

Some Economics of Royalty Bundling

By Jeffrey Cohen, Divya Mathur, and David Giardina

In 2003, after accusing Microsoft Corporation of infringing an “embedded program” patent on its browser system, Eolas Technologies won one of the largest patent awards in history.¹ Though the jury award of \$1.47 per copy of Windows amounted to only 2.5 percent of the price of Windows at the time (\$60), the volume of Windows sales meant that this “small” royalty was transformed into a damage award of \$521 million.

Windows at that time was a bundle of more than 100 different technological innovations. Moreover, Internet Explorer, the product that made use of the allegedly infringing technology, was sold only bundled with Windows. The jury had to consider whether the Eolas technology drove the demand for not only Internet Explorer but also the entire Windows bundle.

In a post-trial opinion, Judge James B. Zagel of the U.S. District Court for the Northern District of Illinois wrote, “[B]undling makes it very difficult for either party to assess the value of each individual component. Since Microsoft has created this difficulty for itself, it must bear the legal risks attendant to its way of business.”² In March 2005, the U.S. Court of Appeals ordered a retrial, and Microsoft and Eolas settled for an undisclosed amount in August 2007.

At the core of the *Eolas* case was the so-called entire market value rule (EMVR), which prescribes that the royalty base for calculating patent infringement damages can relate to the value of an entire product being sold—not just the value of the patented feature—so long as the patented feature can be shown to drive consumer demand for the whole product. The outcomes of more recent cases, such as *Cornell University v. Hewlett-Packard Co.*³ and *Lucent Technologies, Inc. v. Gateway, Inc.*,⁴ suggest that empirical analysis is needed to satisfy the rules of the EMVR.

So how should we assess royalties with respect to a single product feature, when that feature is part of a bundle of attributes? The trier of fact must determine not only the royalty base (the product sales that flow from the disputed feature) but also the royalty rate (some per-unit dollar amount or percentage that prices the feature).

Even if a product’s definition is relatively straightforward, it can be difficult to assign value to the patented invention in question because of the way in which it is sold—that is, because of the economic underpinnings that create the bundle. Judge or jury must consider the purpose of selling goods or services as a bundle (for instance, the cost savings, or the increased functionality) as well as the role played by the patented invention in the profitability of the bundled goods.

In this article, we contend that the value of a patented invention need not be higher than its standalone worth just because it

gets bundled with another good, even a “bigger” good. The value of the patented invention in bundled goods may be higher, lower, (or the same) as its value in a standalone good. To quantify value, we focus on the patented invention’s new role in bundled form, and we analyze its value relative to the next best available alternative that may be used to fulfill the same role.

Some Economics of Patent Value

In the simplest case, the value of a commercialized patent is fully embodied in its royalty. It is far more common, however, for a patented invention to be bundled with other features or components, so we need some reasonable mechanism to apportion the value between the patented invention at issue and the other elements.

This is especially important in cases of patent infringement, where courts have recognized that the value of a patented invention can depend, in part, on its combination with other features. The concept of bundling in intellectual property law surfaces sporadically and somewhat incongruously in court decisions (see sidebar on page 22).

A review of these cases suggests (sometimes contradictory) tests for determining when or how much of bundled goods’ sales should be credited to a patented technology. The value is the amount that is “properly and legally attributable”; or an amount that arises “if in all reasonable probability the patent owner would have made the sales which the infringer has made.” Alternatively, it is an amount that requires that “unpatented components must function together with the patented component.” Then again, “it is not the physical joinder or separation of the contested items that determines their inclusion in or exclusion from the compensation base, so much as their financial and marketing dependence on the patented item.” Also, a “sufficient empirical showing” must be made with respect to the amount the patented feature drives demand.

From an economic standpoint, however, at least with respect to royalties, there is only one test: How much would a user be willing to pay for the rights to use (or not use) a patented input? This value is determined by the incremental increase in profits that results from the use of the patented input. Such use may reduce costs, thereby allowing a firm to earn greater profits; or it may result in a good that is preferred by consumers, thereby increasing sales—or both. In any case, the value of the patented input and the firm’s willingness to pay for it are determined by the increase in profit resulting from the use of the patented good *relative to the fully implemented next best alternative*. To see why, consider the following example.

Suppose that a baker makes and sells donuts using a patented artificial sweetener. The final product, the donut, contains many ingredients besides the artificial sweetener. The patent holder on the sweetener is entitled in the form of royalty payments to only the portion of profits from donut sales that can be attributed to the use of the patented sweetener relative to the baker’s next

Jeffrey Cohen is a managing principal and **Divya Mathur** is a manager in the Chicago office of Analysis Group, an economics, finance, and strategy consulting firm. **David Giardina** is a partner in the Chicago office of Sidley Austin LLP. The authors wish to thank Adam Rolph, formerly an associate at Analysis Group, for his significant contributions to this article.

best alternative.

Despite the royalty payments, the baker may choose to use the artificial sweetener in the donuts because of cost savings or consumer preferences. Certainly if the use of the patented artificial sweetener translates into higher profits for the bakery, the baker should be willing to pay royalties as high as the incremental increase in profits.⁵ But if the royalty payment was high enough to exceed incremental profits, the baker would likely switch to a nonpatented alternative (another sugar-free ingredient) or decide to exit the sugar-free donut market entirely.

The Patent Stands Alone

So how do we apportion value among patented and nonpatented components? We begin by examining how the patented input functions. Returning to our baker's options, donuts made with an artificial sweetener in place of sugar might be valued by customers on a sugar-free diet, in which case offering such a donut might lead to increased sales. Alternatively, the ingredient may be valuable in helping other inputs of production work better—for example, the granularity of an artificial sweetener may help other ingredients dissolve faster or better, thereby reducing baking time (lower costs) or improving taste (increased sales).

Of course, technical expertise may be needed to determine the functionality of some inventions, but economic expertise may be required as well. For example, in some intangible asset-intensive industries such as software or entertainment, value could be driven by “network effects,” which exist when the value of a product to a user increases with the number of other users who also use the product. (Telephones and fax machines are the classic examples.) Patented inventions that either take advantage of or help create network effects introduce yet another layer of complexity into evaluating the way the technology functions and, therefore, the way in which the invention adds value. Ultimately, we are interested in the marginal contribution of the patented input to the overall profitability of the good, whether increased profits arise from lower costs or increased revenues.⁶

Let us now consider the role of the patented technology in a *second* good. The fraction of profitability of a good attributed to a patented input is relevant in the calculation of royalty payments only in the market for that good. It does not automatically extend to a secondary market for another good, which also may have been produced using the same patented input.⁷

For example, our patented artificial sweetener can be used to make sugar-free donuts; it can also be used to sweeten coffee. While the chemical's sweetness may be its key benefit in the production of dough or frosting, its granularity and solubility may be the primary benefit in its contribution to the sale of coffee. It is also possible that the next best available alternative to the artificial sweetener for use in donuts may be cheaper or easier to procure than one used in coffee (or vice versa).⁸ What is worth remembering is that the sweetener's value in one application need bear no relationship to its value in another.

Royalty Bundling

Turning now to the issue of bundling, we consider first the economic motivation involved. Firms often sell goods in bundles

by offering two or more goods (or services) as a package deal, usually for a discounted price. Common bundles include McDonald's value meals; cable television subscriptions with an assortment of channels; automobiles with features such as air conditioning, sunroofs, and GPS systems; and even cold and flu medicine with several active ingredients combined into a single product. In many cases, customers could select and buy each component separately, but buying the bundled package is often cheaper or more convenient. Companies might even create bundles to compete more intensely with other goods—even with other bundles.

From an economic perspective, whether the patented technology increases the value of the bundle or is required for the bundle to be sold, or both, the royalty base should include the nonpatented components. However, the value of the patented technology will not necessarily increase in proportion to the value of the bundle. In fact, there may even be cases where the value of the patented feature decreases when bundled with other goods.

Let us return to our donuts example. Suppose the sugar-free donuts are sold with coffee as a “diet bundle” to calorie-conscious consumers. Presumably, a profit-maximizing firm would sell such a bundle only if the profits from the bundle exceeded the sum of the profits from the separate sales of the goods (or from the firm's next best option). If the addition of the patented sweetener to the donut increases the sales of the donut-coffee bundle, then the patent holder on the sweetener should be entitled to profits from the incremental sales of the donut-coffee bundle, not just to profits from sales of diet donuts.

But the complementary effect must be considered here: We must be careful not to attribute to the patented feature the value derived from *the existence of bundling itself*. The patent holder on the sweetener is allowed a greater royalty only if the donut featuring the patented sweetener increases sales of the donut-coffee bundle, relative to a donut-coffee bundle in which the donut is sweetened with a different artificial sweetener, or whatever sweetener might be the bakery's next best profit-maximizing alternative. In other words, *the patent holder cannot earn additional royalties from the general economic benefit of bundling*. He earns additional royalties only if his patented good contributes to the bundle's higher profits.

Taking a more complex example, imagine there are two possible patented technologies for use in cell phones: one that lets users send and receive text messages even when wireless signal strength is low, and one that increases the speed with which a cell phone powers on and off. Now suppose a cell phone is bundled with a battery charger, and the combination of these products leads to greater profits on both phones and chargers, because of, say, reduced packaging expenses. In the case of the first patented technology, the royalty base should be larger in the bundle since the patented technology fosters network externalities (in this case, a greater number of messages can be sent and received) which in turn lead to higher sales. However, the royalty base does not increase if the patented technology contributes nothing to expanding the network—as in the case of the improved on and off technology. In both instances, the bundle has led to greater sales, but in the former, the patented technology has contributed to the (even) greater



	INCREMENTAL PROFITS FROM KETCHUP	PRICE	COST	TOTAL PROFITS	ROYALTY RATE
DESCRIPTION OF "HOT DOG BUNDLE"	(A)	(B)	(C)	(D)	(E)
1 HOT DOG	N/A	\$3.00	\$2.00	\$1.00	N/A
2 HOT DOG (+ KETCHUP)	\$0.30	\$3.50	\$2.20	\$1.30	8.6%
3 HOT DOG +MUSTARD (+ KETCHUP)	\$0.30	\$4.00	\$2.40	\$1.60	7.5%
4 HOT DOG +MUSTARD + ONIONS (+ KETCHUP)	\$0.30	\$4.50	\$2.60	\$1.90	6.7%
5 HOT DOG +MUSTARD + ONIONS +RELISH (+ KETCHUP)	\$0.30	\$5.00	\$2.80	\$2.20	6.0%
6A HOT DOG +MUSTARD + ONIONS +RELISH +TOMATOES (+ KETCHUP)	\$0.30	\$5.50	\$3.00	\$2.50	5.5%
6B HOT DOG +MUSTARD + ONIONS +RELISH +TOMATOES (+ KETCHUP)	\$0.20	\$5.40	\$3.00	\$2.40	3.7%
ADDITION OF KETCHUP HAS A SLIGHTLY NEGATIVE EFFECT, PRODUCING A \$0.10 DECLINE IN PROFIT					
6B HOT DOG +MUSTARD + ONIONS +RELISH +TOMATOES (+ KETCHUP)	(\$0.30)	\$4.90	\$3.00	\$1.90	0.0%
ADDITION OF KETCHUP HAS A LARGE NEGATIVE EFFECT, PRODUCING A \$0.60 DECLINE IN PROFIT					

Notes:

[D] = [B]-[C]

[E] = [A]/[B]

Each additional condiment generates \$0.50 in revenue and costs \$0.20. If the addition of a condiment has a negative effect, the vendor must charge a lower price to maintain the same quantity.

We assume that both people's willingness to pay for, and the cost of, each additional condiment are constant. We also assume that price equals revenue, and that profits per unit do not vary with quantity. Finally, we assume that people's preferences for any given bundle are identical—i.e., each person experiences the same gain (loss) in utility with the addition of a new condiment, such as tomatoes.

sales; in the latter, only the economics of bundling—and not the patented feature—account for increased sales of the bundle relative to standalone sale of the two goods.

While it is fairly easy for us to see why royalty payments might increase when an infringing good is bundled with another good, it is less obvious that royalty payments may actually *decrease* when two goods are bundled. The importance of the patented feature may be swamped by the larger set of the bundle's features. As a result, demand for the patented feature may become more elastic as consumers develop relatively inelastic demand for the bundle's new features.

To illustrate how this might happen, and in keeping with the gustatory theme we have established so far, let us consider the Chicago-style "red hot": a bundle consisting of a hot dog; condiments including relish, onions, tomatoes, celery salt, and mustard (occasionally even ketchup); a pickle; and a poppy seed bun. For the purposes of this example, we will assume that ketchup is a single-ingredient patented invention, that everyone enjoys hot dogs, and that the more condiments added to (or bundled

with) a hot dog, the better. Adding ketchup to a plain hot dog creates value and thus increases profits; adding ketchup to a hot dog already topped with mustard, relish, and onions also adds value. However, as more condiments are added, the incremental profit from the "patented" good (ketchup) declines as a share of the bundle's total profits. In this case, royalty payments to the holder of the patent on ketchup, which are a function of ketchup's incremental profitability, would decline as well.

Royalty payments may also decrease when the patented good interacts negatively with existing goods in the bundle, thereby reducing the incremental profits from the patented good. In the Chicago-style red hot example, we considered a scenario in which the value of ketchup decreases when it is added to a hot dog already featuring three other condiments, relative to its value to a hot dog featuring fewer condiments. However, suppose we add tomatoes, assuming that hot dog lovers consider them a strong substitute for ketchup. Now, we are presented with a scenario in which the value of ketchup declines not only because its share of *total* value decreases but

also because adding ketchup (a tomato-based product) to a hot dog with tomatoes actually reduces the appeal of ketchup. In this case, people may still buy the hot dog, but the incremental value of ketchup to a hot dog “bundle” that already contains tomatoes is *reduced*.

We can see in the table that the contribution of ketchup to total profits decreases with each additional condiment—note that in rows 1–6A, the royalty on the patented component (ketchup), defined as the incremental profits divided by the price (or revenue), declines as its share of total profits decline.

Additionally, the patented good interacts with the bundle in such a way that the benefits from the patented good *itself* are diminished. In rows 6A, 6B, and 6C, we consider the addition of ketchup to a bundle that contains tomatoes. As shown in row 6B, if consumers regard the interaction between ketchup and tomatoes as slightly negative, demand goes down because the appeal of ketchup, the patented good, is reduced. In this case, *total* profits per hot dog are still increasing but by less than previously—by only \$0.20 instead of \$0.30. Because the

royalty is based on the *incremental* contribution of ketchup to total profits, the royalty rate falls significantly from 6% to 3.7%, instead of 6% to 5.5%.

It is possible that, in an extreme case, consumers may regard the addition of a new component so negatively that demand, and thus profit, actually *declines*. In row 6C, we observe a large negative effect wherein consumers find the combination of ketchup and tomatoes repulsive, and the incremental profits from the addition of ketchup are *negative* \$0.30. Ketchup’s interaction with the existing bundle is so negative that the contribution of ketchup is now also negative, and owning the ketchup patent would be worthless.⁹

Conclusion

Even taking all the legal guidelines into consideration, the economic analysis of bundling in patent infringement cases always returns to the same point: We must parse the incremental value of the patented invention in question from the value consumers find in the bundle as a whole. As we have

THE LEGAL BACKGROUND SOME RULINGS OF NOTE

Early U.S. Supreme Court decisions acknowledged that patent damage awards should be based on the portion of the product’s total value that is attributable to the infringed component, but it is important to note that the court is unable to apportion value until the product or royalty “base” is properly defined.

In *Garretson v. Clark* (1884), a suit in equity for infringement of a patent for an improved mop head, the Supreme Court stated that “damages are to be calculated on the whole machine, for the reason that the entire value of the whole machine, as a marketable article, is properly and legally attributable to the patented feature.”¹⁰

In *Seymour v. McCormick* (1853), the Supreme Court commented on the importance of isolating the “improvement” or incremental value that a patented component adds to a product. Specifically, the court said it is a very grave error to instruct a jury “that as to the measure of damages the same rule is to govern, whether the patent covers an entire machine or an improvement on a machine.”¹¹

Georgia-Pacific Corp. v. U.S. Plywood Corp. (1970) contains guidance on assessing a patented component’s value in a bundle, setting forth the 15 so-called *Georgia-Pacific* factors.¹²

- The sixth factor discusses *convoyed sales* or “the effect of selling the patented specialty in promoting sales of other products of the licensee; the existing value of the invention to the licensor as a generator of sales of his non-patented items; and the extent of such derivative or convoyed sales.”¹³ To the degree that a patented invention increases the sales of other products, these products may be included in the royalty base.
- The 13th factor splits the value between the patented invention and other nonpatented (intangible or tangible)

components as follows: “The portion of the realizable profit that should be credited to the invention as distinguished from non-patented elements, the manufacturing process, business risks, or significant features or improvements added by the infringer.”¹⁴ By emphasizing that the royalty should be based only on the incremental value, or “portion” of value provided by the patented invention, the 13th factor prevents patent holders from claiming royalties on profits provided by other components.

In *Rite-Hite Corp. v. Kelley Co.* (1995),¹⁵ the court noted that not all bundles are considered equal. In evaluating a bundle of vehicle restraints (the patented technology) and dock levelers, the court did not award profits on the bundle, because the nonpatented components were not required to be sold with the patented components in a single, functional unit. In the court’s opinion, “All the components together must be analogous to components of a single assembly or be parts of a complete machine, or they must constitute a functional unit.”¹⁶

The court vacated a \$358 million damages award in *Lucent Technologies, Inc. v. Gateway, Inc.* (2009), focusing on the limited role of a calendar-based date selection tool in Microsoft’s Outlook product: “[T]he infringing use of Outlook’s date-picker feature is a minor aspect of a much larger software program and . . . the portion of the profit that can be credited to the infringing use of the date-picker tool is exceedingly small.”¹⁷

And, in *Uniloc USA, Inc. v. Microsoft Corp.* (2011),¹⁸ an appeals court agreed with the district court’s decision to grant a new damages trial due to a misapplication of the EMVR. The court did not find evidence that a software registration system designed to combat the copying of Microsoft software (the patented feature) drove consumer demand for Office and Windows (the base on which the royalty rate was calculated).

demonstrated, bundling has its own economic underpinnings, which may not be ascribed to the inclusion of some patented invention at issue. Indeed, there are cases in which combinations render patented features in bundles less valuable than they were on their own. ■

Endnotes

1. Mr. Cohen consulted for Microsoft in this case. (U.S. Patent No. 5,838,906.)

2. Memorandum Opinion and Order: Consolidated Rulings on Post-Trial Motions, *Eolas Techs. Inc. v. Microsoft Corp.*, No. 99 C 0626, 2004 U.S. Dist. LEXIS 534, *6–7 (N.D. Ill. Jan. 15, 2004) (footnote omitted).

3. 609 F. Supp. 2d 279 (N.D.N.Y. 2009).

4. 580 F.3d 1301, 1333 (Fed. Cir. 2009).

5. Mathematically, if $\Pi(A; X_p)$ is the profit earned from good A when it is produced using the patented input and $\Pi(A; X_s)$ is the profit earned when it is produced using the next-best substitute to the patented input, the value of the patented input to a firm is given by the difference between these two, i.e., $V = \Pi(A; X_p) - \Pi(A; X_s)$, where $\Pi(\cdot)$ is a profit function, X_p is the patented input, and X_s is the nonpatented next-best alternative to X_p .

6. Mathematically, this can be expressed as the partial derivative of the profit function with respect to X_p , the patented input: $\beta = \frac{\partial \Pi(A)}{\partial (X_p)}$. More informally, β tells us how much the profit from sales of good A changes when an additional unit of the patented input is used, regardless of the form in which increased profitability might come.

7. To summarize, if there is another good in a secondary market that makes use of the patented technology, we cannot use $\beta = \frac{\partial \Pi(A)}{\partial (X_p)}$ to allocate the patent's value in the market for the second good. In other words, if the royalty payments for good A are $r_A = \beta A * RA$, where RA are the revenues from A, it does not follow that good B's royalty

payments are given by $r_B = \beta B * RB$. In order to estimate the importance of the patented technology to the two different standalone goods (A and B) and the ensuing royalty payments for each good, we must therefore compare $\beta_A = \frac{\partial \Pi(A)}{\partial (X_p)}$ and $\beta_B = \frac{\partial \Pi(B)}{\partial (X_p)}$.

8. Another example might be a textile patent on the thread strength of a fiber, where the fiber is used in the production of expedition and mountaineering clothing, as well as regular leisurewear clothing. The value of this invention is different in the two applications. It would not make much sense to extrapolate the greater value in expedition clothing to say, resort wear.

9. In summary, whether royalty payment increases or decreases in the bundle (relative to the stand-alone case) depends on whether the patented good is worth more (in terms of increased profits) in the bundle or in the sum of (profits from) the stand-alone goods. Mathematically, this is determined by analyzing whether is $\frac{\partial \Pi(A+B)}{\partial (X_p)}$ greater or less than $\frac{\partial \Pi(A)}{\partial (X_p)} + \frac{\partial \Pi(B)}{\partial (X_p)}$, where goods A and B constitute the bundle, and X_p is the patented technology.

10. *Garretson v. Clark*, 111 U.S. 120, 121 (1884).

11. *Seymour v. McCormick*, 57 U.S. 480, 490–91 (1853).

12. *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116 (S.D.N.Y. 1970).

13. *Id.* at 1120.

14. *Id.*

15. 56 F.3d 1538 (Fed. Cir. 1995).

16. *Id.* at 1550.

17. *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1333 (Fed. Cir. 2009).

18. 632 F.3d 1292 (Fed. Cir. 2011).