes 6-10.

35. For example, if the dominant firm is an A good monopolist and the B good is sold in a perfectly competitive market at a price equal to marginal cost, then any discount on an A-B package could exclude the rival.

suppose that B and C each cost $9 to produce. In this case, the bundle's incremental price is still $14, but its incremental cost is $18, so the attribution test is failed. This is because the rival's competing goods now have much smaller profit margins, severely limiting its ability to cut prices and compete with the bundle. Moreover, this is true regardless of what profit margin is observed by the rival's excluding goods. Indeed, if the cost of producing A were $0, or even $10, our results would not change.

The implications should not be lost—*the more competitive the markets of a rival's competing goods are to begin with, the easier it will be for a rival to prove exclusion under the prevailing antitrust tests.* This leads to the perverse result that the tests tend to show more positive results as monopolization in the competing good markets becomes less likely.

B. *Joint Offers by Rivals*

Even if no rival produces the full range of bundled goods, predatory bundling may not be a viable strategy. Specifically, if 2 or more rivals can *collectively* produce all or most of the goods within a bundle, then exclusion may not be possible. For example, suppose a bundle includes 1 unit each of the 3 goods X, Y, and Z. Rival 1 produces only good X, rival 2 produces only good Y, and rival 3 produces only good Z. All goods have individual prices and costs of $10 and $6, respectively. Finally, assume the bundle offers a 20% discount, which yields a bundled price of $24. For any one of the three rivals, the bundle's incremental price is $4, while its incremental cost is $6. Hence, the ICT is failed with respect to each rival. However, because the rivals collectively produce the contents of the bundle, the exclusion of any rival is not generally possible, provided each rival has an incentive to compete with the bundle. Indeed, each rival could reduce the price of its only competing good to $8, which still leaves a $2 markup. This effectively eliminates the discount provided by the bundle, as its contents can now be bought separately for the same price at which the bundle is sold.

In fact, even if rivals collectively produce only a subset of the goods within the bundle, exclusion is unlikely if that subset is sufficiently large. We could remove rival one from our previous example,[36] so that the two remaining rivals collectively produce only goods Y and Z. In this case, the two rivals can price their respective competing goods at $7, which still allows them to compete with the bundle at above-cost prices. To generalize, exclusion is not likely to occur if some combination of rivals can collectively produce all or even most of the goods within the bundle—the larger the number of the goods in the dominant firm's bundle they can offer, the less likely they will be excluded.

Note, however, that if the dominant firm offers a bundle subject to joint costs or economies of scope, then rivals will not be able to join forces and compete by offering the larger bundle unless they can also attain the joint cost savings. If A and B can be *produced* more cheaply together than separately, a firm that produces A alone and one that produces B alone will not attain the cost savings simply because they bundle their separately produced A and B together; they would have to engage in actual joint production.[37]

C. *Variable Proportion Bundles*

In a variable proportion bundle, the discount rate and the set of bundled goods are predetermined by the bundling firm, but the bundled quantities of those goods are subjectively chosen by consumers. The competitive effects of variable proportion bundling change as the proportions of bundled goods are varied.

When bundling occurs on a very large scale, it becomes more difficult for purchasers to predetermine the contents of bundles. Indeed, as the set of bundled goods and their respective quantities become more diverse, the bundle appeals to a more specific subset of consumers. In such cases, the sellers have every incentive to give buyers considerable freedom in choosing the bundle's contents. For example, a medical device manufacturer may offer a 10% discount to hospitals that purchase a minimum specified share of their needs of 5 different products from the manufacturer; however, the precise amount that they

36. *See supra* Part II.B.

37. On the significance of joint costs, or cost savings that accrue to production or distribution of the bundle, see Hovenkamp & Hovenkamp, *supra* note 1 at 525-28.

purchase during the contract period will depend on patient demand, and the proportions sold under the same contract could vary from one purchaser to another. Indeed, it would almost certainly be impossible to negotiate a single contract with a large number of purchasers if all purchasers were required to take the goods in the bundle in the same proportion.[38]

To see how varying the proportions of bundled goods impact a bundle's competitive effects, reconsider our example from the first section.[39] Once again, assume that a primary good A costs $5 to produce, while a secondary good B costs $7 to produce. Both goods sell for individual prices of $10. The monopolist offers a 20% discount on a bundle that includes 1 unit of both A and B, yielding a bundled price of $16. A rival sells only B. As before, this bundle flunks both the attribution test and the ICT. In order for a rival who makes only B to compete, it would have to charge $6 for B, which is $1 less than its costs.

However, suppose that the bundle contains 1 unit of A and 3 units of B. As before, the bundle offers a 20% discount, so that its price is $32. To apply the attribution test we attribute the entire $8 discount to the 3 units of B, which results in $22. This is the maximum price that the rival, who makes only the B, can charge for the 3 units. Since B costs $7 to produce, the rival can sell the 3 units and have $1 left over; the bundle passes the AMC's attribution test. Alternatively, to apply the ICT, we compare the bundle's incremental cost (over the single unit of A)[40] to its incremental price. Because we assume there are no joint cost savings, the incremental cost is simply 3 times the cost of B, or $21, while the incremental price is the price of the bundle less the price of A, or $22. Hence, the incremental price of the bundle exceeds its incremental cost, and so the bundle with the 1 to 3 ratio of A to B warrants safe harbor. A pass of the attribution test always guarantees a pass of the ICT, whether or not any cost savings result from jointly

38. In general, a bundle tends to exclude rivals less as it contains more of the competitive product in relation to the monopoly product. *See infra* app. 2.

39. *See supra* Part I.

40. In general, we use the set of all bundled goods not produced by rivals as the basis for measuring its incremental prices and costs (i.e., if this bundle contained X units of A, then we would use X times the price of A as this basis).

producing the contents of the bundle.[41] In sum, changing the proportions of goods in the bundle will affect its exclusionary potential. For that reason, as the proportion of a rival's competing goods in the bundle increases, the bundle becomes less likely to fail either the AMC's attribution test or the ICT.

This fact has a number of implications. First, as a matter of analysis, one can never apply the attribution test or ICT over products in a 1 to 1 ratio if the customers in fact were offered or actually purchased a different ratio. Second, if the goods in the bundle are partial substitutes, a customer can avoid the bundle by purchasing relatively more of the competitive good. Third, the foreclosure story can become much more complex in circumstances where different customers take significantly different proportions of bundled goods. As a matter of antitrust, exclusion is measured by calculating the portion of the *relevant market* from which a rival is excluded. In effect, one asks what portion of the aggregate sales of a rival's competing good(s) consisted of bundles with which that rival could not compete. But when bundles are sold in varied proportions, simply aggregating the sales does not work. Consider a simple example of variable proportion bundling where aggregate sales would indicate a larger degree of harm than actually occurred.

Suppose a dominant firm engages in variable proportion bundling of the two goods A and B. As in previous illustrations, both A and B have individual prices of $10, while production costs are $5 for A and $7 for B. A rival produces only B. The bundling firm offers a 20% on bundled sales, regardless of what quantities appear in a consumer's bundle. For simplicity, we will assume there are only two types of buyers in this setting. Type 1 consumers want bundles with 4 units of A and 1 unit of B. Type 2 consumers want bundles with 1 unit of A and 4 units of B. We will refer to these two bundles as bundle 1 and bundle 2 respectively, —both of which have a bundled price of $40.

Bundle 1, which has 4 units of A and 1 unit of B, is exclusionary. The rival's excluding share of bundle 1 consists of 4 units of A, so the incremental price and cost of

41. *See infra* app. 3.

bundle 1 are $0 and $7 respectively. In any instance where the incremental price of a bundle is non-positive, the rival will not be able to compete with it, provided production costs are above zero. Conversely, bundle 2 earns safe harbor with relative ease. In this case, the rival's excluding share is a single unit of A, so bundle 2 has an incremental price and cost of $30 and $28 respectively. Hence, the rival is excluded from competing for type 1 consumers, but not type 2 consumers.

The fact that all the bundles being purchased are not exclusionary is significant when considering the aggregate sales that take place in this market. Suppose that after serving all consumers of both types, the bundling firm has aggregate sales consisting of 100 units of A and 100 units of B. If we apply the attribution test to the aggregate sales made by the bundling firm, the attribution test is failed. Specifically, we could treat these sales as one large bundle, which would have a net price of $1600. Hence, this bundle would provide a nominal discount of $400 which, when attributed to the 100 units of B, would require that each unit of B be sold for a price of $6 if the rival is to compete. This is below the cost of producing B, so the aggregate sales of the bundling firm would indeed be exclusionary if they were in fact sold in the same proportions. However, we know that this is not actually the case. Rather, bundles were sold in two different proportions, only one of which was exclusionary.

For example, suppose the bundling firm's aggregate sales were comprised of 20 sales of both bundles 1 and 2. Or, to say this differently, the bundling firm served 20 consumers of each type. This would result in aggregate sales of 100 units of A and 100 units of B, as hypothesized earlier. However, of the 100 units of B sold by the bundling firm, only 20 were sold as a part of bundle 1—the only exclusionary bundle sold in the market. Hence, the rival was excluded from only 20% of these sales, as it could have set prices that would have permitted it to compete with bundle 2. By examining market shares, we can determine from what portion of the overall market for B the rival was foreclosed. For example, if bundled sales of B constitute 50% of the overall market for B, and if the rival is foreclosed from only 20% of those sales, then the rival is foreclosed from only 10% of the overall market for B. So, while examining only the aggregate result of bundled sales would suggest the rival has been foreclosed from all bundled sales and hence 50% of the overall market it has in fact been foreclosed from a much smaller portion of that market.

This result is particularly important when assessing, for example, class action suits in which the plaintiffs are rival producers of bundled goods. Clearly, aggregate sales are not a reflection of the market-wide exclusion that actually took place. We can assess the exclusionary impact of the bundling strategy only by examining the specific contents of the various bundles. This also implies that even if 1 rival has a legitimate claim of unreasonable exclusion, a different rival may not. If the bundles being sold contained more than 2 goods, then different rivals would be affected differently depending on what bundled goods they can produce. For example, suppose that all bundles sold in the preceding example also included 1 unit of C, which has a price and cost of $10 and $6 respectively. Hence, both bundles would have a price of $48, and both would fail the attribution test with respect to a rival that produces only C. In that case, the rival is foreclosed from all bundled sales of good C. If we assume that bundled sales constitute 50% of the total sales of C, then this rival would be foreclosed from 50% of the overall market for C. In this way, we see that it is not generally possible to infer a bundle's potential to exclude 1 rival by examining its effect on a different rival. Likewise, we cannot examine aggregate sales to determine the exclusionary force of a variable proportion bundling strategy.

In sum, the exclusionary power of the bundle diminishes, perhaps dramatically, as individual customers are able to make different substitution decisions. This is particularly significant if the goods in the bundle are partial substitutes. If A is a monopolized good and B is a competitive good, a customer will have an incentive to use relatively more of B and relatively less of A and can avoid purchasing the dominant firm's bundle simply by changing its proportions in favor of B. For example, hospital group purchasing contracts for medical devices, such as hypodermic needles or catheters, may include within the bundle goods that are differentiated, but nevertheless have many common uses. The purchaser may be able to avoid the monopolist for purchase of the competitive good simply by purchasing more of that good in relation to the monopolized good. As the A and B good are closer substitutes for each other, customers will find it easier to take relatively more of B and relatively less of A.

In contrast to substitutability, complementarity among the goods in the bundle has a different effect. For example, if a monopolist offers a bundle that cannot be matched by rivals and yet there remains a large number of consumers who only want one of the goods, then significant harm is unlikely to occur. Conversely, if A and B are uniformly consumed together, then a bundle containing a relatively large amount of the A good may prove fatal for competitors. The greater the extent to which the goods in a bundle are complements, meaning that the consumer uses all of them together, the greater the exclusionary power of the bundled discount.

However, complementarity must be perceived by a large portion of consumers if harm is to occur. Trivially, a bundle threatens rival producers of a bundled good only insofar as the rival's customers desire the remaining contents of the bundle. Many instances of bundled discounts might be pro-competitive, despite the fact that they fail the ICT, for the simple reason that plenty of customers exist who do not want all of the goods in the bundle. In fact, when a bundle is sufficiently specialized to prevent losing unbundled sales, the bundling strategy can be profitable no matter how small its profit margin is. That is, if a bundle appeals to a much different group of consumers than does its primary product alone, then a failure of the attribution test is not suspicious in the least. Indeed, if the bundling firm can ensure that customers who buy only the primary good will not revert to the less-profitable bundle, then the bundling strategy will increase total profits no matter how slight the bundle's margin is. In these cases, the bundle serves as little more than an independent compromise between a reduced profit margin and additional sales.

D. *Price Discrimination*

Bundled pricing can often be used to facilitate price discrimination, which occurs when a seller obtains different returns on different groupings of sale.[42] Price discrimination

42. *See* Hovenkamp & Hovenkamp, *supra* note 1, at 528-29; *see also* AMC REPORT, *supra* note 14, at 398-99; DENNIS W. CARLTON & MICHAEL WALDMAN, SAFE HARBORS FOR QUANTITY DISCOUNTS AND BUNDLING (2008), at EAG 08-1, *available at* http://www.usdoj.gov/atr/public/eag/230712.htm. For a more technical treatment of price discrimination strategies, see DENNIS W. CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL ORGANIZATION 324-30 (4th ed. 2005).

of one type can occur when producers predetermine the ratio of goods in a bundle. Such bundling is generally used to attract consumers who place relatively less value on a particular bundled good or who require a relatively uncommon combination of related goods. Specifically, the bundling firm charges these consumers different prices by bundling different combinations of goods that appeal to their respective demands. This also protects the bundling firm from arbitrage, as these bundles typically include particular goods or quantities that appeal only to the consumers for whom they were intended. For example, suppose a firm produces an electric drill that strongly appeals to "light users," who need it only for sporadic household repairs. However, the drill attracts only a small number of "heavy users," who require near daily use of electric drills. In order to better reach these consumers, the drill producer might decide to offer a discounted bundle whose contents appeal to heavy users. For example, the bundle might include a large number of industrial drill bits, which are typically sold in a competitive market. It would offer a large discount on the bundle, as heavy users place less value on the drill itself. As a result, the bundle would likely be less profitable than the drill sold individually. But, in exchange, the drill producer acquires many customers who would otherwise buy a different drill. More importantly, it does not lose standalone sales of the drill, because the bundle includes far more of the heavier bits than are required by light users. Hence, total profits could easily increase, even if the bundle's incremental cost exceeds its incremental price. In this way, the bundle is used to reach a specific group of consumers who place relatively less value on the drill itself and who can be uniquely targeted with a highly specific bundle. What is more, the drill producer accomplishes this without having to cut the drill's standalone price.[43] When price discrimination

43. For example, suppose light users value the drill at $22 and heavy users at $18 because they prefer a more heavy duty alternative. The drill has a standalone price of $20, which includes a $5 markup. A package of heavy duty bits has a price of $10, which includes a $1 markup. With little use for the heavy drill bits, light users value this package at only $4 and would not purchase it in a competitive market. But heavy users, who require the bits every day, value the package at $12. The firm bundles the drill and the bits at a price of $28, which is valued at $30 by heavy users, but only $26 by light users. Hence, heavy users buy the bundle and light users buy the drill individually. Moreover, the manufacturer earns good profits either way.

works in this fashion, it increases the manufacturer's sales in some portion of the market. Further, since the sales are profitable, the strategy does not require the exclusion of any rival. As with all output increasing practices, however, exclusion of a rival might result.

As is well known, price discrimination can also be facilitated by variable proportion ties,[44] and bundled discounts might serve as a substitute for a tie. For example, the owner of a printer monopoly might sell the printer at cost, but require the customer to purchase ink cartridges at monopoly prices. In that case, the seller's return on any particular customer's print/cartridge combination will be higher as the customer uses more cartridges.

But variable proportion bundled discounts may not work as effectively as variable proportion ties. As the preceding discussion suggests, as the ratio of competitive units (the cartridges) to monopolized units (the printer) increases, it becomes less likely that the bundle will flunk the attribution test.[45] As a result, competition would be relatively easier for rival ink producers. This implies that high-volume customers will very likely be able to forego the discount on the printer and then purchase their cartridges at a lower price in a competitive market. So, the strategy loses the very customers from whom the higher rate of return would be expected.

CONCLUSION

Bundling practices are extremely diverse and their impact must be evaluated individually. The type of multi-product bundling most likely to cause harm is that which was at issue in *LePage's*, where the defendant offered evidently custom-made bundles to different large customers in order to get them to drop the plaintiff's line of cellophane tape.[46] The kind that is least likely to cause harm occurs when the seller has a single contract calling for discounts

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44. *See* 9 PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW ¶ 1711 (2d ed. 2004); HERBERT HOVENKAMP, FEDERAL ANTITRUST POLICY: THE LAW OF COMPETITION AND ITS PRACTICE § 10.6e (3d ed. 2005).

45. *See supra* notes 33-37 and accompanying text.

46. LePage's Inc. v. 3M, 324 F.3d 141, 154 (3d Cir. 2003) (en banc) (describing individually targeted discount schemes linked to customers' cessation of purchases of plaintiff's tape).

aggregated across a large number of products and sold to numerous customers. Harm is less likely as customers are able to vary the proportion of goods in the bundle or substitute one good for another, or as rivals produce the same good(s) that the allegedly excluded firm produces, even if the rivals do not produce a full line. When nearly all consumers want a diverse bundle of some variety of goods, but the desired contents of those bundles differ among buyers, bundling plays a larger role than simply to serve the rarified interests of a few. Specifically, it works both to pass on to consumers the cost savings observed by large-scale buyers or producers and to reduce transaction costs. Much of these savings can then be passed down to customers, who also avoid the many transactions that would be necessary without multi-product purchasing contracts.

True anticompetitive exclusion by means of bundled discounts is undoubtedly a rarity. Most of all, our analysis shows that the Antitrust Commission's "attribution" test, which we have modified as an incremental cost test, is a useful safe harbor for recognizing bundled discounts that cannot exclude an equally efficient rival. However, the test produces very severe false positives and should be regarded as nothing more than a starting point for analysis. As the number of goods in a bundle increases and as undiscounted prices move closer to cost, the extent of false positives increases as well.

APPENDICES

The arguments made in the appendices rely on the general methods and notations introduced in Appendix 1. We attempt to model the practice of bundled discounting in the most general possible context. We will then be able to draw several important conclusions regarding this practice and also evaluate the cost-based tests currently used to assess its competitive effects.

The analysis presented below is not intended to evaluate the competing strategies employed by bundling firms and their rivals. The objects of this analysis are not the firms or agents that engage in bundled discounting, but rather the bundles themselves. We seek to provide a means of assessing a given bundle's potential for harm which, upon comparison to the strategy's overall profitability will allow for more educated assessments of a bundle's propriety. Indeed, to merit antitrust intervention, the courts require not only that a bundle excludes, but that it is in fact "unreasonably exclusionary," or designed with only that purpose in mind.

Appendix 1: The Model

To begin, we will characterize the competitive environment hypothesized by the model. Let $X = \{x_1, x_2, \ldots, x_N\}$ denote a discrete set of N different goods. We will consider bundles over this set, though a bundle need not include every good therein. Rather, we assume only that every bundle contains at least two elements of X in positive quantities.

We will rely on a cost vector of the form $C = (C_1, C_2, \ldots, C_N) \in (0, \infty)^N$, which is observed by all firms. Explicitly, for all $i = 1,2,\ldots,N$, C_i gives the marginal cost of producing x_i. Likewise, X admits a price vector $P \in (0, \infty)^N$, which is of the form $P = (P_1, P_2, \ldots, P_N)$. These define standalone prices, so that, for all $i = 1,2,\ldots,N$, P_i gives the price of an individual unit of x_i. We will assume that no goods in X are priced below cost, so that $P \geq C$. Also, we will assume that no bundle is priced below the aggregate cost of its contents, as this would effectively constitute an instance of predatory pricing, which is not within the scope of this paper.

We will characterize bundles as vectors of the form $\gamma = Q_\gamma \times \{\beta_\gamma\} \in [0, \infty)^N \times (0, 1)$, where $Q_\gamma = (q_1(\gamma), q_2(\gamma), \ldots, q_N(\gamma))$ defines the bundled quantities of each good in X, and β_γ denotes the discount factor employed by γ. Each bundle has a component that defines its own discount factor because variations in these factors can lead to further variations in the competitive effects of those bundles. As such, it is best to consider two bundles with identical contents and different discount factors as two distinct possibilities. With this, we can define a correspondence whose values define the sets of all possible discounted bundles, given prices and costs.

Definition 1.1: Let X, C, and P be as defined above. Then the following correspondence defines the sets of all possible discounted bundles over X:

$$\Gamma(X, C, P) = \Big\{ \gamma = Q_\gamma \times \{\beta_\gamma\} \in [0, \infty)^N \times (0, 1) \;\Big|\; Q_\gamma \cdot C \leq Q_\gamma \cdot \beta_\gamma P \;;\; \exists i, \in \{1,2,\ldots,N\},\ i \neq j,\ \text{with } q_i(\gamma), q_j(\gamma) > 0 \Big\}$$

Where $q(\gamma)$ denotes the i_{th} component of Q_γ, which gives the bundled quantity of the good x_i, for all i = 1,2,...,N. It should be noted that a bundle's price is given by $Q_\gamma \cdot \beta_\gamma P$. With these things in mind, we can go on to present several definitions that will be important in later sections.

Definition 1.2: Fix $\gamma \in \Gamma(X, C, P)$. We let $S(\gamma) \subseteq X$ denote the support of γ, or the set of all goods in X with positive bundled quantities. Explicitly, $S(\gamma) = \bigcup_{i=1}^{N} \{ x_i \in X \mid q_i(\gamma) > 0 \}$.

Definition 1.3: Fix $\gamma \in \Gamma(X, C, P)$, and let R be a firm that sells only individual units of goods in X. We will let $Y(R) \subseteq X$ denote the set of goods in X that R produces. Then we say R is a rival of the bundling firm if and only if $Y(R) \cap S(\gamma) \neq \emptyset$, and we characterize R's position relative to γ with the following definitions:

I. $G_C(\gamma; R) = Y(R) \cap S(\gamma) \in X$ defines the set of *competing goods* observed by R.

II. $G_E(\gamma; R) = S(\gamma) \backslash Y(R) \in X$ defines the set of *excluding goods* observed by R.

III. $Q_C(\gamma; R) = (\varphi_1(\gamma; R)q_1(\gamma), \varphi_2(\gamma; R)q_2(\gamma), \ldots, \varphi_N(\gamma; R)q_N(\gamma)) \in [0, \infty)^N$ defines the *competing share* of γ observed by R.

IV. $Q_E(\gamma; R) = ([1 - \varphi_1(\gamma; R)]q_1(\gamma), [1 - \varphi_2(\gamma; R)]q_2(\gamma), \ldots, [1 - \varphi_N(\gamma; R)]q_N(\gamma)) \in [0, \infty)^N$ defines the *excluding share* of γ observed by R.

$$\text{Where } \varphi_i(\gamma; R) = \begin{cases} 1 & \text{if } x_i \in G_C(\gamma; R) \\ 0 & \text{otherwise} \end{cases} \qquad \forall\, i = 1,2,\ldots,N.$$

Two obvious implications of these definition are that $G_C(\gamma; R) + G_E(\gamma; R) = S(\gamma)$ and $Q_C(\gamma; R) + Q_E(\gamma; R) = Q_\gamma$, for any rival R.

Appendix 2: Competitive Effects

In the text, we often referred to a rival's ability to compete with a bundle. We said that in order to compete with a bundle, a rival must price his competing goods so that consumers can buy the contents of the bundle separately for a net price no greater than the price of the bundle. Before offering an explicit condition for this, however, we will define the set of pricing strategies that allow a rival to compete with a bundle. Specifically, we will define the set of price cuts that (i) allow the rival to compete with the bundle, and (ii) result in sustainable prices for all competing goods observed by the rival. This will then allow us to define a condition for competing with a bundle, which will be given in terms of these price cuts.

Definition 2.1: Fix $\gamma \in \Gamma(X, C, P)$, and let R be a rival. Then the following correspondence defines the set of all possible combinations of price cuts $K = (k_1, k_2,\ldots, k_N)$ that can be implemented by R in order to compete with γ, and which leave all competing goods priced no lower than cost:

$$PC(\gamma; R) = \{ K \in [0, \infty)^N \mid k_i \leq P_i - C_i \text{ if } x_i \in G_C(\gamma; R),\ i = 1,2,\ldots,N\ ;$$

$$k_i = 0 \text{ if } x_i \notin G_C(\gamma; R),\ i = 1,2,\ldots,N\ ;$$

$$Q_C(\gamma; R)\cdot K \geq Q_Y\cdot(1 - \beta_Y)P \}$$

Where k_i denotes the i_{th} component K, for all $i = 1, 2,\ldots,N$.

The third condition stipulated by the price cut correspondence ensures that the price cuts allow the rival to compete with the bundle. To see how the condition was formulated, we consider an equivalent inequality:

$$Q_C(\gamma; R)\cdot(P - K) + Q_E(\gamma; R)\cdot(P - K) \leq Q_Y\cdot\beta_Y P.$$

This says that, after the price cuts have been imposed, consumers can afford to buy separately the competing and excluding shares of the bundle for a net price no greater than the bundle's price. It should be noted that the price of the bundle is still defined as $Q_Y\cdot\beta_Y P$ and not $Q_Y\cdot\beta_Y(P - K)$, because the price cuts apply to sales made by the rival and not those of the bundling firm. This is the same premise that underscores the cost-based tests used for granting safe harbor; it is the same definition of rival-bundle competition that was provided in the text. Of course, the price cuts only correspond to competing goods, so that we can simply the condition as follows:

$Q_C(\gamma; R)\cdot(P - K) + Q_E(\gamma; R)\cdot P \leq Q_\gamma\cdot\beta_\gamma P.$

$\Rightarrow Q_C(\gamma; R)\cdot K \geq Q_\gamma\cdot(1 - \beta_\gamma)P.$

As definition 2.1 indicates, the above inequality is a necessary condition for any price cut combination that permits R to compete with γ. The two remaining conditions stipulate that (i) price cuts are attributed only to a rival's competing goods; and (ii) no competing goods are priced below cost after the price cuts are imposed. An obvious corollary of this definition is that a rival can compete with a bundle without pricing any competing goods below cost if and only if $PC(\gamma; R) \neq \emptyset$.

By defining the set of price cuts sufficient for a rival to compete with a bundle, we can identify how different aspects of bundles contribute to their potential for harm. To do this, we first note that a bundle can exclude a rival only if that rival must resort to setting unsustainable in order to compete with a bundle. To that end, we can characterize a bundle's potential for harming a rival by examining the magnitude of the price cuts that allow said rival to compete. This will allow us to determine what aspects of a bundle contribute to its potential for harm.

Our first result will identify how various characteristics of a bundle's excluding share contribute to its potential for harm. As the following proposition illustrates, this potential is influenced by both the number and quantities of excluding goods, as well as the bundle's discount factor.

Proposition 2.2: Fix $\gamma_1, \gamma_2 \in \Gamma(X, C, P)$, and let R be a rival such that $Q_C(\gamma_1; R) = Q_C(\gamma_2; R)$. Then $\forall$ $K \in PC(\gamma_1; R)$, $\exists\alpha \in (0, 1)$ such that $\alpha K \in PC(\gamma_2; R)$ if any of the following conditions are observed:

(I) $\beta_{\gamma 1} = \beta_{\gamma 2}$; $G_E(\gamma_1; R) = G_E(\gamma_2; R)$; $Q_E(\gamma_1; R) \geq Q_E(\gamma_2; R)$; and $q_m(\gamma_1) > q_m(\gamma_2)$ for some excluding good $x_m \in G_E(\gamma_1; R) = G_E(\gamma_2; R)$, $m \in \{1,2,\ldots,N\}$.
(II) $Q_E(\gamma_1; R) = Q_E(\gamma_2; R)$ and $\beta_{\gamma 1} < \beta_{\gamma 2}$.
(III) $\beta_{\gamma 1} = \beta_{\gamma 2}$; $G_E(\gamma_2; R) \subsetneq G_E(\gamma_1; R)$; and $q_i(\gamma_1) = q_i(\gamma_1)$ for all $x_i \in G_E(\gamma_2; R)$, $i=1,2,\ldots N$.

Proof: Assume $PC(\gamma_1; R) \neq \emptyset$, and fix $K \in PC(\gamma_1; R)$.

(Part I) Assume that $\beta_{Y1} = \beta_{Y2}$; $G_E(\gamma_1; R) = G_E(\gamma_2; R)$; $Q_E(\gamma_1; R) \geq Q_E(\gamma_2; R)$; and $q_m(\gamma_1) > q_m(\gamma_2)$ for some excluding good $x_m \in G_E(\gamma_1; R) = G_E(\gamma_2; R)$, $m \in \{1,2,\ldots,N\}$.

$\Rightarrow Q_C(\gamma_1; R)\cdot K \geq Q_{Y1}\cdot(1 - \beta_{Y1})P$

$\Rightarrow Q_C(\gamma_2; R)\cdot K \geq Q_{Y1}\cdot(1 - \beta_{Y2})P > Q_{Y2}\cdot(1 - \beta_{Y2})P.$

Set $\alpha = [Q_{Y2}\cdot(1 - \beta_{Y2})P]/[Q_{Y1}\cdot(1 - \beta_{Y2})P] \in (0, 1)$.

$\Rightarrow Q_C(\gamma_2; R)\cdot\alpha K \geq Q_{Y1}\cdot\alpha(1 - \beta_{Y2})P = Q_{Y2}\cdot(1 - \beta_{Y2})P.$

Moreover, $K \in PC(\gamma_1; R)$ implies that, $\forall i=1,2,\ldots N$: (i) $\alpha k_i = 0$ if x_i is not a competing good; and (ii) $P_i - \alpha k_i \geq C_i$ if x_i is a competing good.

$\Rightarrow \alpha K \in PC(\gamma_2; R)$.

(Part II) Assume that $Q_E(\gamma_1; R) = Q_E(\gamma_2; R)$ and $\beta_{Y1} < \beta_{Y2}$.

Set $\alpha = (1 - \beta_{Y2})/(1 - \beta_{Y1}) \in (0, 1)$.

$K \in PC(\gamma_1; R)$ and $Q_C(\gamma_1; R) = Q_C(\gamma_2; R) \Rightarrow Q_C(\gamma_2; R)\cdot\alpha K \geq Q_{Y1}\cdot\alpha(1 - \beta_{Y1})P$, which likewise implies $Q_C(\gamma_2; R)\cdot\alpha K \geq Q_{Y2}\cdot\alpha(1 - \beta_{Y1})P = Q_{Y2}\cdot(1 - \beta_{Y2})P$.

$\Rightarrow \alpha K \in PC(\gamma_2; R)$, by the same argument used in Part I.

(Part III) Assume that $\beta_{Y1} = \beta_{Y2}$; $G_E(\gamma_2; R) \subsetneq G_E(\gamma_1; R)$; and $q_i(\gamma_1) = q_i(\gamma_2)$, for all excluding goods $x_i \in G_E(\gamma_2; R)$, $i=1,2,\ldots N$.

$\Rightarrow Q_C(\gamma_1; R)\cdot K = Q_C(\gamma_2; R)\cdot K \geq Q_{Y1}\cdot(1 - \beta_{Y1})P = Q_{Y1}\cdot(1 - \beta_{Y2})P > Q_{Y2}\cdot(1 - \beta_{Y2})P.$

Set $\alpha = [Q_{Y2}\cdot(1 - \beta_{Y2})P]/[Q_{Y1}\cdot(1 - \beta_{Y2})P] \in (0, 1)$.

$\Rightarrow Q_C(\gamma_2; R)\cdot\alpha K \geq Q_{Y1}\cdot\alpha(1 - \beta_{Y2})P = Q_{Y2}\cdot(1 - \beta_{Y2})P.$

$\Rightarrow \alpha K \in PC(\gamma_2; R)$, by the same argument used in Part I.

□.

This proof outlines conditions sufficient for reducing the magnitude of any price cut combination that allows a rival to compete with a bundle. It relies on the premise that if a rival can compete with one bundle using price cuts that are strictly smaller than those required by a second bundle, then the latter is more harmful than the former. In this way, the preceding proof demonstrates that a bundle's potential for harm decreases as (i) the bundled quantities of one or more excluding goods decrease; (ii) its discount factor increases; or (iii) the number of excluding goods decreases, *ceteris paribus*.

We can also say something about how the prices and quantities of competing goods affect a bundle's potential for harm. As indicated in the text, in order to compete with a bundle, a rival must make relatively larger price cuts as the ratio of the excluding share's value to the number of competing units is increased.

Proposition 2.3: Fix $\gamma \in \Gamma(X, C, P)$, and let R be a rival. Then, holding constant the ratio of the competing share's retail value to the number of competing bundled units, the average price cut per bundled unit (of competing goods) required for R to compete with γ is strictly increasing in the ratio of the excluding share's retail value to the number of bundled units of competing goods, or $[Q_E(\gamma; R)P]/[Q_C(\gamma; R)\cdot\{1\}^N]$.

Proof: Recall that $Q_C(\gamma; R)\cdot K$ gives the sum of all price cuts applied by a rival to competing units within the bundle. We have previously shown that a rival can compete with these price cuts if and only if the following condition holds:

$$Q_C(\gamma; R)\cdot K \geq Q_\gamma\cdot(1 - \beta_\gamma)P.$$

Hence, the right hand side of this inequality defines the smallest possible sum of all price cuts that are applied to bundled units of competing goods, and which allow the rival to compete with the bundle. Hence, on average, the price of each bundled unit (of a competing good) must fall by the following amount if the rival is to compete:

$$\mu_k = [\ Q_\gamma\cdot(1 - \beta_\gamma)P]/[\ Q_C(\gamma; R)\cdot\{1\}^N] = 1 - \ \beta_\gamma) \left[\frac{Q_C(\gamma;R)\cdot P}{Q_C(\gamma;R)\cdot\{1\}^N} + \frac{Q_E(\gamma;R)\cdot P}{Q_C(\gamma;R)\cdot\{1\}^N}\right]$$

Written in this way, the desired result is trivial. μ_k is obviously growing in the ratio of the excluding share's value to the number of competing units (given by the second bracketed term), *ceteris paribus*.

□.

Appendix 3: Cost-Based Tests for Safe Harbor

In previous cases of bundled discounting, the courts have occasionally applied a cost-based test known as the attribution test. In effect, the test determines whether an equally efficient rival can afford to compete with a bundle without pricing below cost. We can define this test so that it is applicable to the general case of many different bundled goods and quantities. However, to do this, it will be useful to drop our previous assumption of constant marginal production costs. Explicitly, if $V \in [0, \infty)^N$ is a bundle of goods in X, where the i_{th} component of V gives the quantity of x_i for all $i = 1,2,\ldots,N$, then we will let C(V) denote the cost of jointly producing the bundle described by V. We will still assume that all rivals are equally efficient producers of competing goods, though they may not observe cost savings that result from jointly producing competing and excluding goods. Also, we will assume that firms minimize production costs, so that C(V) denotes the cheapest possible cost of producing the contents of V. This will be useful in discussing certain cost irregularities (e.g., joint costs or economies of scope), which may be observed only by the bundling firm as a result of its larger range of outputs.

Definition 3.1: Fix $\gamma \in \Gamma(X, C, P)$, and let R be a rival. Then γ passes the attribution test with respect to rival R if and only if the following condition is met:

$$Q_\gamma \cdot \beta_\gamma P - Q_E(\gamma; R) \cdot P \geq C[Q_C(\gamma; R)].$$

As discussed in the text, this test is effectively a mechanism for determining whether a bundle is exclusionary with respect to a particular rival. Recall that we define a bundle to be exclusionary with respect to an equally efficient rival if that rival must price one or more competing goods below cost in order to compete with the bundle. However, as we describe in the text, a bundle's failure of this test is not a strong indicator that the bundle is predatory (i.e., that its overall profitability depends on the exclusion of one or more rivals). Indeed, the test often yields failing grades to bundles that clearly merit safe harbor. To correct this, we introduced an alternative test in a previous paper that takes into account any efficiency gains that may explain a firm's decision to offer discounted bundles. We call this test the incremental cost test, which we will now define for the general case of many bundled goods and quantities.

Definition 3.2: Fix $\gamma \in \Gamma(X, C, P)$, and let R be a rival. Then γ passes the incremental cost test with respect to the rival R if and only if the following condition is met:

$$Q_\gamma \cdot \beta_\gamma P - Q_E(\gamma; R) \cdot P \geq C(Q_\gamma) - C[Q_E(\gamma; R)].$$

The left hand side of this inequality measures the incremental price of the bundle, measured with respect to the excluding share observed by the rival R. Likewise, the right hand side describes the bundle's incremental cost. Given our assumption that firms minimize production costs, and given an equally efficient rival, we can show that a pass of the attribution test implies a pass of the incremental cost. However, the converse can be false under certain cost conditions.

Proposition 3.3: Fix $\gamma \in \Gamma(X, C, P)$, and let R be a rival. If γ passes the attribution test with respect to R, then it also passes the incremental cost test with respect to R.

Proof: Assume that γ passes the attribution test with respect to R.

$$\Rightarrow Q_\gamma \cdot \beta_\gamma P - Q_E(\gamma; R) \cdot P \geq C[Q_C(\gamma; R)].$$

Suppose $C[Q_C(\gamma; R)] < C(Q_\gamma) - C[Q_E(\gamma; R)]$.

$\Rightarrow C[Q_C(\gamma; R)] + C[Q_E(\gamma; R)] < C(Q_\gamma)$, where $Q_C(\gamma; R) + Q_E(\gamma; R) = Q_\gamma$ by definition.

This contradicts our assumption that firms minimize production costs. That is, we define $C(Q_\gamma)$ to be the lowest cost at which the contents of Q_γ can be produced, which cannot be the case if $C[Q_C(\gamma; R)] + C[Q_E(\gamma; R)] < C(Q_\gamma)$.

$$\Rightarrow C[Q_C(\gamma; R)] \geq C(Q_\gamma) - C[Q_E(\gamma; R)].$$

$$\Rightarrow Q_\gamma \cdot \beta_\gamma P - Q_E(\gamma; R) \cdot P \geq C(Q_\gamma) - C[Q_E(\gamma; R)].$$

$\Rightarrow \gamma$ passes the incremental cost test with respect to R.

□.

Of course, the converse is not necessarily true. In the text we give examples in which the bundling firm observes cost savings (e.g., joint cost savings, economies of scope) that can be passed down to consumers. Given explicitly, this condition says that the bundling firm observes a cost structure such that $C(Q_\gamma) < C[Q_C(\gamma; R)] + C[Q_E(\gamma; R)]$. Of course, if a bundling firm takes advantage of these efficiency gains, and if a large portion of the savings are passed on to consumers, then the resulting prices may leave rivals unable to compete. However, this is clearly not the sort of exclusion that merits antitrust intervention. Indeed, such strategies are often beneficial for both consumers and the bundling firm, regardless of how rivals are impacted.

In the case that no savings result from jointly producing the contents of a bundle, things become much simpler. In fact, the attribution test and the incremental cost test are actually equivalent in this case. To demonstrate this, we offer the following proposition:

Proposition 3.4: Fix $\gamma \in \Gamma(X, C, P)$, and let R be a rival. If no cost savings result from jointly producing the competing and excluding shares of a bundle, then the attribution test and the incremental cost test are identical with respect to R.

Proof: ($\Rightarrow$) In proposition 3.3, we showed that a pass of the attribution test with respect to R implies a pass of the incremental cost test with respect to R. This result held without regard to cost savings resulting to joint production. With this, we must now show that the converse is also true, given our assumptions on costs.

($\Leftarrow$) Assume that γ passes the incremental cost test with respect to R, and that no cost savings result from jointly producing the competing and excluding shares of the bundle. Explicitly, this says:

$$C[Q_C(\gamma; R)] + C[Q_E(\gamma; R)] = C(Q_\gamma).$$

$$\Rightarrow Q_\gamma \cdot \beta_\gamma P - Q_E(\gamma; R) \cdot P \geq C(Q_\gamma) - C[Q_E(\gamma; R)] = C[Q_C(\gamma; R)].$$

$\Rightarrow \gamma$ passes the attribution test with respect to R.

$\Rightarrow$ Taken with respect to R, the attribution test and the incremental cost test are equivalent when no cost savings result from jointly producing the entire contents of the bundle.

$\square$.

In some cases it may be preferable to determine whether a bundle is *potentially* exclusionary. That is, we may want to determine whether a bundle meets the necessary requirements for excluding *any* rival within the markets for its component goods. To serve that purpose, we offer the following definition, for which we will return to our previous assumption of constant marginal costs.

Definition 3.5: Fix $\gamma \in \Gamma(X, C, P)$. Then γ is potentially exclusionary if the following condition is met:

$$\exists\ x_i \in S(\gamma),\ i \in \{1,2,\ldots,N\}, \text{ such that } q_i(\gamma)[P_i - C_i] < Q_\gamma \cdot (1 - \beta_\gamma)P.$$

This condition says that the nominal value of the discount provided by the bundle is greater than the summed profits earned by all bundled units of one of its bundled goods. This is equivalent to saying that the bundle would fail the attribution test with respect to a rival who produced only the good x_i.

As indicated within the text, the incremental cost test relies on the assumption that a bundle whose incremental price (with respect to a rival's excluding share) exceeds its incremental cost is not predatory. By examining the implications of passing the incremental cost test, we can see why this assumption was made. To begin, we can restate the condition stipulated by the incremental cost test, so that we can see its implications regarding the bundle's profitability. By moving around the terms that comprise the condition stipulated by the incremental cost test, we derive following, equivalent condition:

$$Q_\gamma \cdot \beta_\gamma P - C(Q_\gamma) \geq Q_E(\gamma; R) \cdot P - C[Q_E(\gamma; R)]$$

This says that the profits earned by the bundle are at least as great as those earned by the excluding share alone. If this is true, the likelihood that a bundle could be predatory and yet still pass the incremental cost is very low. Significantly, this could occur only if the bundling firm observes significant savings from the joint production of the bundle's various elements. After all, if that were not the case, then the attribution test and incremental cost would be equivalent, so that a pass of the incremental cost test implies that the bundle is not exclusionary with respect to the rival. That would imply that a rival could not be excluded, which eliminates the strategy as a candidate for predatory bundling. Of course, in the case that the bundling firm does observe cost savings due to joint production, it is difficult to see how such a bundle might be anticompetitive. Indeed, in this case the bundling firm is effectively passing its efficiency gains on to consumers in the form of a discount. Moreover, the notion of 'equal efficiency' becomes skewed or even inapplicable in these cases, as described within the text. When a rival is left in an untenable position due to the innovations or efficiency gains of a competitor, it will often be the case that those firms were equally efficient before said innovation took place. But these efficiency gains must surely be incentivized, particularly if they result in discounted prices. And if the profitability of the innovated product is no less or even greater than that of the preceding one–even after the discount–then this tactic has all the defining characteristics of a pro-competitive practice. Finally, note that even a bundle that permits rivals to compete at above-marginal-cost prices could serve as a mechanism for exclusion. All that is necessary is that the rival's sales volume is reduced to such an extent that it cannot cover its fixed costs, which can occur anytime the demand for a good decreases. For these reasons, it seems that the incremental cost test is largely successful in its purpose, which is merely to distinguish those instances of bundled discounting that are almost certainly not predatory.