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TYING LAW AND POLICY: A DECISION THEORETIC APPROACH

Keith N. Hylton and Michael Salinger*

Abstract. This paper offers a decision theoretic framework for analyzing tying law, and presents a critical assessment of post-Chicago tying theory. The decision theoretic framework takes into account the likelihood of judicial error in the application of rules and the costs of such error. We use the decision theoretic framework to assess the proper legal rules regarding tying and technological integration. Three general themes run throughout much of our analysis. First, the per se rule against tying simply has no economic foundation. Second, while the post-Chicago literature established the theoretical possibility of anticompetitive tying, one must know the frequency of anticompetitive tying to formulate a rational legal rule. Because beneficial tying is so pervasive, rules against tying could be harmful even with a small rate of “false convictions.” Third, the most plausible post-Chicago theory of anticompetitive tying is based on the assumption that the tying and tied goods are complementary and that they are both susceptible to market power. However, the long-established principle that integrated complementary monopoly results in lower prices than independent complementary monopolies suggests that a policy biased toward independent complementary monopolies has the predictable consequence of reducing consumer welfare. There are two implications for the law: for contractual tying cases, the rule of reason with a heavy burden of proof for plaintiffs should be applied; and for technological integration cases, the deferential legal standard in most circuits is preferable to the D.C. Circuit’s rule of reason standard for software.

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I. Introduction

Like much of antitrust, tying law and theory have developed gradually through a colloquy between the courts and academic commentators. Both law and theory can be divided into roughly three developmental periods: “classical,” “Chicago School,” and “post-Chicago.” In the classical period, antitrust courts developed a complicated per se prohibition based on the theory that the motive for tying was to leverage market power from the tying to the tied product. Classical tying doctrine and theory came under attack from the Chicago School from the 1950s to the 1970s.¹ Armed with a set of arguments drawn from microeconomic theory, the Chicago School suggested that tying should be lawful per se. The Chicago School critique seemed to have an impact on the law, as the Supreme Court took an increasingly narrow view of the scope of the per se prohibition. Indeed, by the mid-1980s, in its *Jefferson Parish* decision,² the Court came within one vote of overturning the per se rule. But even as the Supreme Court was fracturing over the appropriate rule in *Jefferson Parish*, the post-Chicago School analyses began to appear in academic journals.³ Much of this literature applied arguments based on game theory to show that tying and similar tactics could be anticompetitive after all, in contrast to the Chicago School’s conclusions. The post-Chicago literature has not had the same influence on the courts to this point as did the Chicago School writings, but it has

¹ For an early example, see Aaron Director & Edward Levi, *Law and the Future: Trade Regulation*, 51 NW. U. L. REV. 281 (1956). For discussions of the Chicago School approach, see RICHARD A. POSNER, *ANTITRUST LAW: AN ECONOMIC PERSPECTIVE* (1976); ROBERT H. BORK, *THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF* (1978).

² *Jefferson Parish Hosp. Dist. No. 2 v. Hyde*, 466 U.S. 2 (1984).

³ See, e.g., Steven C. Salop & David T. Scheffman, *Raising Rivals’ Costs*, 73 AM. ECON. REV. 267 (1983); Thomas Krattenmaker & Steven C. Salop, *Anticompetitive Exclusion: Raising Rivals’ Costs to Achieve Power over Price*, 96 YALE L.J. 209 (1986). For an early survey, see Herbert Hovenkamp, *Antitrust Policy After Chicago*, 84 MICH. L. REV. 13 (1985).

affected some decisions, notably the Supreme Court's *Eastman Kodak*⁴ decision and the district court's decision in the *Microsoft* litigation.⁵

This paper presents an assessment of post-Chicago tying law and theory and offers a decision-theoretic⁶ framework for analyzing tying doctrine. The decision-theoretic framework takes into account the likelihood of judicial error in the application of rules and the costs of such error. Although this is by no means the first application of decision theory to antitrust,⁷ our approach differs from previous work by stressing the importance of the relative frequencies of pro- and anticompetitive conduct in such an analysis. It is especially important to apply decision analysis to the post-Chicago literature because, as our exposition will make clear, the game theory underpinning the literature rests on highly stylized assumptions that are difficult to apply to the factual settings courts confront. One of our main points is that the literature does not contain clear guidance on how to distinguish benign from harmful instances of tying. A rational policy must therefore take account of errors that will inevitably occur.

Three general themes run throughout much of our analysis. First, the per se rule against tying simply has no economic foundation. The courts seem to recognize this, and

⁴ *Eastman Kodak v. Image Technical Servs., Inc.*, 504 U.S. 451 (1992). The Court adopted several post-Chicago arguments, and in footnote 21 cited one article from the post-Chicago literature (Howard Beales, Richard Craswell & Steven C. Salop, *The Efficient Regulation of Consumer Information*, 24 J. L. & ECON. 491 (1981)).

⁵ *United States v. Microsoft Corp.*, 84 F. Supp.2d 9 (D.D.C.1999) (Findings of Fact); *United States v. Microsoft*, 87 F. Supp.2d 30 (D.D.C. 2000) (Conclusions of Law). Judge Jackson's Findings of Fact seem to mirror some of the arguments made by the government's economic experts in the trial, and these arguments were influenced by the post-Chicago literature.

⁶ For a general treatment of decision theory, see HOWARD RAIFFA, *DECISION ANALYSIS* (Addison-Wesley) (1968). See also Steven C. Salop, *Evaluating Uncertain Evidence with Sir Thomas Bayes: A Note for Teachers*, 1 J. ECON. PERSP. 155 (1987).

⁷ For an earlier important contribution, see C. Frederick Beckner III & Steven C. Salop, *Decision Theory and Antitrust Rules*, 67 ANTITRUST L.J. 41 (1999).

have tried to preserve the per se rule while limiting the conditions under which it applies.⁸ From an economic standpoint, however, there is no basis for a per se rule, even given the conditions established in *Jefferson Parish* for triggering the rule.⁹ Second, the post-Chicago literature merely established the theoretical possibility of anticompetitive tying – and even then under conditions more burdensome to plaintiffs than those established in the case law.¹⁰ Put another way, the post-Chicago literature has given us a set of necessary as opposed to sufficient conditions for triggering antitrust scrutiny. Under the decision-theoretic approach, however, one must know the frequency of anticompetitive tying to formulate a rational legal rule. Moreover, in formulating a rule, the prevalence of tying for procompetitive reasons is an important consideration. Because beneficial tying is so pervasive, rules against tying could be harmful even with a small rate of falsely labeling tying as anticompetitive. Third, the most plausible post-Chicago theory of anticompetitive tying is based on the assumption that the tying and tied goods are complementary and that they are both susceptible to market power and, indeed, monopoly. It is a long-established principle of economics, however, that integrated complementary monopoly results in lower prices than distinct complementary

⁸ See *infra* part II.A.1. In particular, in *Jefferson Parish* the Supreme Court said that the per se rule applies only when (1) the seller has tied separate products, *Jefferson Parish*, 466 U.S. at 20-21, (2) the seller has market power in the tying product, *id.* at 17, (3) the tie leads to a substantial foreclosure of commerce in the tied market, *id.* at 16.

⁹ For a detailed discussion of *Jefferson Parish*, see *infra* part II.A.2. One might argue that the separate-products inquiry of *Jefferson Parish* makes the per se rule equivalent to a rule of reason test. We consider and reject that argument in part II.A.2.

¹⁰ In particular, the Whinston model (see *infra* part II.C.1) shows that tying may be anticompetitive when the market for the tied good is potentially oligopolistic because of the presence of entry barriers. This suggests that in addition to the conditions required by *Jefferson Parish* (separate products, market power in tying good, substantial foreclosure in tied market), the presence of entry barriers in the tied good should be listed as a fourth *necessary condition* for triggering the per se rule. We are unable in our analysis below (*infra* part III.C) to identify a set of factors among those discussed in the literature and case law that would justify a court's decision to treat these four conditions as *sufficient* for triggering per se analysis.

monopolies.¹¹ A public policy that imparts a bias toward independent complementary monopolies instead of integrated complementary monopolies has the predictable consequence of raising prices and reducing consumer welfare.

We also use the decision-theoretic framework to assess the proper legal rule regarding technological integration. This is an important issue in the *Microsoft* litigation, in which reviewing courts have had to determine whether it was lawful for Microsoft to integrate the Internet Explorer web browser with the Windows operating system. The most important decision to come from that litigation is the D.C. Circuit's *Microsoft III*¹² opinion, which articulates a rule of reason test for cases involving integration of a software application with an operating system. Given the risk that *Microsoft III* and other appellate decisions in the *Microsoft* litigation could establish standards that will be applied across the board to all cases of technological integration, it is difficult to exaggerate the importance of this issue. Legal standards that excessively discourage technological integration could be quite harmful to the whole economy, not just high technology or software markets. Of course, an ideal standard should also avoid granting legal immunity to anticompetitive tying.

There are two important legal issues concerning technological integration in play at this moment. The most prominent, by far, is the type of legal standard that should be applied to technological tying. Most circuits have held that technological tying is permissible unless it is carried out with the sole (or, at least, overwhelming) purpose of hampering competition, rather than to achieve some technologically beneficial result.¹³

¹¹ See JEAN TIROLE, *THE THEORY OF INDUSTRIAL ORGANIZATION* 174 (1988).

¹² *United States v. Microsoft Corp.*, 253 F.3d 34 (D.C. Cir. 2001) (*Microsoft III*).

¹³ See *Response of Carolina, Inc. v. Leasco Response, Inc.*, 537 F.2d 1307, 1330 (5th Cir. 1976)(violations

The only exception to this general standard is the rule of reason test of *Microsoft III*, which requires courts to balance technological benefits against competitive harms in cases involving software platforms.¹⁴ *Microsoft III* raises the question whether the rule of reason is generally preferable to the sole-purpose standard in technological integration cases.

The second unresolved issue is the standard of proof in technological tying cases. The courts have provided two clear alternatives. *Caldera, Inc. v. Microsoft Corp.*¹⁵ requires the defendant to produce credible evidence of a significant technological improvement.¹⁶ The D.C. Circuit in *Microsoft II*¹⁷ said the defendant could satisfy his burden merely by providing a “plausible claim” of the existence of a significant consumer benefit,¹⁸ though the court later rejected that standard in *Microsoft III*.¹⁹ In any event, whether courts settle uniformly on the sole-purpose test or the rule of reason as the substantive legal standard, the standard of proof will play a key role in determining the full impact of the legal standard. To date, courts have not settled on a rule governing the allocation of proof burdens in technological tying cases.

should be limited to instances where the integration “has been for the purpose of tying the products, rather than to achieve some technologically beneficial result.”); *United States v. Microsoft Corp.*, 147 F. 3d 935, 949-50 (D.C. Cir. 1998) (reviewing antitrust law on technological integration and concluding: “The short answer is thus that integration may be considered genuine if it is beneficial when compared to a purchaser combination. . . . In antitrust law, from which this whole proceeding springs, the courts have recognized the limits of their institutional competence and have on that ground rejected theories of ‘technological tying.’”); see also 10 PHILLIP E. AREEDA *et al.*, ANTITRUST LAW ¶ 1757c (1996). For further discussion of the law governing technological integration, see *infra* part II.A.2.

¹⁴ *Microsoft III*, 253 F.3d at 94-95. Although the D.C. Circuit rejected the approach of district court judge, Thomas Penfield Jackson, it adopted a test that is virtually identical to the one articulated by Judge Jackson in his opinion. See *United States v. Microsoft Corp.*, 87 F. Supp.2d 30, 48-49 (D.D.C. 2000).

¹⁵ *Caldera, Inc. v. Microsoft Corp.*, 72 F. Supp.2d 1295 (D. Utah 1999) (*Caldera*).

¹⁶ *Id.* at 1325.

¹⁷ *United States v. Microsoft Corp.*, 147 F.3d 935 (D.C. Cir. 1998) [hereinafter *Microsoft II*].

¹⁸ *Id.* at 950.

¹⁹ *Microsoft III*, 253 F.3d at 92 (stating that *Microsoft II* is limited to case of interpreting consent decree)).

The splintering of legal rules created by the *Microsoft III* decision casts a cloud of uncertainty over technological integration. We will argue that the sole-purpose test in force in the majority of circuits is the best legal standard for technological tying, and, perhaps more controversially, the “plausible claim” standard articulated in *Microsoft II* provides the proper standard of proof for these cases.²⁰ We will also argue that in cases of contractual tying the rule of reason should be applied.

Part II of this paper provides an overview of the law and literature of tying. Since a large part of the theoretical discussion in this paper is a critique of post-Chicago models and their implications for tying law, we devote a substantial amount of space in Part II to a presentation of post-Chicago tying theory. Part III presents the decision theory framework. Part IV applies the decision framework to the post-Chicago literature in order to assess the literature’s implications for antitrust enforcement. In particular, we ask in Part IV whether the post-Chicago literature has provided a set of requirements that, when coupled with those of classical tying doctrine, could provide a defensible set of sufficient conditions for triggering the per se prohibition. We consider the following conditions in the tied market: entry barriers, complementary goods, network effects, and technologically advancing industries. We conclude that these conditions fail to provide a compelling set of sufficient conditions, and that it is hard to avoid a rule of reason approach that considers potential benefits as well as harms. Part V applies the decision framework to the legal standards governing technological integration.

²⁰ See *infra* part IV.A.

II. The Law and Literature of Tying

A. Law

Tying doctrine, like tying theory, can be analyzed under classical and post-Chicago categories.²¹ Under classical doctrine the defendant's liability is based on the theory that it has extended or leveraged its market power in the tying product market to the tied product market by "forcing"²² consumers to purchase the tied product with the tying product.²³ The three essential parts of this analysis are market power, leveraging, and forcing.²⁴ We will also include within classical doctrine the case law on product

²¹ Tying theory includes classical, Chicago, and post-Chicago categories. We refer to only classical and post-Chicago categories of tying law because the Chicago influence, we hope to make clear below, has largely been in the form of altering the interpretation of classical doctrine rather than changing the doctrine itself.

²² The term "forcing" is emphasized in *Jefferson Parish*. In the Court's opinion Justice Stevens remarks, "Our cases have concluded that the essential characteristic of an invalid tying arrangement lies in the seller's exploitation of its control over the tying product to force the buyer into the purchase of a tied product that the buyer either did not want at all, or might have preferred to purchase elsewhere on different terms. When such 'forcing' is present, competition on the merits in the market for the tied item is restrained and the Sherman Act is violated." *Jefferson Parish Hosp. Dist. No. 2 v. Hyde*, 466 U.S. 2, 12 (1984). No court has provided a special legal definition of forcing. However, the *Jefferson Parish* opinion suggests that forcing can only occur in settings in which the consumers have few alternatives to begin with (because of the defendant's market power) and the defendant has actively restricted their choices further by requiring them to purchase the tied product with the tying product. *Id.* at 16. *Jefferson Parish* seems to reject the theory that consumers can be "forced" by their own inability to engage in intelligent comparison-shopping. *Id.* at 27-28.

²³ One example of such leveraging, discussed in the case law, is price discrimination. *See Fortner Enters., Inc v. United States Steel Corp.*, 429 U.S. 610, 617-18 (1976) (*Fortner II*) (suggesting that antitrust violation is less likely, given that tying arrangement could not have been used as a form of price discrimination).

²⁴ One could say that the doctrine seeks to prohibit tying when the defendant has market power in the tying market, could use that power to gain additional power (e.g., in the tied market), and also harm consumers. It follows that the doctrine requires plaintiffs to present evidence of market power, consumer harm (forcing), and a credible theory of tying as a method of monopoly extension (leveraging). We interpret the leveraging inquiry as including the case in which tying is used to maintain a monopoly position. *See Robin Cooper Feldman, Defensive Leveraging in Antitrust*, 87 GEO. L.J. 2079 (1999). The per se tying prohibition, which makes tying unlawful when the tie-in involves separate products, the seller has market power in the tying good, and there is substantial foreclosure in the tied good market, *Jefferson Parish*, 466 U.S. at 16-21, is part of classical tying doctrine, though not a necessary feature of it. As Justice O'Connor noted in her concurrence in *Jefferson Parish*, the lines of inquiry required by classical tying analysis could be pursued without requiring much more effort under a rule of reason test. *Jefferson Parish*, 466 U.S. at 33-35. What seems to be essential to the classical legal framework is the presumption that the defendant

integration generated over the late 1970s and early 1980s,²⁵ which articulates a far less burdensome standard for defendants. The post-Chicago doctrinal category includes contractual tying and technological integration cases that have deviated from the standards of the classical case law.

1. Classical Tying Doctrine

The important cases formulating classical tying doctrine are well known to antitrust students: *International Salt*,²⁶ *Northern Pacific*,²⁷ *Fortner II*, and *Jefferson Parish*.²⁸ *International Salt* and *Northern Pacific* lay the foundations of classical tying analysis and establish the per se test currently applied by antitrust courts.

International Salt and *Northern Pacific* establish liberal approaches to analyzing the existence of market power, extension, and forcing. Market power was more or less presumed in *International Salt* from the fact that the tying products – salt processing machines – were patented.²⁹ In *Northern Pacific*, the Court concluded the defendant had

should be found in violation of the law, in the absence of good justification, if the classical doctrine requirements are satisfied. Consistent with this view, the per se rule should be seen as an attempt to restrict the set of conditions under which the presumption of illegality may be rebutted.

²⁵ For further discussion, see *infra* part II.A.2.

²⁶ *International Salt Co. v. United States*, 332 U.S. 392 (1947).

²⁷ *Northern Pac. Ry. Co. v. United States*, 356 U.S. 1 (1958).

²⁸ *IBM v. United States*, 298 U.S. 131 (1936), should be named among this list of classical theory cases. *IBM* is important for two reasons. First, it establishes the leverage theory as the basis for concern under tying doctrine. Second, *IBM* establishes the norm under tying doctrine that “goodwill defenses” will have to meet a very high burden. In other words, a defendant that claims it must tie in order to maintain the quality of the bundle must prove that quality could not be maintained through some less restrictive alternative. This norm has been adhered to in subsequent cases, such as *International Salt* and *Jerrold Electronics* (*United States v. Jerrold Electronics Corp.*, 187 F. Supp. 545, 560 (ED Pa. 1960), *aff’d per curiam*, 365 U.S. 567 (1961)). *Jerrold Electronics* establishes an exception to the per se rule for the case in which tying is used in order to enter into a new industry. See *Jerrold Electronics*, 187 F. Supp. at 557. Under the *Jerrold Electronics* exception courts will impose a much lower burden on defendants who assert a goodwill defense for tying.

²⁹ *International Salt*, 332 U.S. at 395.

market power in the tying product, land, because of its sizeable holdings and because of what it described as the “strategic location” of the parcels.³⁰ Moreover, the Court suggested in *Northern Pacific* that market power in the traditional sense required under Sherman Act Section 2 is not required by tying doctrine; it is enough if the defendant has “sufficient economic power” to restrain competition in the tied market.³¹

The liberal approach to classical tying analysis reflected in *International Salt* and *Northern Pacific* was taken to a questionable degree when the Court examined the extension and forcing issues. In both cases the defendant had included an opt-out clause allowing the consumer to purchase the tied product from any other seller who provided it at a lower price.³² Given such a clause, one could argue that the consumer was forced, if at all, by an extremely light hand.³³ In spite of this, the Court regarded the presence of an opt-out clause as irrelevant.³⁴

The Supreme Court’s willingness in these cases to fudge the market power and forcing issues in order to find the defendant’s tie-in unlawful is consistent with a proposition it announced in *Standard Stations*³⁵ that “tying agreements serve hardly any

³⁰ *Northern Pacific*, 356 U.S. at 7-8.

³¹ More specifically, *Northern Pacific* provides that the per se rule applies if the defendant has sufficient economic power in the tying market to appreciably restrain competition in the tied product market, and a “not insubstantial” amount of commerce has been foreclosed in the tied market. *Id.* at 11.

³² *International Salt*, 332 U.S. at 396-97; *Northern Pacific*, 356 U.S. at 12.

³³ It is doubtful that the defendant could have included a monopoly surcharge in the price of the tied product. Given the opt-out clause, and other evidence, Peterman suggests that the tie in *International Salt* probably served efficiency purposes. John Peterman, *The International Salt Case*, 22 J.L. & ECON. 351 (1979). Since railroads have high fixed costs, and need to maximize service in order to minimize the average cost of rail service, the tie-in in *Northern Pacific* could have been designed to facilitate full or nearly full utilization of the railroad’s infrastructure. This would have benefited the railroad’s consumers by lowering the price of rail service to them over time.

³⁴ *International Salt*, 332 U.S. at 397; *Northern Pacific*, 356 U.S. at 7-8. We note that the market for salt, the tied product in the *International Salt* case, was probably competitive. See Peterman, *supra* note 35, at 357.

³⁵ *Standard Oil Co. v. United States*, 337 U.S. 293 (1949) (*Standard Stations*).

purpose beyond the suppression of competition.”³⁶ While the *Standard Stations* proposition is questionable, it does provide a simple theoretical premise for the Court’s early tying decisions. The later classical cases reveal efforts by the Court to qualify and back away from the *Standard Stations* proposition. In these later decisions, the Court clarified both the limits of classical tying doctrine and of the per se test.

2. The Chicago Influence

In both *Fortner II* and *Jefferson Parish* the Court insisted on a more rigorous notion of market power to form the basis of classical tying doctrine. This was probably a reflection of the Chicago School’s influence, though it is important to note that the Court’s insistence did not require a change in the formal doctrine. Whereas the Chicago School led to a change in predatory pricing doctrine,³⁷ this has not been the case in tying law.

In *Fortner II*, the Court made a conscious effort to bring tying doctrine in line with the classical analytical requirements of market power, leveraging, and forcing. The Court held that in the absence of proof that U.S. Steel had a cost advantage in the tying market (credit),³⁸ its market share was too small to indicate the degree of tying-market

³⁶ *Id.* at 305.

³⁷ The important Chicago-influenced changes in predatory pricing doctrine are reflected in *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574 (1986), and *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209 (1993). *Matsushita* and *Brooke Group* impose a “recoupment” test that requires plaintiffs to show that the defendant reasonably could have expected to recoup losses incurred in a predatory pricing campaign. For a critique of this doctrine, as well as the Chicago theory that inspired it, see Joseph F. Brodley, Patrick Bolton, and Michael H. Riordan, *Predatory Pricing: Strategic Theory and Legal Policy*, 88 GEO. L.J. 2239 (2000).

³⁸ The defendant U.S. Steel offered to finance the cost of acquiring and developing land provided the developer agreed to purchase U.S. Steel’s prefabricated homes. *Fortner II*, 429 U.S. at 611.

power required under the law.³⁹ The Court also said that it would be improper to infer unlawful tying without analyzing the price of the whole bundle in comparison to the market,⁴⁰ suggesting that some indication of consumer harm is an important component of tying analysis.

Jefferson Parish dealt with a hospital's tying of anesthesiology services to surgery.⁴¹ The Court concluded that the hospital did not have sufficient economic power because it lacked market power in its geographic market,⁴² where the hospital served only 30 percent of the population.⁴³ The plaintiff argued that even though the defendant's market share was modest, consumers could not effectively shop among anesthesiologists because of imperfect information.⁴⁴ The Court rejected the imperfect information argument as a basis for finding sufficient economic power,⁴⁵ and in so doing suggested that evidence of market power in the traditional Section 2 sense is necessary to find unlawful forcing.⁴⁶

Jefferson Parish is the Court's most vigorous effort to date to put limits on the *Standard Stations* proposition and its expansive implications for the per se rule. The

³⁹ *Id.* at 620-22.

⁴⁰ *Id.* at 618.

⁴¹ Any patient planning to undergo surgery at the East Jefferson Hospital had to use the anesthesiologists on the hospital staff. *Jefferson Parish*, 466 U.S. at 4-5.

⁴² *Id.* at 27-29.

⁴³ *Id.* at 26.

⁴⁴ *Id.* at 27-28. The Court used the more general term "market imperfections," which were caused by the fact that "the prevalence of third-party payment for health care reduces price competition," and "a lack of adequate information renders consumers unable to evaluate the quality of medical care provided by competing hospitals." *Id.* at 27.

⁴⁵ *Id.* at 28-29.

⁴⁶ Such forcing, the Court stressed, requires the blocking of competition on the merits, *Jefferson Parish*, 466 U.S. at 28, and imperfect information does not imply that the seller's tie-in has restricted competition in the sense of forcing a purchase that would not have otherwise been made or preventing a purchase that would have been.

Court focused on the separate-products distinction and the forcing requirement as limiting principles. On the separate-products question, the Court said that the tying and tied products would be regarded as separate if there is “sufficient demand” for the tied product “to identify a distinct product market in which it is efficient to offer” the tied product separately from the tying product.⁴⁷ On forcing, the Court suggested that the elimination of competition on the merits in the tied good is essential.⁴⁸

Although the Court’s use of the term “efficient” in its separate-products test has not been a major focus of the case law or literature following *Jefferson Parish*, it is potentially a key consideration.⁴⁹ Of course, its importance is a function of how courts interpret the term. If it is understood to require an examination of economic efficiency, the separate-products standard of *Jefferson Parish* becomes indistinguishable from a rule of reason inquiry. However, no court has indicated a willingness to interpret the term in this manner, and the only court to carefully consider the application of the term “efficient” in the separate-products test, the D.C. Circuit in *Microsoft III*, rejected the full-blown efficiency interpretation.⁵⁰ If, consistent with the D.C. Circuit, we view the separate-products inquiry as an empirical test that looks to the behavior of competitive firms,⁵¹ specifically whether fringe competitors also engage in tying, we see immediately that the test fails to take efficiency defenses into account in two important settings. One,

⁴⁷ *Id.* at 21-22.

⁴⁸ *Jefferson Parish*. 466 U.S. at 12 (“the essential characteristic of an invalid tying arrangement lies in the seller’s exploitation of its control over the tying product to force the buyer into the purchase of a tied product that the buyer either did not want at all, or might have preferred to purchase elsewhere on different terms.”).

⁴⁹ On the efficiency of bundling and the decision to sell products separately, *see infra* part III.B (example of bundling to save packaging costs).

⁵⁰ *Microsoft III*, 253 F.3d at 88.

⁵¹ *Id.* at 87-88.

noted in *Microsoft III*, is the case of the first-mover who ties two products that had been sold separately.⁵² The second is the case in which tying is used for product differentiation purposes. Given the likely prevalence of these cases, we think it is appropriate to view the standard articulated by the *Jefferson Parish* majority as a per se test rather than as a modified rule of reason standard.

Justice O'Connor's concurring opinion, joined by three other Justices, differed from the majority by wanting to replace the per se rule with a rule of reason test,⁵³ and by urging a wider "single product" safe harbor. For two products to be considered as distinct, O'Connor's approach would require that some consumers might wish to purchase the tied product separately without also purchasing the tying product.⁵⁴ The O'Connor approach would call the package a single integrated product when the "economic advantages of joint packaging are substantial."⁵⁵ The separate-products test of O'Connor's opinion would create a near-per se legality exception that would have applied to the defendant hospital in *Jefferson Parish*. Moreover, the near-per se legality rule clearly would apply to most product integration decisions, such as the integration of lenses into cameras, or engines into cars. As we will see shortly, this approach would have brought contractual tying doctrine in line with the technological integration case law developed in lower courts.

3. Technological Integration and Classical Tying Doctrine

⁵² *Id.* at 92-93.

⁵³ *Jefferson Parish*, 466 U.S. at 33.

⁵⁴ *Id.* at 39.

⁵⁵ *Id.* at 40.

As Justice O'Connor's *Jefferson Parish* opinion suggested, tying doctrine has implications for technological integration. If it is unlawful to package two goods together, a seller will have an incentive to bolt the two goods together and call it a single integrated product. Justice O'Connor's opinion alluded to the fact that tying doctrine does create this incentive. In general, the law provides an exception to the tying prohibition for the case of technological integration. In other words, if we view classical tying doctrine broadly as consisting of case law on contractual tying and case law on technological integration, we see entirely different standards in the two sub-fields. In the contractual tying law we have a qualified per se illegality rule, and in the technological tying case law we have a rule that puts such a high proof burden on plaintiffs that it seems to presume legality.

Courts have held that in order to succeed in a technological tying claim, a plaintiff must show that the defendant integrated the two products for the sole purpose of hampering competition, rather than to produce some additional utility to consumers. More specifically, the prevailing standard is that of *Response of Carolina, Inc. v. Leasco Response, Inc.*,⁵⁶ which requires proof that the integration was solely “for the purpose of tying the products, rather than to achieve some technologically beneficial result.”⁵⁷ For example, a car manufacturer that bolts a radio onto the dashboard would not fall under the safe harbor of *Leasco* if it could be shown that the bolting offers consumers no additional utility beyond what they could achieve on their own by purchasing the car and a radio separately. If the seller's integration provides no additional utility to consumers,

⁵⁶ *Response of Carolina, Inc. v. Leasco Response, Inc.*, 537 F.2d 1307 (5th Cir. 1976) [hereinafter *Leasco*].

⁵⁷ *Id.* at 1330; see also 10 PHILIP E. AREEDA, ANTITRUST LAW ¶ 1757c (1996) (technological tying claim requires proof that design or redesign of product “is ‘artificial’ in that it lacks a technological advantage or purchaser utility”).

the proper inference, it would appear, is that the seller did it for the sole purpose of harming competition.

In operation, the *Leasco* standard has proved to be a formidable barrier to plaintiffs. For example, in a prominent series of cases involving IBM's efforts to integrate the functions of various peripheral devices into and to otherwise redesign the central processing unit – the *IBM cases* – courts uniformly rejected the tying claims brought by plaintiffs.⁵⁸ In each of these cases, the essence of the plaintiff's claim was the same: that IBM had excluded them from the market by redesigning the mainframe in a way that made their products superfluous or incompatible. Courts refused to apply the tying prohibition, generally on the ground that innovation is too important to the competitive process to subject to judicial second-guessing.⁵⁹

The early technological integration cases introduced, or perhaps brought into sharp relief, an especially protective approach toward product integration in classical

⁵⁸ *Calif. Computer Prods., Inc. v. IBM*, 613 F.2d 727 (9th Cir. 1979) (directed verdict for IBM because design changes made to product were a cost-saving effort rather than an attempt to monopolize); *Innovation Data Processing, Inc. v. IBM*, 585 F. Supp. 1470, 1476 (D.N.J. 1984) (finding that IBM's integration of a "dump-restore" utility into mainframe operating system was a lawful package of technologically interrelated components); *ILC Peripherals Leasing Corp. v. IBM*, 448 F. Supp. 228 (N.D. Cal. 1978), (finding that disk drives and head/disk assembly combination were lawful), *aff'd per curiam sub nom.* *Memorex Corp. v. IBM*, 636 F.2d 1188 (9th Cir. 1980); *In re IBM Peripheral EDP Devices Antitrust Litig.*, 481 F. Supp. 965 (N.D. Cal. 1979) (finding, among other things, that IBM's design changes for the interface between the central processing units and certain peripherals and for certain models of central processing units were not unreasonably restrictive of competition), *aff'd sub nom.* *Transamerica Computer Co. v. IBM*, 698 F.2d 1377 (9th Cir. 1983); *Telex Corp. v. IBM*, 367 F. Supp. 258 (N.D. Okla. 1973), (denying a claim that IBM's integration of additional memory and control functions into its central processing unit constituted unlawful tying), *rev'd on other grounds*, 510 F.2d 894 (10th Cir. 1975).

⁵⁹ *See, e.g., Telex Corp. v. IBM*, 367 F. Supp. at 306 ("In the court's view it would not be a proper application of the antitrust laws under the circumstances shown by the record to preclude or discourage the utilization of advancing technology by this type of integration."). Another prominent case of integration decided on the same theory involved Kodak's simultaneous introduction of the 110 instamatic camera and Kodacolor II film, requiring new equipment for development. *Foremost Pro Color, Inc v. Eastman Kodak Co.*, 703 F.2d 534 (9th Cir. 1983). *Foremost*, one of Kodak's competitors in the photo finishing business, brought suit on the theory that this constituted an unlawful tying arrangement. The court rejected *Foremost's* claim on the ground that "any other conclusion would unjustifiably deter the development and introduction of those new technologies so essential to the continued progress of the economy." *Id.* at 542-43.

tying doctrine. There were two motivations. One is that an uncertain doctrine that threatens harsh penalties for integrating products could deter innovation, an important competitive force.⁶⁰ The other concern is that where the advantage or efficiency is in the product design itself (“integration” versus “bolting”) courts should be especially reluctant to impose liability.

4. Post-Chicago Tying Doctrine

a) Eastman Kodak

We have described classical tying doctrine as consisting of the Supreme Court’s decisions up to *Jefferson Parish* and the lower court decisions on technological integration issued in the same period. Within this set of cases, courts have not explicitly deviated from the classical framework, though implicit deviations have been common. Indeed, one could say that the history of tying doctrine has been dominated by the Supreme Court’s failure to consistently apply the classical doctrinal requirements of market power, leveraging, and forcing.

Explicit deviations from the classical framework have been rare in the cases following *Jefferson Parish* as well. Of the Supreme Court’s cases only one, *Eastman Kodak v. Image Technical Services*,⁶¹ arguably falls into this set of explicit deviations, which we call the post-Chicago category. Consistent with the classical model, Kodak’s policy – selling replacement parts only to copy machine owners who relied on Kodak for

⁶⁰ For an empirical evaluation of the benefits of innovation in one particular product line, see Amil Petrin, *Quantifying the Benefits of New Products: The Case of the Minivan* (NBER Working Paper 8227, Apr. 2001) available at <http://www.nber.org/papers/w8227>.

⁶¹ 504 U.S. 451 (1992).

service or who self-serviced their equipment⁶² – could be seen as an effort to extend its power in the parts market to the service market. However, the consistency with the classical model breaks down after this observation. The key difficulty is that Kodak did not have market power in the original equipment market,⁶³ so equipment purchasers could not have been compelled to purchase the aftermarket products (parts, service) by the lack of alternatives in the equipment market. Still, the Court concluded that market imperfections (lack of information, switching costs) could make it difficult for competition in the original equipment market to discipline monopoly extension efforts in the after-market for service.⁶⁴

Since *Eastman Kodak* is not easily reconcilable with *Jefferson Parish*, where the Court rejected the contention that market imperfections could supplant market share analysis as a basis for finding market power, lower courts have been forced to reconcile the two decisions. Circuit courts have limited the holding in *Eastman Kodak* to the case in which the firm *changes* its service policy after consumers have purchased the equipment.⁶⁵

b) Microsoft and Technological Tying

⁶² Kodak sold copying machines and provided parts and service for the machines. In an attempt to eliminate independent service organizations, Kodak tied service to parts by selling parts only to equipment owners who relied on Kodak for service or who self-serviced their equipment. *Eastman Kodak*, 504 U.S. at 458.

⁶³ *Id.* at 451.

⁶⁴ *Id.* at 477-78.

⁶⁵ *Metzler v. Bear Automotive Service Equip. Co.*, 19 F. Supp.2d 1345, 1357 (S.D. Fla. 1998) (*Metzler*); *Lee v. Life Ins. Co. of N. Am.*, 23 F.3d 14, 19 (1994); *Queen City Pizza, Inc. v. Domino's Pizza Inc.*, 124 F.3d 430, 440 (3d Cir. 1997). In particular, if a firm that does not have market power in the original equipment market announces in advance that it will tie service to parts, it will not be found liable for unlawful tying. *Metzler*, 19 F. Supp.2d at 1364-65.

Other than *Eastman Kodak*, the only other significant deviations from the classical tying model have occurred in the course of the *Microsoft* litigation, which involves technological tying. As we have noted, classical tying doctrine viewed broadly creates a safe harbor for technological integration – in the sense that it is very unlikely that plaintiffs will win. The most prominent illustration of this doctrinal safe harbor is provided by the *IBM cases*. The *Microsoft* litigation has generated two cases, *Microsoft III* and *Caldera*, that have gone against the classical law on technological integration.

In *Microsoft III*, the D.C. Circuit held that “the rule of reason, rather than per se analysis, should govern the legality of tying arrangements involving platform software products.”⁶⁶ The court rejected both the per se analysis from the contractual tying cases relied on by the district court,⁶⁷ and the “sole purpose” inquiry developed in *Leasco* and other technological integration cases. The court noted, as did Justice O’Connor’s *Jefferson Parish* concurrence, that some instances of efficient integration could be penalized under the test of the *Jefferson Parish* majority.⁶⁸ However, rather than adopting a test that provides a safe harbor for these instances, as O’Connor had urged, the D.C. Circuit adopted a balancing test that weighs consumer benefits against competitive harms.

While the D.C. Circuit seemed eager to reject per se analysis for software platform cases,⁶⁹ the test it adopted clearly deviates from the classical tying doctrine on

⁶⁶ *Microsoft III*, 253 F.3d. at 84.

⁶⁷ Trial court judge Thomas Penfield Jackson had held that Microsoft violated Section 1 of the Sherman Act by integrating the Internet Explorer Web browser with the Windows operating system. *Microsoft III*, 87 F. Supp.2d 30, 47-51 (D.D.C. 2000). Using the separate-products test of the *Jefferson Parish* majority, Jackson concluded that the Web browser and the operating system were separate products. *Id.* at 49.

⁶⁸ *Microsoft III*, 253 F.3d at 92-93.

⁶⁹ Paradoxically, the rule of reason test adopted by the D.C. Circuit is virtually indistinguishable, except for

technological integration. In particular, the classical doctrine exhibited a protective approach toward product integration on the grounds that the risk of harsh penalties would deter innovation and that antitrust liability should be scaled back where the advantage or the efficiency inheres in the product's design as opposed to its marketing. The rule of reason test violates both norms by subjecting software platform sellers to a substantial risk of treble damages for design choices.⁷⁰

In *Caldera*,⁷¹ the court considered the burden of proof in a technological tying case, and held that a tying claim must be rejected “if the evidence shows that a valid, not insignificant, technological improvement has been achieved by the integration of two products.”⁷² Although this seems generally consistent on first impression with the classical standard on integration, its novelty becomes clear when compared to the test suggested by the D.C. Circuit in *Microsoft II*, the only other case to explicitly consider the burden of proof question.⁷³ In *Microsoft II*, the D.C. Circuit suggested that a technological tie-in should be deemed lawful if “there is plausible claim that the tie-in brings some advantage.”⁷⁴ The standard announced in *Caldera* requires credible evidence of a *significant technological improvement*, rather than the existence of a

the allocation of the proof burden, from the per se test adopted by Judge Jackson. Judge Jackson's interpretation of *Eastman Kodak* led him to reject the deferential proof standard of *Microsoft II*, 87 F.Supp.2d at 47-48, and to hold that the defendant, in order to prevail, must demonstrate procompetitive justifications sufficient to outweigh anticompetitive effects. *Id.* at 48-49.

⁷⁰ Provided, of course, that the platform seller has sufficient market power to trigger scrutiny under tying doctrine. For a platform seller with a small market share, the risk of having to pay treble damages as the result of a design choice is negligible.

⁷¹ *Caldera, Inc. v. Microsoft Corp.*, 72 F. Supp.2d 1295 (D. Utah 1999).

⁷² *Id.*, at 1325.

⁷³ Although the D.C. Circuit limited *Microsoft II* in its *Microsoft III* opinion, the *Caldera* court had interpreted *Microsoft II* as providing a rule regarding the standard of proof. The *Caldera* court explicitly rejected the *Microsoft II* standard. *Caldera*, 72 F.Supp.2d at 1323-25.

⁷⁴ *Microsoft II*, 147 F.3d at 950.

plausible claim of consumer advantage.⁷⁵ While *Microsoft II* places the burden of proof almost entirely on the plaintiff, *Caldera* shifts a substantial part of the burden to the defendant.⁷⁶

In particular, the significant-technological-improvement standard differs from the plausible-benefit standard in two respects: it involves a hindsight judgment and it focuses on the quality of the technological improvement rather than the benefit to the consumer. These features of the *Caldera* test threaten to penalize some of the most desirable types of innovation. The most efficient cases of product integration will involve easy technical combinations that provide a great deal of utility to consumers, such as the eraser-pencil combination. The *Caldera* standard poses the highest risk of liability for precisely these combinations because it places little emphasis on consumer benefits and a great emphasis on the “validity and significance” of the technical improvement, using hindsight to judge.

More generally, one can argue that the protective treatment technological integration gets in the classical doctrine suggests that these cases are different in important respects from the contractual tying cases that make up the foundation of tying law. One proposition stands at the core of the classical tying model: competition on the merits in the tied good is blocked when a consumer is compelled by the lack of substitutes in the tying product market to purchase a tied product that he does not want or would prefer to purchase from another source. However, setting aside the convenience issue, many consumers of an integrated product would not view the stand-alone version

⁷⁵ *Caldera*, 72 F. Supp.2d at 1325-26 (“Accordingly, the technological improvements must have demonstrated efficiencies. This is more than just a ‘plausible claim that brings some advantage.’”).

⁷⁶ Both *Caldera* and *Microsoft II* state clear rules governing the allocation of proof – rules that had not been clarified in earlier cases. Given this, one might argue that it is *Microsoft II* that is the novel case rather than *Caldera*. As our discussion in the text suggests, we view *Caldera* as the novel interpretation because *Microsoft II* follows the pattern of a substantial line of cases (e.g., the *IBM cases*) articulating a deferential

of the tied component as preferable or even as a perfect substitute. Of course, in the case of a mere “bolting together,” the integrated tied-product is a perfect substitute to the stand-alone version of the same item. The technological tying case law has incorporated this distinction by exempting from the tying prohibition only those cases in which the integration offers some nontrivial utility to consumers above what they could achieve on their own by combining the different products.⁷⁷

B. Classical and Chicago Theories

1. Classical Tying Analysis

Classical tying doctrine developed before industrial economics and the economic analysis of law achieved their current level of technical sophistication.⁷⁸ As a result, classical tying doctrine rests primarily on a verbal proposition rather than one or more of the formal models used in modern economics. The proposition was quite simple: a firm with a monopoly over one good (tying good) could monopolize another (tied good) by selling them only in conjunction with each other. If it did so, a firm seeking to compete in the market for the tied good would be foreclosed from selling to all those who received the tied good in conjunction with their purchase of the tying good. Little attention was paid initially to whether tying was an efficient way of exploiting existing monopoly power in the tying good, or a method of creating a new monopoly in the tied good.⁷⁹

approach toward technological integration decisions.

⁷⁷ *Leasco*, 537 F.2d at 1329-31.

⁷⁸ The founding of the *Bell Journal of Economics* in 1970 roughly coincides with and may well have been an important cause of the increased level of mathematical sophistication underlying theory in industrial economics and law and economics.

⁷⁹ See Ward S. Bowman, Tying Arrangements and the Leverage Problem, 67 *YALE L.J.* 23, 23-24 (1957) (noting the ambiguity of the leverage hypothesis).

2. The Chicago Critique

Starting in the 1950s,⁸⁰ Chicago School scholars challenged virtually every aspect of antitrust doctrine with the exception of the per se ban on horizontal price fixing.⁸¹ The Chicago critique of classical tying doctrine rested on three main ideas. First, tying could provide convenience for customers and lower transaction costs. Second, tying was an inefficient use of monopoly power. A firm with monopoly power over one good might have the ability to monopolize the market for another good, but doing so could not increase profits and could reduce them. This idea is sometimes called the “single monopoly profit” theory. Third, bundling could result in lower prices for some customers and higher levels of output.⁸²

Of these three ideas, the first is the one of greatest practical importance. A moment’s reflection reveals that tying is utterly ubiquitous. For example, when a

⁸⁰ For early examples, see Aaron Director & Edward Levi, *Law and the Future: Trade Regulation*, 51 NW. U. L. REV. 281 (1956); Ward S. Bowman, *Tying Arrangements and the Leverage Problem*, 67 YALE L.J. 19 (1957).

⁸¹ Chicago School legal theorists relied on Chicago School industrial economics. For an example of the Chicago School approach to industrial economics, see GEORGE J. STIGLER, *THE ORGANIZATION OF INDUSTRY* (1968). Contrast it with, for example, F. M. SCHERER, *INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE* (1970). The Chicago School relied on models in which markets were assumed to be either monopolistic or perfectly competitive. Thus, the analysis of actions, such as tying and vertical integration, turned on whether a monopolist in one market could use these practices to extend the monopoly to another. See J. Vernon & D. Graham, *Profitability of Monopolization by Vertical Integration*, 79 J. POL. ECON. 924 (1971). The Chicago School also analyzed situations in which two products were monopolized and asked whether the coordination of these monopolies could harm consumers. Joseph J. Spengler, *Vertical Integration and Antitrust Policy*, 58 J. POL. ECON. 347 (1950).

⁸² To elaborate, there is an extensive literature on the possibility of bundling to accomplish much the same goals as price discrimination. This argument potentially applies to a wide variety of goods in which most customers buy bundles that contain components they do not want. Most cable subscribers have little interest in some channels included with basic cable service. Most buyers of newspapers likely discard entire sections. Purchasers of such goods may often feel that they are forced to buy something they do not want. Forcing a company to sell on an unbundled basis would not, however, necessarily make consumers better off (even if doing so did not increase transactions costs). The reason is that the sum of the prices a company would charge for the components would exceed the bundle price. Thus, while consumers who would buy a sufficiently small fraction of the bundle might well be hurt, others benefit; and there is no reason to suppose that consumers in aggregate are hurt by this practice.

university offers its courses only to degree candidates, it sells an integrated product.

Even if it were to allow students to enroll for individual courses, charging for a course as opposed to individual sessions and including the cost of evaluating the student's work in the course fee are all examples of product bundling. This example not only illustrates that tying is common but also why it is beneficial. Suppose universities sold separately each lecture, grading of a paper, and visit to a professor's office. Even putting aside the difficulty of determining prices, the cost of keeping records to implement such a system would be enormous.

The second idea has been illustrated with examples based on the nature of the demand for the tying and for the tied products; specifically whether the demands are independent or complementary. The independent case is where the quantity demanded of one good would not depend on the price of the other, if they were sold separately. In this case, tying a competitively supplied good to a monopolistically supplied one is equivalent to putting a tax on the supply of the monopoly good. Unless consumers want to pay the tax – i.e., they want the tied good and it is being sold at the competitive price – tying reduces profits. The complementary case is where the demand for each good, if they were sold separately, would depend on the sum of the prices of the two goods. In this case, the tying-good monopolist has no clear incentive to take over the tied-good market. Rather than selling both goods together, it could do just as well by selling the monopoly good at the monopoly price.⁸³ If a more efficient firm can sell the tied good at a lower price, the tying-good monopolist can increase its profits by abandoning the tied-good market and raising its price on the monopoly good.

⁸³ Suppose, for example, that the widgets and gadgets both cost \$1 to produce and that the widget monopolist would charge \$3 if it bundled. The firm can do just as well by charging \$2 for widgets and

The third idea has also been illustrated with examples, the most famous of which is George Stigler's movie example.⁸⁴ In his analysis of block booking by movie distributors, Stigler presented a simple example that laid the foundation for the view that tying – in the case where the firm has a monopoly in the tied as well as the tying good – could be a beneficial form of price discrimination.⁸⁵ In his analysis, one firm distributes two films, X and Y. Half of all theaters are willing to pay \$8,000 for movie X and \$2,500 for movie Y. The other half are willing to pay \$7,000 for movie Y and \$3,000 for movie X. With unbundled sales, the distributor would charge \$8,000 for movie X and \$7,000 for movie Y. Each theater would take one of the two films, and consumer surplus (treating the theaters as consumers) would be 0. With bundling, the distributor would charge \$10,000 for the two films together. All theaters would take both films. The distributor's profits would go up by \$2,000 per theater for the first group and \$3,000 for the second. Moreover, each of the first type of theater would get a surplus of \$500. Thus, tying would make the distributor and some consumers better off while not harming any other consumer.⁸⁶

relying on the competitive markets to supply gadgets for \$1.

⁸⁴ GEORGE J. STIGLER, *THE ORGANIZATION OF INDUSTRY* 165-70 (1968). Another famous example is that of "metering," in which one good is used to monitor the intensity of demand for the monopoly good. For example, a camera monopolist might sell his camera at the competitive price and put the monopoly surcharge into the price of film. As in Stigler's movie example, there is no general result that tying is harmful to consumers.

⁸⁵ Since this analysis was based on a single highly stylized example, a literature developed to explore the applicability of the findings to more general sets of assumptions. See Walter J. Adams & Janet L. Yellen, *Commodity Bundling and the Burden of Monopoly*, 90 Q.J. ECON. 475 (1976); Richard L. Schmalensee, *Gaussian Demand and Commodity Bundling*, 57 J. BUS. S211 (1984); R. Preston McAfee, John McMillan, & Michael D. Whinston, *Multiproduct Monopoly, Commodity Bundling, and Correlation of Values*, 114 Q. J. ECON. 371 (1989); Michael A. Salinger, *A Graphical Analysis of Bundling*, 68 J. BUS. 85 (1995); Yannis Bakos & Eric Brynjolfsson, *Bundling Information Goods: Pricing, Profits, and Efficiency*, 45 MGMT. SCI. 1613 (1999).

⁸⁶ The result that tying increases consumer surplus is not a general result, but neither is there any reason to suppose that tying lowers consumer welfare. Tying leads to some inefficiencies. That is, even if someone who obtains a gadget along with a widget values the gadget at more than the cost of production, there might

While the direct efficiencies from tying are the most important part of the Chicago critique, the other points associated with it have provided more interesting grist for the mills of economic theorists. In particular, the “single monopoly profit” defense has been discredited, as we will make clear below. It is a relatively weak part of the Chicago attack, because showing that a firm has no incentive to tie does not mean that consumers are not hurt by tying.

More generally, two essential features of Chicago School analysis made it susceptible to criticism from post-Chicago theorists. First, the arguments were stated entirely as theoretical arguments. Chicago School theorists may well have developed theories that matched their casual empiricism about the cases being brought, but the arguments they made were not that anticompetitive tying is rare. They argued that it is fundamentally illogical – i.e., that there is no logically sound explanation for why tying could be anticompetitive. That feature of the argument would not necessarily make the analysis vulnerable if the theory were completely convincing. The second key feature, however, was that the Chicago School models did not address the situations that at least today seem to be the most likely ones for intervention. The leveraging of monopoly into markets that would otherwise be perfectly competitive is not an issue. Rather, the more modern concerns are the use of market power (that might fall short of pure monopoly) to distort competition in an otherwise oligopolistic market.

C. Post-Chicago Analysis

be another customer that does not purchase the bundle who values gadgets more than some of the people who obtain them. On the other hand, the price a company charges for a bundle of goods is typically less than the sum of the prices it would choose if it sold them separately. Thus, people who would have purchased both goods if they were sold separately typically benefit from bundling.

The post-Chicago analysis of tying was a response to the Chicago literature's implication that tying should be legal per se. Every post-Chicago article that suggests that tying might be harmful assumes some market power in both the tying and tied goods,⁸⁷ and rules out by assumption convenience or any other benefits generally associated with tying.

1. The Whinston article

Michael Whinston's "Tying, Foreclosure, and Exclusion" is widely recognized as the seminal post-Chicago article on tying.⁸⁸ Whinston presents a series of models in which he first makes assumptions in which tying does not increase profits and then alters the assumptions slightly so that they do.

a) The Base Model

Whinston considered a firm with a monopoly over two goods, one of which was subject to potential competition. He assumed that the tied good was produced with scale economies, which has the implication that the market for it cannot be perfectly competitive.⁸⁹ As a result, an entrant would need to attain sufficient scale⁹⁰ to survive in

⁸⁷ Specifically, a key feature of essentially all post-Chicago analysis is a reliance on economic models either of oligopoly or of entry deterrence.

⁸⁸ Michael D. Whinston, *Tying, Foreclosure, and Exclusion*, 80 AM. ECON. REV. 837 (1990).

⁸⁹ For the purposes of this article, "scale economies" means that average cost (AC) is lower for higher levels of output. As a matter of pure arithmetic, marginal cost (MC) must therefore be below average cost. To see this point, suppose that the total cost of producing 1,000 units was \$10,000, which would imply that the average cost is \$10. If average cost is a declining function of output, then the average cost of producing 1,001 units must be less than \$10. For that to be the case, the total cost of producing 1,001 units must be less than \$10,010, which would in turn mean that the marginal cost of the 1001st unit must be less than \$10. Under perfect competition, price equals marginal cost. The combination of $MC < AC$ with scale economies cannot exist (in the long run) with the condition that $P = MC$ in perfect competition. Together, they imply $P < AC$, which means that firms earn negative profits.

⁹⁰ In virtually all markets, there are scale economies up to some level of output and, as a result, entrants

the market. In the Whinston model, tying can foreclose the entrant from enough sales to be the difference between making entry profitable and unprofitable. In those cases, tying can both increase profits and harm consumers.

The simplest version of the analysis goes as follows. Suppose there are 1 million potential customers. The incumbent firm (Monocorp) has a monopoly over a good (widgets) that costs \$1 per unit to produce and that all customers value at \$2 per unit. In addition, Monocorp sells gadgets, which also cost \$1 per unit to produce. Absent the threat of entry, Monocorp maximizes its profits at \$2 million by charging \$2 for both widgets and gadgets and selling 1 million units of each.

Now suppose that there is a potential competitor (Entcorp) in the market for gadgets. Although it is not essential to the argument, suppose that Entcorp's gadgets are better than Monocorp's but still cost only \$1 to make. If Entcorp indeed enters, suppose that it charges \$1.50 for its gadgets and that, because of its quality disadvantage, Monocorp would rationally reduce its price to \$1.25. Suppose furthermore that the quality difference is such that 666,667 people buy Entcorp's gadgets despite the higher price whereas only 333,333 buy Monocorp's.⁹¹ Thus, Entcorp earns \$333,333 gross of entry costs and Monocorp's profits are reduced to \$1,083,333 (of which \$1 million is from the sale of widgets).

Whinston considers whether Monocorp would find it profitable to bundle the monopolized good with its competitive good. On the surface, the bundling strategy

must attain sufficient scale to survive. When efficient scale is small relative to the total market output, a market can be perfectly competitive (or at least nearly so). Scale economies make a market naturally monopolistic or oligopolistic when the scale economies are large relative to the market, in which case at most a small number of efficient firms can co-exist.

⁹¹ Whinston, *supra* note 88, §I Ex. 2.

seems like a device to force customers to buy the inferior gadgets in order to get widgets. Upon further examination, however, the desirability of the strategy is not obvious at all. Entcorp's customers get no surplus from the \$2 they pay for an unbundled widget. Since they prefer Entcorp's gadgets at \$1.50 to Monocorp's at \$1.25, they would not rationally pay \$3.25 for the bundle of a gadget and a Monocorp widget. The consequence of the bundling strategy with the \$3.25 price is simply to pass up the sale of 666,667 widgets. Consistent with Chicago School analysis, this model suggests that the efficient way to exploit the monopoly over widgets is through the pricing of widgets and that the monopolist only ends up hurting itself by trying to force unwanted gadgets on its widget customers.

One might suspect that Monocorp could get the benefits of bundling while avoiding the cost by selling unbundled widgets for \$2 in addition to the bundle of widgets and gadgets for \$3.25. While doing so would indeed prevent Monocorp from losing any sales of widgets, it would confer no strategic advantage to Monocorp over a strategy of unbundled sales. With widgets priced at \$2 and a widget-gadget bundle priced at \$3.25, Monocorp is effectively selling gadgets for \$1.25.⁹²

If Monocorp does sell widgets and gadgets only as bundles, then, as Whinston demonstrated, it would rationally charge less than \$3.25. Of course, the price that Entcorp charges depends on Monocorp's price, and a reduction in the price of the Monocorp's bundle below \$3.25 would have the predictable consequence of inducing Entcorp to charge less than \$1.50. Given the precise assumptions Whinston makes about the oligopolistic interaction between the two firms, Monocorp charges \$2.58 for the

⁹² This argument rests on the assumption that everyone buys a widget at a price of \$2.

bundle while Entcorp charges only \$1.17 for its gadgets. At these prices, demand for the Monocorp's bundle is 777,778 and demand for Entcorp's gadgets is only 222,222. Monocorp's profits are \$453,704 while Entcorp's profits gross of entry costs drop to \$37,037. Note that Monocorp's profits, while greater than they would be at a bundle price of \$3.25, are less than when it sells its products unbundled (or when it sells widgets separately from the bundle).

The crucial last step in Whinston's analysis is to consider Entcorp's cost of entry. Suppose that the cost of entry is \$100,000, which is between the \$37,037 gross profits that Entcorp can make when Monocorp bundles and the \$333,333 gross profits it can make when Monocorp does not. In that event, the Monocorp decision to bundle is the difference between making entry profitable or unprofitable for Entcorp. Moreover, if Entcorp stays out, then Monocorp does not even have to cut the bundle price. In the example here, it can raise the bundle price to \$4 and earn \$2 million, the same as it would earn if it was immune from entry.⁹³

⁹³ For an extended analysis, see Barry Nalebuff, Bundling (Yale ICF Working Paper Series No. 99-14, Nov. 22, 1999) available in the SSRN Electronic Paper Collection: http://papers.ssrn.com/paper.taf?abstract_id=185193. Nalebuff examines two reasons for tying and the interrelationship between them. The first is that even a monopolist over two products might have an incentive to bundle them even if there is no threat of entry. The incentive to do so depends on the correlation of reservation values across customers, the marginal cost of the goods, and the extent to which bundling itself saves costs. The second is that bundling two products might make it difficult to enter with just one. This effect is related to one of the traditional concerns about vertical integration, which is that it makes entry more difficult by making it impossible to enter at just one stage. The relationship between the two is that bundling can be a relatively inexpensive form of entry deterrence.

Suppose a company has a monopoly over widgets and gadgets and that the monopoly price for each is \$2. Depending on the marginal cost of production and the correlation of reservation values, it might be able to earn more money by selling them only as a bundle and charging, say, \$3.50. Moreover, the company might not be able to charge \$2 each selling the goods separately because it might face entry. If so (and if it cannot deter entry by threatening to cut its price once entry occurs), it cannot get the full monopoly price. With bundling, however, it might be able to get the full \$3.50 because entry is less of a threat. Without bundling, an entrant into the widget market can capture the entire market simply by offering a lower price. With bundling, people who value gadgets will get widgets in their bundle. This limits the potential market for a widget producer and, given Nalebuff's assumption of increasing returns to scale, makes it possible that a would-be widget competitor cannot enter profitably.

The situation Whinston analyzed falls into a more general class in which an incumbent in a market with scale economies wants to deter an entrant. Analysis of this problem dates back at least to Joe Bain's seminal work, *Barriers to New Competition*.⁹⁴ Bain suggested that a firm would expand production beyond monopoly levels to the point where entry at any scale would drive the price below an entrant's average cost, thus ensuring that the entrant would lose money.⁹⁵ A criticism of the model is that the price reduction after entry would make the market unprofitable for the incumbent as well (and on a larger scale than for the entrant).⁹⁶ According to this critique, the incumbent would rationally cut its output once entry occurred to increase its own profits; and the potential entrant would choose to enter based on the expectation that the incumbent would follow its self interest. Using the terminology of game theory, the incumbent's threat to let the price drop after entry to non-remunerative levels is not credible.⁹⁷

While it is now widely accepted that the Bain model was not fully worked out, there have been modern extensions that suggest that an incumbent might be able to deter entry. Dixit showed that while scale economies alone are not an entry barrier, the combination of scale economies and sunk costs could be.⁹⁸ In its simplest form, the Bain

In the Nalebuff analysis, it is not clear that tying is harmful. He primarily examines cases in which tying, in the absence of the threat of entry, would be beneficial. His observation is that it might also have the side-benefit of deterring entry. Given that his assumptions are somewhat unconventional, some will question his conclusions. Even if they are correct, however, they are points about corporate strategy. By themselves, at least, they do not justify any limitation on tying.

⁹⁴ JOE BAIN, *BARRIERS TO NEW COMPETITION* (1956).

⁹⁵ For a recent exposition of what is known as the "Bain limit pricing model," see Richard J. Gilbert, *Mobility Barriers and the Value of Incumbency*, in *HANDBOOK OF INDUSTRIAL ORGANIZATION* 476, 480 (Richard Schmalensee & Robert D. Willig eds., 1989).

⁹⁶ *Id.* at 485.

⁹⁷ Reinhard Selten, *Reexamination of the Perfectness Concept for Equilibrium Points in Extensive Games*, 4 *INT'L J. GAME THEORY* 25 (1975).

⁹⁸ Avinash Dixit, *The Role of Investment in Entry Deterrence*, 90 *ECON. J.* 95 (1980).

model considers the actions of a monopolist faced with a single potential entrant. In practice, one would expect multiple potential entrants; and one would generally expect that a firm might have an incentive to behave aggressively toward one in order to establish a reputation with the others.⁹⁹

In the Whinston model tying is theoretically a device for committing to a low price for gadgets once entry occurs, and thus making the threat of such a price credible. The foregoing alternative explanations (sunk costs, multiple entrants) for why Monocorp might respond aggressively to entry are ruled out in his model.

b) Complementary Products

In his analysis of tying of complementary goods, Whinston modified Chicago School assumptions to allow for the possibility of a competitor, albeit an inefficient one, in the sale of the tying good. Under Chicago School theory, a monopoly over one of a pair of perfectly complementary products is as good as having a monopoly over both. If so, competition in the sale of one of the components does not harm and, indeed, can help the monopolist because it provides an opportunity to raise the price of the other. Whinston showed, however, that potential competition in the sale of the (potentially) tying good limits the firm's ability to get all available profits from the sale of that good and provides an incentive to use tying to preserve its monopoly over the tied good.

Consider, for example, computers and monitors, and suppose that everyone with a computer uses exactly one monitor. Assume that a computer costs \$300 to produce and a monitor costs \$200. Since consumers demand computers and monitors only in combination, the demand for the two depends on the sum of the prices. If one firm had a

⁹⁹ See Gilbert, *supra* note 95, at 515.

monopoly over both computers and monitors, therefore, it would need to determine the profit-maximizing sum of the two prices. It could then allocate that sum between the two components any way it chose. Suppose that the profit-maximizing sum is \$2000, and that the seller divided that into \$1400 for the computer and \$600 for the monitor. The firm's profits would then be \$1500 per system sold.

Now suppose that Entcorp can sell monitors, and either that it has lower production cost per monitor or that some people prefer a system with a Monocorp computer and an Entcorp monitor to one supplied entirely by Monocorp. Surprising as it might seem (at least to those not familiar with Chicago School analysis), Monocorp benefits from this, provided it raises the price for the computer to \$1801 and lowers its price on monitors to \$199. This strategy keeps the system price the same (thus preserving both the quantity of computers sold and the profit per computer) but realizes all of the profits in the monopoly component. That way, the company is not hurt (and indeed receives a small benefit) when customers buy a Monocorp computer to use with an Entcorp monitor. This example illustrates the single-monopoly-profit theory.

As Whinston demonstrates, however, the single-monopoly-profit theory is fragile. With a slight change in assumptions, Monocorp does have an incentive to tie in order to keep Entcorp out of the market. The argument that Monocorp is not harmed by entry into the production of monitors rests on the assumption that Monocorp is a true monopolist in the production of computers. Suppose, however, that there is a firm (Schlockcorp) that produces competing but inferior computers. To keep matters simple, suppose that Schlockcorp's cost per computer is \$300, the same as Monocorp's. Yet, everyone considers a system with a Schlockcorp computer to be worth \$100 less than a system

with a Monocorp computer.

Absent Entcorp, Schlockcorp poses no problem for Monocorp. It can keep Schlockcorp out by charging \$350 for computers and \$1650 for monitors. Its system price would still be \$2000. The strategy excludes Schlockcorp because the minimum price Schlockcorp can profitably charge is \$300 per computer and no one would pay that price when Monocorp computers are available for \$350. As noted above, absent Schlockcorp, Entcorp's entry does not threaten (and indeed even helps) Monocorp. The combination of the two, however, is a problem. In order not to be harmed by Entcorp, Monocorp must be able to raise the price of its computers to \$1801. The presence of Schlockcorp, however, prevents Monocorp from charging anything more than \$400 for its computers.¹⁰⁰

Finally, even if Schlockcorp does not exist, Whinston observes that the argument that Monocorp necessarily benefits from Entcorp's entry rests on the assumption that monitors are purchased only in conjunction with computers. If there is another use of monitors, however, then there might be an incentive to tie for much the same rationale that arises in Whinston's core model (in which goods are not complements). If Entcorp's monitors did not exist, then Monocorp could choose the price for its monitors that maximizes its profits in the market for the alternative use. Suppose that price is \$600. It could then charge \$1400 for a computer, to achieve the desired price of a computer-monitor system. Were Entcorp to come into the market and force it to lower its monitor price, Monocorp's profits in the sale of monitors for the alternative use would drop.

¹⁰⁰ Put another way, competition from one component does not constrain the system price. With competition in all components, however, a consumer can assemble an entire system that contains no element produced by Monocorp. The competing system (or systems) constrains the price that Monocorp can charge for a system.

Indeed, Entcorp's entry would hurt Monocorp even if no one desired Entcorp's monitors for the alternative use.¹⁰¹ Of course, if some people did buy Entcorp's monitors for the alternative use, the damage to Monocorp would be even greater.

Under these circumstances, selling computers only in packages with monitors can be an effective strategy. First of all, it would preserve Monocorp's profits in selling computers. Secondly, the strategy would deny Entcorp any profits from selling monitors for sales in computer systems. To the extent that such profits are necessary to cover the fixed costs of entry, the strategy could prevent Entcorp from entering the market.

2. Carlton and Waldman

Carlton and Waldman extend the Whinston analysis to include assumptions that they claim more nearly fit the government's theories in the *Microsoft* case.¹⁰² A key issue in that litigation is what distinguishes the integration of Internet Explorer into Windows from other features Microsoft has bundled into Windows without raising antitrust objections. The Carlton and Waldman analysis considers two such features: the possibility that a complementary good might at some point in the future become a substitute, and the presence of network externalities. Their analysis formalizes the claim that anticompetitive tying could occur in industries with these features.

Carlton and Waldman first consider sellers of systems of two components, a primary good and a complementary good. The primary good can be used by itself, while

¹⁰¹ This assertion is based on the assumption that Monocorp cannot charge different prices for monitors depending on whether they are used as a part of a computer system.

¹⁰² Dennis W. Carlton & Michael Waldman, *The Strategic Use of Tying to Preserve and Create Market Power in Evolving Industries* (NBER Working Paper No. 6831, Dec. 1998) available at <http://www.nber.org/papers/w6831/>.

the complementary good can be used only in conjunction with the primary good. One firm is initially a monopolist in both. A firm with a superior complementary good has the opportunity to enter. It cannot enter the market for the primary good at the same time, but it has the prospect of doing so at some point down the line. This possibility of the entrant also producing the primary good serves the same role in the Carlton-Waldman analysis as the potential entrant in the tying good in Whinston's complementary goods model. Without that possibility, the monopolist would benefit from entry by a superior complementary product. Once the entrant can sell the primary good as well, the monopolist cannot hope to reap the gains from improvement in the complementary good by raising the price of the primary good.

Carlton and Waldman also construct a model in which there are two complementary goods and one is subject to network externalities.¹⁰³ As in their first model, one firm is initially able to enter with one good (the one with network externalities) but it cannot enter with the other (the one that is complementary to the good with network externalities) until later. In the Carlton-Waldman model, the presence of network externalities gives the monopolist an incentive to get a head start in the race to be the standard by tying. Absent the threat of entry in the primary good, the firm would have no incentive to seek this advantage. It would prefer to have competition to be the standard in the complementary product result in adoption of the best available standard. It could then realize the benefits of that standard through its price for the primary good. Once entry into the primary good becomes possible, however, the firm can no longer try

¹⁰³ Network externalities are benefits consumers enjoy because a product is used widely, such as a software product that facilitates file sharing. For discussions of network effects and antitrust law, see David A. Balto, *Networks and Exclusivity: Antitrust Analysis to Promote Network Competition*, 7 GEO. MASON L. REV. 523 (1999); Carl Shapiro, *Exclusivity in Network Industries*, 7 GEO. MASON L. REV. 673 (1999).

to extract all the available rents through that good.

3. Farrell and Katz

The competitive effects of tying are related to the competitive effects of integration because a firm with market power over one product can only tie it to another product by producing a second product. Farrell and Katz do not address directly the question of tying, but they do analyze the competitive effects of integration. In particular, they examine the effect of integration on incentives to innovate.¹⁰⁴

The Farrell-Katz model analyzes a market in which consumers buy a system of two components (e.g., computers and printers). Only one company produces computers. It can choose to produce printers as well, but there are many potential suppliers of printers. Consumers place no value on a computer alone or a printer alone. They always buy exactly one printer per computer.

In the Farrell-Katz model, printer producers not only compete in the price they charge, but also in research & development (R&D) to improve the printers. As was the case in the Whinston model, computer producers benefit from improvements in the price-quality profiles of printers. A printer producer benefits from R&D if it develops a product that is superior to its competitor's. If so, it can charge a price premium that fully reflects the difference between its quality and its competitor's. To get some sense of the model's results, suppose that two firms initially sell the same quality printer and then only one of them innovates. Given the stark assumptions of the model, the innovating firm gets all of the benefits from the R&D (in the form of a higher price), leaving none of

¹⁰⁴ Joseph Farrell & Michael L. Katz, Innovation, Rent Extraction, and Integration in Systems Markets (Jan. 4, 2000) (unpublished manuscript on file with authors).

the surplus for consumers or the computer producer. In contrast, if both firms improve their quality by the same amount, price competition between them eliminates any benefit to them.¹⁰⁵

Farrell and Katz show that in their model, the computer manufacturer would spend more on R&D if it integrated into printers than would a stand-alone printer producer.¹⁰⁶ This effect might initially appear to be procompetitive, since the merged entity competes more aggressively. Farrell and Katz interpret it as being anticompetitive, however, in part because it lowers the R&D by independent firms and in part because the integrated firm's R&D exceeds the socially optimal level.

In evaluating the practical implications of the Farrell-Katz arguments, three points are worth considering. First, the criterion they use is controversial. While it is theoretically possible for competition to be harmful, it is not clear that harmful competition is anticompetitive.¹⁰⁷ Second, the result that independent firms lower their R&D in response to increases by the integrated firm's is not a general result.¹⁰⁸ Third,

¹⁰⁵ They cannot raise their price. The quantity they sell goes up, but they get no benefit because they are charging a price that just covers their marginal cost.

¹⁰⁶ A firm's optimal expenditure on R&D turns on a weighing of the marginal benefit and the marginal cost. Marginal cost does not depend on whether the firm is integrated. The integrated firm does get a greater marginal benefit from innovation because R&D expenditures by printer producers can benefit computer producers. The integrated firm captures this latter benefit whereas an independent printer producer does not.

¹⁰⁷ To illustrate this point with a numerical example, suppose that each printer firm would spend \$100 million on R&D if each remained unintegrated. Now suppose that one of the firms integrates into computers and, because it internalizes the effects of printer improvements on computer sales, increases its R&D budget to \$150 million. The issue is whether that increase should be understood as procompetitive or anticompetitive. The position implicitly endorsed by Farrell and Katz is whether it is anticompetitive depends on whether it passes (or at least does not fail) a social welfare test. Before adopting such a standard, courts should consider how the welfare analysis would be conducted. Real settings would inevitably be (much) more complicated than the stylized settings of the models; and, because both expert and judicial error would be distinct possibilities, issues such as the burdens and standards of proof should properly depend on assessments of the relative frequency of procompetitive and anticompetitive R&D.

¹⁰⁸ To continue with the numerical example from the previous note, competing printer producers could conceivably lower their R&D on the grounds that competing with the integrated firm's higher spending

the incentives for R&D are almost never socially efficient.¹⁰⁹ Under a wide variety of circumstances, firms are not able to appropriate the full benefits from their R&D.¹¹⁰ Thus, even if one accepts social welfare as the appropriate criterion, the result that integration creates incentives to perform too much R&D is unlikely to be general.

Like the Whinston paper, the Farrell and Katz paper is an example of what Franklin M. Fisher has labeled “exemplifying theory.”¹¹¹ The anticompetitive phenomenon Farrell and Katz model may well occur. That is, in industries with complementary goods, widgets and gadgets, that both can be monopolized, the widget monopolist may invest in the ability to produce gadgets simply as a bargaining tool; and such investment may be socially wasteful. Moreover, recognizing that the widget monopolist may pursue this strategy, independent gadget producer may limit their own investment. But it also possible that the widget monopolist might really want to produce a better gadget in part to stimulate widget sales. It is hard to see how the highly stylized assumptions in the Farrell and Katz model could be used to assess which is more likely.

4. Preliminary Assessment

As we noted earlier, the post-Chicago literature arose in response to the Chicago School’s implication that tying should be legal per se. The post-Chicago models indicate that tying can be anticompetitive, not that it must be anticompetitive or that it is likely to be anticompetitive. Indeed, the models cannot tell us even that anticompetitive tying is

would not be worth the chase. Another possibility, though, is that they would increase their R&D in order to produce printers that would be able to compete successfully with those of the integrated firm.

¹⁰⁹ See TIROLE, *supra* note 11, at 389-401.

¹¹⁰ *Id.*

¹¹¹ Franklin M. Fisher, *Games Economists Play: A Noncooperative View*, 20 RAND J. ECON. 113 (1989).

more than a remote possibility. For example, in Whinston's models, what makes tying anticompetitive is that it denies a supplier of the tied good the scale necessary to survive. This mechanism can work only when scale economies in the tied good are large enough relative to the market that the practice of tying makes the difference between achieving or not achieving adequate scale. When cost and demand are configured so that this condition is not satisfied,¹¹² anticompetitive tying is not a profitable strategy even under the assumptions of the model, which rule out tying for beneficial reasons.

The primary contribution of the post-Chicago analysis is the demonstration that the single-monopoly-profit theory rests on very strong assumptions. That theory is not, however, the primary reason to question legal hostility to tying. Rather, the primary reason is that the prevalence of tying in competitive markets indicates that it often provides the economic benefits of providing convenience and lowering costs. The challenge for policy is to find rules that weigh these competing explanations appropriately.

III. A Decision Theoretic Approach

The ultimate objective in formulating tying doctrine is to outlaw tying or product integration that lowers consumer surplus (or, alternatively, economic welfare) and allow tying or product integration that does not. As a practical matter, however, courts must rely on inherently imperfect tests. Decision theory provides a powerful framework for understanding situations in which choices among alternative actions must be based on imperfect information. It helps us understand the tradeoffs between, in effect, convicting

¹¹² And even if the cost/demand condition is satisfied in one time period, it may not be satisfied in the next in an expanding market. Thus, a firm that is deterred from entering in period 1 need only delay its entry until period 2, when the market is larger.

the innocent and absolving the guilty.

As we will see, decision theory makes clear that a rational legal standard for tying must come to grips with the utter ubiquity of the practice. When a law firm offers legal services, it offers the services of its partners only in conjunction with the services of its associates, paralegals, and secretaries. Clients cannot pick a partner from one firm, a paralegal from another, and a secretary from a third. While some clients with strong preferences for particular paralegals or secretaries might conceivably be harmed by this bundling, most clients benefit from the convenience it provides. This example is one of a virtually infinite number of possibilities. As Carlton and Perloff have put it, "In the extreme, every product can be thought of as composed of multiple products."¹¹³ Decision theory implies that the ubiquity of benign tying affects how aggressive the law should be in trying to prevent harmful tying.

A. Decision Theory Framework

Under the decision-theory framework, a legal rule divides cases into two categories: those that are legal under the rule and those that are illegal. Because the rule is inherently imperfect, this categorization is not identical to the distinction between the cases that are harmful and benign. Thus, one can further categorize cases according to whether the practices found legal or illegal are harmful or not. This leads to the following cross-classification scheme:¹¹⁴

¹¹³ DENNIS W. CARLTON & JEFFREY M. PERLOFF, *MODERN INDUSTRIAL ORGANIZATION* 466 (1990). For the observation that tying is ubiquitous, see also LAWRENCE A. SULLIVAN, *ANTITRUST* 443 (1977).

¹¹⁴ The matrix need not be 2x2. There can be different gradations of harmful and different gradations of illegal.

	<i>Harmful</i>	<i>Not Harmful</i>
Illegal	% of cases that both are harmful and violate the legal standard	% of cases that violate the legal standard even though they are not harmful
Legal	% of cases that are harmful even though they do not violate the legal standard	% of cases that are both benign and legal under the standard

In this matrix, the upper left and lower right-hand cells represent cases that the legal standard judges appropriately, while the upper right and lower-left hand cells are those in which the legal standard is in error. There are two distinct types of errors that the legal standard can make, false "convictions"¹¹⁵ and false "acquittals."¹¹⁶ Under a decision-theoretic approach, the basis for comparing two standards is their respective rates of these two types of errors.

Suppose that courts are comparing two rules, A and B, whose properties are represented by the following matrices.¹¹⁷

		<i>Rule A</i>	
		Harmful	Not Harmful
Illegal		20%	5%
Legal		10%	65%

¹¹⁵ It is important to be clear, though, that a false conviction does not necessarily mean that a trial would actually occur and result in a conviction. Included in false convictions are benign occurrences that do not occur because of the belief that they could be challenged in court. Indeed, some false convictions might entail cases that would not be found in violation of the law if they went to trial but which nonetheless do not occur because of uncertainty about the law or courts' enforcement of it.

¹¹⁶ The terms that are more commonly used in decision theory for the two possible types of errors are "false negatives" and "false positives." Here, we adopt the terminology used in C. Frederick Beckner III & Steven C. Salop, *Decision Theory and Antitrust Rules*, 67 ANTITRUST L.J. 41 (1999).

¹¹⁷ Because the percentage of harmful and benign cases is not a function of the legal rule, the sums of the respective columns in the two tables are the same. In this particular case, 30% of the cases are harmful and 70% are not. In contrast, the fraction of cases that are legal is not constant. Under Rule A, 25% of cases violate the rule whereas only 11% violate Rule B.

<i>Rule B</i>		
	Harmful	Not Harmful
Illegal	10%	1%
Legal	20%	69%

Rule A is the stricter rule. Of the instances of the practice in question, 25% are illegal as opposed to the 11% under rule B. The stricter standard is a mixed blessing. Fewer harmful instances escape legal sanction, but more benign instances get penalized. Precisely this sort of mixed blessing, coupled with a reduction in administrative costs, has been the traditional argument for preferring per se analysis to the rule of reason standard in antitrust.¹¹⁸

In order to choose between Rules A and B, courts must assess the cost of each type of error. Assuming administrative costs for the rules are the same, the best rule minimizes the total costs of error. For example, if a court decided that false acquittals and false convictions were equally costly, then it would opt for Rule A, which has the lower combined error rate. If, however, it views a false conviction as being three times as costly as a false acquittal, then it would opt for Rule B.

Let's apply this "rule matrix" framework to tying. Given that tying is ubiquitous (e.g., cameras and lenses) and that under any sensible legal standard the vast majority of instances of tying are legal, any representation of a legal rule on tying and product integration will necessarily have a very high number in the lower right hand corner of the

¹¹⁸ See *United States v. Trenton Potteries Co.*, 273 U.S. 392, 397-98 (1927).

rule matrix. Suppose, for example, that only 0.1% of all instances of bundling are anticompetitive. Furthermore, suppose that under rule of reason analysis courts can always identify harmful cases as being illegal and that they judge 98% of benign cases to be legal. Most people's reaction to this set of assumptions is that the judgment of the courts is highly accurate. Given these assumptions, the rule matrix is:

<i>Outcome Rates under Rule of Reason for Tying</i>		
	Harmful	Not Harmful
Illegal	0.1%	1.96%
Legal	0%	97.94%

In this matrix, 99.9% of all instances of bundling are not harmful.¹¹⁹ However, as can be seen in the table, 95.1% of the instances of bundling found to be illegal under this rule are benign.¹²⁰ In other words, even though the proposed rule of reason standard for tying is highly accurate in the eyes of most observers, the vast majority of convictions under the standard are false. This is a general result that is observed whenever the relevant *base rate probability* – in this case, the fraction of instances in which tying is harmful – is low. As we will see below, this has important implications for the design of the appropriate legal standard for tying.

We have referred to the importance of the relative costs of false convictions and

¹¹⁹ Since only 0.1% of instances of bundling are harmful, it follows that 99.9% are not. In the table, the sum of the percentages under "Harmful" is 0.1% and the sum of the two cells under "Not Harmful" is 99.9%. Note also that the ratio 97.94/99.9 is roughly equal to 98 percent – which is the fraction of benign cases judged to be legal.

¹²⁰ This follows from applying Bayes' Theorem: note that $95.1\% = 1.96\% \text{ divided by } (0.1\% + 1.96\%)$. For a discussion of Bayes' Theorem, see ROBERT D. MASON ET AL., *STATISTICAL TECHNIQUES IN BUSINESS*

false acquittals in determining the appropriate legal standard. It is easy to demonstrate that the imposition of a relatively accurate test may not be desirable if false conviction costs are large relative to false acquittal costs. To take a concrete and striking example, consider an AIDS test that, like our tying test above, judges 98% of uninfected cases to be uninfected, and 100% of infected cases to be infected. If used in a population in which only 0.1% is infected, the test will have an outcome similar to that shown in the matrix: 95% of cases which the test reports as infected will be uninfected. If the cost of a false positive from an AIDS test is sufficiently high, one could easily generate a scenario in which members of the tested population are better off either not taking the test or taking it only under carefully controlled circumstances.

There are several criticisms one might levy against the numerical example of tying that we have put forward as a plausible case. One is to observe that our low estimate of the base rate probability of harm (0.1%) is subjective. We have two responses. First, in forming our subjective estimate, we assumed that because of the ubiquity of tying to provide convenience or lower transaction costs, the vast majority of ties are procompetitive. Even if some anticompetitive tying occurs, it is at most a tiny percentage of all ties. Second, the charge that our numerical example should be discounted because the estimates are subjective misses a key point about the application of decision theory to legal doctrine. Decision-theoretic concepts have always been implicit in many aspects of legal doctrine. The value of making the analysis explicit is that it lays bare the assumptions that underlie any particular doctrine.

A more sophisticated critique would be that despite the so-called per se rule

against tying, very few instances of tying in fact run afoul of the law. Since the fraction of false convictions cannot exceed the fraction of convictions, one might ask, how can we be sure that the rate of error against defendants is an order of magnitude greater than the rate of truly harmful cases, rather than the reverse? We concede that the de facto antitrust treatment of tying is not nearly as hostile as the nominal legal standards would lead one to believe. But that observation does not refute what we consider to be the key insight of our approach. Given the ubiquity of beneficial tying, a rational legal rule must have virtually no risk of a false conviction. In our example, courts would have to have a less than a 1-in-1000 chance of labeling a beneficial tie as anticompetitive to have more false convictions than true convictions and only a 1-in-10,000 chance of this type of error for 90% of convictions to be anticompetitive. Thus, one cannot defend the current legal regime on the ground that it is not really as hostile to tying as it might initially appear. Rather, one needs to assert that it is nearly perfect. In the absence of a clearly articulated standard that distinguishes beneficial from harmful tying, we see no reason to presume that the small number of cases that do run afoul of the law are the harmful ones. If, as we contend, most examples of ties are beneficial, then an appropriate legal test would be accompanied by a tough standard for what constitutes an illegal tie and would place the burden of proof on plaintiffs to establish that the standard is met.

B. Some Implications for Tying Law and Early Literature

We can apply this framework to identify some of the implicit assumptions underlying alternative legal standards for tying. To simplify, we will treat the per se illegality rule, for the moment, as if it were a categorical prohibition of tying by firms

with market power in the tying good. This is inaccurate given that our earlier description of the per se rule notes that it includes proxies for rule of reason considerations.

However, this is sufficient for the crude distinctions we wish to make below.

Decision theory implies that the best legal rule minimizes the overall expected costs of error. The three important factors suggested by the analysis are the base rate probability of harm, the ratio of the false conviction to the false acquittal probability (relative error rates), and the ratio of the false conviction to the false acquittal cost (relative error costs). The expected cost of a particular type of error - say of a false acquittal - is simply the product of the false acquittal rate and the cost of a false acquittal, where the false acquittal rate is a function of the base rate probability of harm. It follows that the per se legality rule is more desirable as the expected cost of a false conviction increases relative to that of a false acquittal, which, in turn, is more likely as either the probability or the cost of a false conviction increases. Thus, holding the base rate probability of harm fixed, as courts have greater difficulty in distinguishing harmful from benign instances of tying, and as the cost of mistaking benign instances for harmful instances increases, the case for adopting a per se legality rule gets stronger. Similarly, as the expected cost of a false acquittal rises relative to that of a false conviction, the case for the per se illegality rule gets stronger.

If we restrict our attention to relative error costs, it is easy to see the case-specific factors that influence the choice of an optimal legal standard. Other things equal, false acquittal costs are likely to be small relative to false conviction costs when there are (1) market constraints, such as competition or entry, on the firm's conduct, (2) strategies other than tying that the firm could use to gain the same advantage in the market, or (3)

no clear incentive to use tying for the sole purpose of harming consumers. False conviction costs are likely to be relatively large when there are substantial potential efficiencies associated with tying.

A few examples can be used to illustrate these factors. Market constraints are most obvious in the instances where the tying firm does not have market power in the tying product. For example, when a firm sells widgets and gadgets only in combination, the concern is that someone who wants a widget but not a gadget is forced to buy a gadget. If, however, other firms sell widgets separately (so that the seller has no market power in widgets), then there cannot be any sense in which the bundling forces an unwanted gadget on someone.

There are plenty of instances of tying in which one cannot reasonably argue that the seller's only plausible objective is to restrict competition. Goods are often sold together in competitive markets when the joint selling either saves cost or provides convenience. Indeed, even a monopolist has an incentive to cut costs and provide convenience. Suppose for example that 80% of the purchasers of widgets also want gadgets, that gadgets cost \$1 to produce, and that the incremental cost of packaging gadgets separately from widgets is \$0.30. In this example, it is cheaper to provide a gadget for those who do not want it (a cost of \$1 per customer for 20% of the customers) than it is to package the goods separately (\$0.30 per customer for 80% of the customers). Customers who want both widgets and gadgets are likely to get a lower price than they would if the company were forced to sell the goods separately.¹²¹ Those who do not want

¹²¹ The case of the widget monopolist who can cut its packaging costs by tying gadgets also reveals ways in which market constraints reduce the relative cost of false acquittals. The Chicago School literature has shown that the likelihood of anticompetitive harm is extremely small when the market for the tied good is competitive, so we need only consider the case where the market for the tied good is susceptible to

gadgets would likely end up paying more for the bundle than they would just for a widget (under unbundled sales). Thus, they are “forced” to buy gadgets, and the 20% is presumably large enough to be considered substantial foreclosure.¹²²

It is straightforward to see the implications of this perspective for the classical and Chicago theories. Recall that the classical theory assumes that tying is used by the seller as a monopoly leveraging mechanism. The classical theory provides a justification, on decision theory grounds, for the limitation that the seller must have market power in the tying good. However, since even monopolists have incentives to cut costs and provide convenience to consumers, a per se rule against tying whenever the seller has market power creates a substantial risk of false convictions because it outlaws tying for beneficial reasons. Even though classical theory justifies a per se legality rule for instances in which the seller does not have market power in the tying good, it does not justify a per se illegality rule for those instances in which the seller has market power. In order to use classical theory to justify the per se prohibition, one must assume that expected false conviction costs are essentially zero.

Now consider the Chicago School through the lens of decision theory. Recall that the Chicago School analysis suggested a radical departure from classical tying theory.

monopolization. Even in this case competitive pressures constrain the relative frequencies of harmful and beneficial tying. If the savings that result from bundling are sufficiently large, they may so far outweigh any losses due to competitive barriers that all consumers are better off under the tie-in. In the mixed case where some consumers gain and others lose, this may not be the case. Still, given the likelihood that entry will be encouraged where consumers are harmed, one should expect that most cases of bundling observed in the market will be those in which the typical consumer is better off on net.

¹²² The principle of allowing tying in cases when it would arise in a competitive market underlies the test proposed by Ordover and Willig. For a discussion of the general principle, see Janusz A. Ordover & Robert D. Willig, *An Economic Definition of Predation: Pricing and Product Innovation*, 91 YALE L.J. 8 (1981). For a discussion of how the principle relates to tying in technologically advanced markets such as computer software, see Janusz A. Ordover & Robert D. Willig, *Access and Bundling in High-Technology Markets*, in *COMPETITION, INNOVATION, AND THE MICROSOFT MONOPOLY: ANTITRUST IN THE DIGITAL MARKET PLACE* (Jeffrey A. Eisenach & Thomas M. Lenard eds., 1999).

The Chicago School critique suggested that because there was no logically sound explanation for why tying could be anticompetitive, the appropriate legal doctrine was per se legality. Such a rule would create no risk of false acquittals, and any stricter rule would run a risk of false convictions. False acquittals costs are assumed to be zero under the Chicago analysis because the Chicago School could find no plausible basis in microeconomic theory for the anticompetitive view of tying. False conviction costs, on the other hand, are assumed to be substantial under the Chicago analysis because the Chicago School found many ways in which tying could be efficient.

The Chicago School analysis was incomplete because it did not address the case in which tying is used to distort competition in a market that is already oligopolistic. The post-Chicago literature, particularly the Whinston model, has addressed this problem, and as a byproduct provided a more general framework for tying analysis. Whinston's key contribution was to show that one could construct a theoretically rigorous economic model in which a firm with market power could use tying in an anticompetitive manner. This implies that false acquittal costs may be positive. However, this is not enough to make a detailed judgment about the law (e.g., whether a per se prohibition is optimal) because we need to have some sense of the relative frequencies of false acquittal and false conviction costs.

C. A Decision-Theoretic Perspective on the Post-Chicago Literature

Having laid out the post-Chicago literature on tying and described the fundamentals of the decision-theoretic approach, we now use that approach to assess the literature. We first examine the post-Chicago literature's implications for the

continuation of the existing *per se* rule, and then its implications for a rule of reason or modified *per se* analysis.

1. Implications for continuation of *per se* rule

Recall that the post-Chicago literature arose in reaction to the Chicago School's prescriptions that tying should be *per se legal*, not to the state of the law. As we have suggested, nothing in this literature justifies continuation of the *per se illegal* rule, even given its qualifications. The D.C. Circuit explained in *Microsoft III*¹²³ that the existing *per se* rule incorporates empirical proxies for a rule of reason analysis. However, the test still works to exclude efficiency justifications in substantial areas of application, notably the first-mover and product-differentiation cases.¹²⁴ In view of the importance of these settings, in terms of their prevalence and in terms of their likelihood of generating litigation, we think it is appropriate to treat the rule as including significant *per se* prohibitions.

Within our decision-theoretic framework, there are two conceivable foundations for a *per se* illegal rule. One possibility would be that the courts could identify a checklist of conditions under which tying was sufficiently likely to be anticompetitive that no further inquiry was merited. Under this “checklist” theory, courts could use the post-Chicago literature to develop a stable list of features that justify application of the *per se* prohibition. The other foundation for the *per se* prohibition would be that the harmful effects of tying are so great relative to the potential benefits that the courts would be willing to risk a high rate of false convictions.

¹²³ *Microsoft III*, 253 F.3d at 87-88.

¹²⁴ *See supra* part II.A.2 (discussing *Jefferson Parish*).

All of the post-Chicago models of anticompetitive harm from tying rest on very specific assumptions about such issues as demand, costs, timing of when firms enter or can enter the market, and the ways that firms within the market compete. Within each model, it would be a trivial exercise to modify the assumptions so that tying would not be a profitable strategy. Of course, the tying that occurs in those models is anticompetitive, so a per se law against tying would benefit consumers within the hypothetical world of the model. In reality, though, there are potentially beneficial effects of tying that the models exclude by assumption. It is hard to see why one would ever choose not to consider the possibility of these alternative explanations. Given the post-Chicago models' reliance on assumptions that may not hold, and their exclusion of obvious efficiency motivations, the post-Chicago models cannot provide a defensible checklist that courts could use in implementing a modified per se prohibition.

As for quantification of costs and benefits, the post-Chicago models give us little if any guidance. While the models lay out a set of assumptions under which tying is anticompetitive, none of the models lays a serious framework for quantifying the costs of such behavior. To the extent that tying lowers costs or provides convenience, there is no reason to suppose that its benefits are insubstantial. Thus, the models provide no justification for being willing to tolerate large rates of false convictions.

In short, post-Chicago models do not provide a justification for the existing per se rule. The models rely on assumptions that are by no means generally valid, and exclude potential efficiency justifications that are commonly asserted by firms. In addition, the models fail to quantify the relative costs and benefits of tying.

Somewhat ironically, perhaps the clearest implication of the post-Chicago

literature is that per se analysis is inappropriate. The post-Chicago literature implies that in addition to market power and substantial foreclosure, one must have evidence of the presence of entry barriers in the tied good market, and that these conditions are *necessary* rather than sufficient for tying to be harmful. It follows that instead of a per se prohibition triggered by a finding that the tie-in involves separate products, market power in the tying good, and substantial foreclosure in the tied good, a superior rule would be one of per se legality unless these three elements are satisfied *and* scale economies are large relative to the market in the tied good. An economically defensible, “neoclassical” tying doctrine would require, at a minimum, evidence favorable to the plaintiff on these four conditions in order to survive a motion for summary judgment.

The post-Chicago models could be used to formulate a rule of reason approach or perhaps a doctrine that retains some elements of per se analysis – provided evidence exists of market power in the tying good and barriers to entry in the tied good. Under such a doctrine, a court would have to weigh the likelihood that an example of tying or product integration would be anticompetitive against the benefits from tying or integration that defendants would inevitably present. In assessing the implications of the post-Chicago literature, it is natural to examine what insights it yields into what conditions in the tied market the court should look to in assessing the likelihood that an example of tying could be anticompetitive. We consider four conditions below: entry barriers, complementary goods, network effects, and technologically advancing markets.

2. Basic Conditions in the Market for the Tied Good

a) Entry barriers

One common link among all of the theories of anticompetitive tying is that the

market for the tied good has basic conditions that are conducive to market power. More precisely, the existing models are based on the assumption of scale economies in the production of the tied good.¹²⁵ Tying is anticompetitive because it denies an entrant the scale needed to survive.¹²⁶

In particular, tying works in the Whinston model as an exclusionary device only when scale economies in the tied good are large enough relative to the market that the practice of tying makes the difference between achieving or not achieving adequate scale. This implies that finding large scale economies (relative to the market) should be a necessary condition for triggering a finding of an illegal tie. However, there are two reasons that this additional prerequisite, when added to the other prerequisites, would still fail to justify a per se prohibition of tying.

First, as the discussion of the Whinston model makes clear, anticompetitive tying occurs only for certain levels of fixed cost or market demand. Thus, the Whinston analysis and its various extensions imply that courts should examine the effects of scale economies on a case-by-case basis. Second, the scale economies argument necessarily casts antitrust into treacherous territory. One of the fundamental issues in the enforcement of antitrust is the distinction between protecting competitors and protecting competition. When scale economies are present, this distinction gets blurry. Harm to a

¹²⁵ An area that arguably needs further exploration in the literature is whether tying can be a successful strategy in the presence of entry barriers other than scale economies. Because the direct mechanism through which tying is potentially anticompetitive is to foreclose sales to competitors, it was natural for economic theorists to base their models of anticompetitive tying on assumptions of scale economies. However, as was suggested by Bain in *Barriers to New Competition* and subsequently proved more formally by Schmalensee (see the discussion in part C.1 *supra*), there are limitations to the amount of market power that can be attributable to scale economies.

¹²⁶ In the presence of scale economies, tying is not the only strategy that might be used to deter entry. Analysis of this class of problem dates back at least to BAIN, *supra* note 94. For a more modern treatment, see Richard J. Gilbert, *supra* note 95.

competitor can prevent it from being able to achieve the necessary scale economies and thereby induce exit. While it is easy to construct models in which the distinction between competing vigorously and harming competitors is clear, in evaluating the facts associated with any real market the distinction is unlikely to be clear.

One way to minimize the risk of false convictions would be to place a high burden on the plaintiff to make the case in light of demand and cost conditions that, with a high degree of certainty, the competitor could survive without the tie but not with it. In addition, credence should be given to claims of efficiency, absent strong evidence to the contrary.

If courts were to adopt a rule of reason or modify the per se rule, they might rely on an analysis of whether the market for the tied good was susceptible to market power. Courts could, for example, apply a test similar to the “dangerous probability of success” standard in the attempts-to-monopolize doctrine.¹²⁷ Under such an analysis, the courts would reject tying claims in settings where market conditions, such as easy entry or competitive structural features, indicate that the prospects for successful monopolization of the tied good market are low. In implementing the test, courts could employ a variety of options that would have the effect of trading off the risks of false convictions and false acquittals. For example, in undergoing an analysis of the basic conditions of the tied market, the courts could inquire not only whether tying could be a successful monopolization strategy but also whether there are other strategies that would be equally

¹²⁷ The legal test governing attempts to monopolize was first articulated by Justice Holmes in *Swift & Co. v. United States*, 196 U.S. 375 (1905). The test requires the plaintiff to prove intent to monopolize plus a “dangerous probability of success.” See, e.g., HERBERT HOVENKAMP, *FEDERAL ANTITRUST POLICY: THE LAW OF COMPETITION AND ITS PRACTICE* §6.5 at 280 (2d ed. 1999). The “dangerous probability” part of the attempt test generally requires the plaintiff to show that the defendant has market power in the relevant market. *Spectrum Sports v. McQuillan*, 506 U.S. 447 (1993).

plausible. If there are, then the costs of a false acquittal would be relatively low because the seller could substitute some other monopolization strategy for the tie.¹²⁸

b) Systems goods

As we argued in part II.C, Whinston's model successfully demonstrates the fragility of the single-monopoly-profit theory. Since this theory had been used to dismiss concerns about the incentive to leverage market power in one good into complementary goods, then one might be tempted to conclude that courts should be particularly suspicious of tying close complements, or system goods, such as computers and peripherals, cameras and lenses, and the like. Such a conclusion would be a mistake, however. Under a decision-theoretic approach, the appropriate legal rules turn on the relative risks of false acquittals and false convictions. It may well be that the risk of false acquittals from either per se legality or a strong burden of proof on plaintiffs is higher with complementary goods than for independent goods. Before adopting a stricter standard in response, however, one must ask whether the risk of false convictions from a stricter standard for complementary goods would be correspondingly greater.

While it may well be true that anticompetitive tying is more plausible with system goods, the potential benefits from tying are also more plausible. First of all, the demands for components of systems goods are necessarily positively correlated. People who buy computers are more likely to demand computer monitors than people who do not. With

¹²⁸ For example, the firm could set prices for two products that it sells in a way that accomplishes the same effect as a tie-in. *See* Carlton & Waldman, *supra* note 102, at 17-18. If the resultant prices are not predatory, then the alternative pricing strategy is certainly legal. Moreover, the legal standard governing predatory pricing places a high burden of proof on the plaintiff. *See generally* Brodley, Bolton & Riordan, *supra* note 37 (criticizing existing standard for predation and proposing an alternative). Thus, while a per se prohibition applies to tying, the alternative pricing strategy would be treated under a test that clearly disadvantages plaintiffs.

positively correlated demands, it is much more plausible that direct cost savings and increased convenience are real benefits of tying. Legal hostility toward tying under such circumstances would pose a risk of preventing these benefits from occurring.

As was argued above, the theories of anticompetitive tying require the potential for market power in the markets for both goods. Legal hostility to tying of complementary goods would necessarily create a bias in the system toward having the components of systems goods provided by different firms. If one knew that market power would be present in the sale of each component of a systems good, then consumers would benefit if the same firm or firms were suppliers in both markets. Having separate firms with market power in the provision of complementary goods results in double marginalization. Also, the Farrell-Katz argument notwithstanding, it can result in inefficient incentives for research and development, as the reward for innovation to complementary monopolists is smaller than the reward to the integrated monopolist. Thus, a legal bias toward having separate providers of complementary goods would result in economic inefficiency.

In response, one might argue that hostility toward tying would not eliminate the natural advantage that the seller of one systems component would have in the market for the complementary good. Even without tying, a firm with market power in the sale of computers would have an incentive to compete more aggressively in the sale of monitors. However, it is possible to use pricing to create a “virtual tie” even when a literal tie is not in place – by setting the price for the complementary good at a level that makes entry unprofitable.¹²⁹ Thus, to be effective, a ban on tying must also limit the seller’s freedom

¹²⁹ Carlton & Waldman, *supra* note 102, at 17-18 (introducing and analyzing effects of “virtual tying” through pricing).

to offer discounts for buying both components of the system. There may, however, be real cost savings from selling a system instead of individual components, and it would be desirable for firms to pass some of these cost savings on to consumers. Legal hostility toward tying which in turn treats discounts as virtual ties would limit such desirable behavior. One might argue that a seller would be allowed to rebut allegations that its pricing constituted an illegal tie by demonstrating that its package discounts merely reflected cost savings. Such a doctrine would place the burden of proof on defendants. Given the risk of error and the cost of litigation, some sellers would simply forgo the practice rather than put themselves in the position of having to defend it in court. That is, such a legal doctrine would entail a higher risk of false convictions, with additional false conviction costs.

Because both the benefits from tying and the risk of anticompetitive harm are higher for system goods than for others, the stakes in tying doctrine are higher. Thus, the courts should arguably be more willing to devote their efforts to such cases. The point that the stakes are higher for complementary goods does not, however, imply that the courts should be more hostile to tying in these cases.

c) Network externalities

As described in part C.2 above, Carlton and Waldman lay out the economic logic under which bundling can be used to gain an advantage in a market with network externalities. Recall the basic set up of the model. Widgets and gadgets are complements. One firm initially has a monopoly over widgets, although subsequent entry into widgets is possible. Gadgets are subject to network externalities.

In assessing that model's potential contribution to the law, the key issue is

whether it justifies making the presence of network externalities in the tied good a factor in judging that a tie is illegal. Within the decision-theoretic framework, such a conclusion could be valid for one of two reasons. The first would be if the model demonstrated that the difference between the probability of anticompetitive tying and procompetitive tying was greater when the tied good is subject to network externalities. The second would be if there was reason to believe (either because of the model or for some other reason) that the network externalities in the tied good makes the cost of a false acquittal greater relative to the cost of a false conviction.

A topic of particular interest in the analysis of network industries is whether the better standard necessarily comes to dominate. It is theoretically possible that if an inferior standard gets a head start or has any other sort of artificial advantage, then it could prevail over a superior standard because of the network externality effect.¹³⁰ On the surface, this possibility might seem to suggest that with network externalities in the tied good, anticompetitive tying is both more likely and more costly when it occurs. The argument that it is more likely would be that the potential pay-off is greater. The argument that it is more costly is that it results in everyone adopting the wrong standard.

Neither of these arguments is completely compelling as positive predictions, and they are even less compelling as justifications for making network externalities in the tied good as a "plus factor" in determining that a tie is illegal. First, as a matter of pure logic, laying out a set of stylized assumptions under which tying is anticompetitive cannot possibly justify conclusions about the probability of observing such occurrences. Judging by academic interest in the topic, it appears that many economists find compelling the

¹³⁰ Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424 (1985).

hypothesis that markets can gravitate to the wrong standard. One must consider, however, that the most commonly cited example of the wrong standard prevailing is the QWERTY standard for typewriter keyboards.¹³¹ The example continues to be cited even though (1) it makes no logical sense,¹³² and (2) there was never any evidence that QWERTY was worse than a competing standard.¹³³ Even if the QWERTY example were a case of the choice of an inefficient standard, the lack of a more recent example casts considerable doubt on the empirical importance of the theoretical possibility that markets adopt the wrong standard. Moreover, several examples in which new standards supplanted old ones¹³⁴ suggest that such mistakes, if they indeed occur, are not necessarily permanent.

Moreover, even if one could establish a significant probability of anticompetitive tying in the presence of network externalities, one would need to consider the probability of error due to legal hostility toward tying under such circumstances. The probability of error would be amplified by the incentives competitors would have to bring a legal challenge. Would such hostility increase the risk of incorrectly rejecting the offering of

¹³¹ See Paul A. David, *Clio and the Economics of QWERTY*, 75 AM. ECON. REV. 332 (1985).

¹³² The explanation typically given is that once typewriters with the QWERTY standard came into existence, all typists learned the QWERTY system. With all typists trained on QWERTY, typewriter manufacturers only produced QWERTY typewriters. The training of typists and the production of machines were mutually reinforcing, and no individual could break the standard. That is, of course, until people started typing almost exclusively on computers where a keyboard could easily be programmed to any more efficient standard. Arguably, the evidence against the QWERTY myth began to mount with the introduction of the IBM Selectric, which had detachable, relatively inexpensive "track balls" that could be made to different standards. Once that technology became common, the switch to a new supposedly improved standard would not require all or a substantial fraction of typists to switch altogether. If the Dvorak standard were truly superior, an individual typist could increase his typing speed (and thereby presumably command higher pay) by investing in a set of Dvorak track balls and learning the new standard. No coordination with his employer or with other typists would be necessary.

¹³³ See S.J. Liebowitz & Stephen E. Margolis, *The Fable of the Keys*, 33 J.L. & ECON. 1 (1990); S.J. Liebowitz & Stephen E. Margolis, *Network Externality: An Uncommon Tragedy*, 8 J. ECON. PERSP. 133 (1994).

¹³⁴ For example, compact disks completely replaced records, and 3.5" diskettes completely replaced 5 1/4"

the firm that produces the complementary product?

In the Carlton-Waldman model of complementary products, a "virtual tie" through pricing is as effective as an actual tie.¹³⁵ That is, the widget producer can sell widgets and gadgets separately but charge a high price for the former but not the latter. Since every consumer needs the primary good (widget), the widget producer creates a virtual tie by raising the price of the widget and reducing the price of the gadget to a level that makes it impossible for a competing gadget producer to enter and make a profit. However, a legal doctrine that attempts to prohibit virtual ties necessarily would entail restrictions on the pricing of one firm in the market but not the other. The possibility of sanctioning virtual ties as well as actual ties necessarily increases the risk of false convictions, since it would be difficult as a general matter to determine whether a seller set his prices in order to compete effectively or to harm competition.¹³⁶

The fundamental dilemma of all leveraging policy relating to complementary goods is that it applies asymmetrically to one firm. Moreover, there are compelling arguments why it is in society's interest to have that particular firm prevail. If widgets and gadgets are complementary and both are going to be monopolized, then consumers are generally better off if a single firm has the monopoly over both.

To be sure, there is a counterargument, which is that complementary monopolists are the most likely entrants into each other's markets and therefore act as competitive

diskettes.

¹³⁵ Carlton & Waldman, *supra* note 102, at 17-18.

¹³⁶ Admittedly, the choice here is between false acquittals and false convictions. A policy that exempts virtual ties while restricting actual ties encourages firms to substitute the former for the latter and generates false acquittals. However, a policy that restricts virtual ties necessarily generates false convictions, for reasons given in the text. Moreover, legal rules that restrict price-cutting must be considered especially costly, since they work against the fundamental policy of the antitrust laws. Any legal rule governing tying should be capable of handling instances of actual and virtual tying with low error costs.

constraints. The basis for the claim is sometimes based on capability. That is, by virtue of operating in the related gadget market, a firm will have knowledge and other assets that make entry into widgets easier. Because the same logic would seem to justify protecting an inefficient widget producer, this rationale gets perilously close to being a justification of protecting competitors for the sake of protecting competition. A widget producer that is currently inefficient often has a better chance of overtaking the leader than a new entrant. At other times, the argument is based on incentives. A gadget monopolist's margin in the gadget market gives it an extra incentive to enter the widget market in order to bring widget prices down and stimulate demand for the gadget. This argument turns a problem, excessive prices in each market, into a virtue, an incentive to bring them down.

d) Technologically advancing versus stable markets

There is a longstanding issue about the relative role of antitrust in stable as opposed to technologically advancing markets.¹³⁷ The view that has probably predominated historically is that antitrust is better suited to deal with stable markets than technologically advancing markets. Within the context of decision theory, there are three parts to the argument. The first is that the maintenance of market power is harder in the presence of opportunities for technological advance. Thus, the cost of false acquittals is less. The second is that short-run market power is a necessary cost of generating technical change, and there is a concern that antitrust enforcement focuses too narrowly at eliminating short-run market power. Third, technologically advancing markets may be

¹³⁷ For one economic perspective on this view, see Richard A. Posner, *Antitrust in the New Economy* (University of Chicago Working Paper) available in the SSRN Electronic Paper Collection: http://papers.ssrn.com/paper.taf?abstract_id=249316.

harder for courts to understand so that the risk of incorrect decisions is greater.

Again, there is a dissenting view. One might argue that it is precisely when a firm with market power faces the threat of being replaced by a superior competitor that it has an incentive to use anticompetitive means to thwart its rivals. Even if the positive part of the argument is true, however, the policy implications are not clear. A firm with market power that faces threats to its market has a strong incentive to use all means, competitive and anticompetitive, that it has available. Thus, the fundamental policy dilemma of distinguishing competitive from anticompetitive actions applies in technologically advancing markets. Appropriate policies turn on the relative probabilities and costs of false convictions and false acquittals. Many of the arguments about the role of technological advance imply that the stakes are higher, but doubling the cost of both types of possible mistakes does not justify a tilt toward stricter (or less strict) enforcement policies.

e) Assessment

We conclude that each of the four tied-market conditions considered in this section and emphasized by the post-Chicago literature – entry barriers, complementary goods, network effects, and technologically advancing markets – would be insufficient to justify a per se prohibition even if coupled with the existing requirements for the per se rule. Given the potential benefits of tying, none of these conditions raises the threat of anticompetitive harm to a level that would justify the adoption of a per se prohibition under any general set of conditions. It follows that the post-Chicago literature should be interpreted as an argument for applying a rule of reason analysis, rather than per se analysis, provided that the plaintiff can pass the threshold requirements of proving that

the tie-in involves separate products, market power in the tying good, substantial foreclosure in the tied good, and entry barriers in the tied good market.

Further, in view of the frequency with which beneficial tying occurs, a rule of reason analysis should be conducted in a manner that puts a high burden of proof on the plaintiff. The reason for this is that false conviction costs are likely to be high relative to false acquittal costs in a setting in which the challenged conduct has many procompetitive uses. In order to minimize error costs, the proof standard should require the plaintiff, in addition to meeting the four threshold requirements, to exclude the possibility that the tie-in could serve beneficial purposes.¹³⁸

IV. Some Implications for Law: Tying Standards and Technological Integration

The post-Chicago literature has not had a big impact on tying law. Except for *Eastman Kodak*, the important Supreme Court tying decisions – *IBM*, *International Salt*, *Northern Pacific*, *Fortner II*, *Jefferson Parish* – are consistent with and reasoned within the classical framework. Even *Eastman Kodak* serves to some extent as an illustration of the post-Chicago School’s tenuous influence, since its reach has been severely limited by lower courts.¹³⁹

¹³⁸ In particular, the plaintiff should be required to show (subject to a high standard of proof) that tying is profitable to the defendant only if it has an exclusionary effect, and that the cost of tying to the defendant is likely to be recouped through its exclusionary impact. This approach is consistent with the vertical restraints test proposed by Janusz Ordover and Robert Willig. See Janusz A. Ordover & Robert D. Willig, *Access and Bundling in High-Technology Markets*, in *COMPETITION, INNOVATION, AND THE MICROSOFT MONOPOLY: ANTITRUST IN THE DIGITAL MARKET PLACE* (Jeffrey A. Eisenach & Thomas M. Lenard eds., 1999). We should note that this standard also has the substantial virtue of being equally applicable to cases of “virtual tying” through pricing (see *supra* part IV.B.2), since it is a generalization of the *Brooke Group* predatory pricing standard.

¹³⁹ See *Metzler*, 19 F. Supp.2d. (tie between original equipment and derivative after-markets can be deemed unlawful, when the original equipment market is competitive, only if the tie-in is the result of a change in

In this part we consider whether the decision-theoretic approach provides a justification for the lax, or non-interventionist, “sole purpose” standard governing technological integration (*Leasco*) in almost every circuit. There are two sub-issues connected to this. Is the sole-purpose standard optimal, or should we prefer instead a per se test or a rule of reason test? Does the risk that sellers will substitute technological integration for contractual tying militate in favor of applying a more stringent test (e.g., rule of reason or per se analysis) to technological tying?

A. The optimal legal standard for integration

To simplify the comparison of legal standards, suppose we are comparing two, a strict one and a lax one. For example, the strict standard could be the combination of the *Caldera* proof standard (“significant technological benefit”) and the *Microsoft III* substantive standard (rule of reason), while the lax standard could be the combination of the *Microsoft II* proof standard (“plausible claim”) and the *Leasco* substantive test (sole purpose). The existence of separate substantive and procedural tests suggests four potential combinations of substantive and procedural standards that courts could apply. However, for our purposes now, it is enough to consider only two extremes. We know that the relevant choice is between subjecting product integration and contractual tying to the same doctrines, or remaining with the current regime, *Leasco*, that creates a much more lenient or deferential review standard for product integration decisions. This difference in standards would remain, though clearly to a lesser degree, even if courts adopted the rule of reason approach to contractual tying. Is this difference in standards

the seller’s marketing policy).

defensible?

Under the decision-theoretic approach, the choice between strict and lax standards is determined by three factors. The first is the base-rate probability that product integration is benign, or not anticompetitive. As this probability increases, the lax standard becomes more desirable as a means of minimizing error costs. The second factor is the ratio of the cost of a false conviction to the cost of a false acquittal, which also enhances the desirability of the lax standard. An assumption that this ratio is higher in the case of technological tying would be justified if the benefits of technological tying were typically greater than the benefits due to contractual tying. In this case, false conviction costs would be relatively high in the case of technological integration, other things being equal. Alternatively, the ratio of false conviction to false acquittal costs may be relatively high because the costs of false acquittals are relatively low in the case of technological integration. This assumption would be justifiable if in markets where integration is common, such as software, the market positions of dominant firms were especially vulnerable to the innovative efforts of rivals.¹⁴⁰ The third factor determining the choice between strict and lax standards is relative probabilities of false convictions and false acquittals. We do not mean to suggest that this information is objectively observable. Rather, a choice of one legal standard over another rests on implicit assumptions about these values.

Consider the first factor: the base-rate probability of harm. Is there a good reason to believe that the base-rate probability of anticompetitive harm is larger in the case of

¹⁴⁰ Although these examples are obviously one-sided, one need only reverse them to see the case for the opposite argument. For example, if, in software markets, the positions of dominant firms are especially resistant to the efforts of rivals to displace them, then the cost of a false conviction relative to a false acquittal is somewhat lower, other things being equal, than the ordinary case.

technological integration than in the case of contractual tying? We do not believe so. Whether the seller ties two goods contractually or technologically, the foreclosure effect on rival sellers should be the same.¹⁴¹

Indeed, there are good reasons to believe that the base-rate probability of anticompetitive harm is lower for technological integration than for contractual tying. The technological integrator incurs a substantial sunk cost in setting up a specialized production process for the integrated product. The integrator incurs a relatively large opportunity cost as well. Technological integration is difficult to reverse, relative to contractual tying. In addition, the seller's decision to integrate two products, A and B, makes it more difficult, in most cases, for the consumer to reverse the decision by combining A with another good C.¹⁴² In other words, technological integration entails sunk costs that are generally larger than those associated with contractual tying. The risks are larger for the technological integrator, and the market is likely to impose relatively severe penalties for mistakes – in comparison to contractual tying.¹⁴³

Now consider the second factor: the relative ratios of false conviction and false acquittal costs. We noted that it would be justifiable to assume that this ratio is larger for technological tying if the benefits from technological integration were typically greater

¹⁴¹ Technological integration may have weaker foreclosure effects, given that some of these instances involve integration that does not foreclose rival sellers. For example, in *Microsoft III* rivals arguably were not foreclosed by the integration of Microsoft's browser and operating system, since a consumer who wanted to use the biggest rival, Netscape, could use Microsoft's browser to download Netscape's from the web.

¹⁴² Of course, this is not true in every case. Recall that a seller's decision to integrate a browser with an operating system may facilitate the consumer's decision to use another firm's browser – by making it easy for the consumer to use the web to download an alternative browser.

¹⁴³ One might argue that there is another side of the coin: technological integration increases the base-rate probability of harm when it enhances the credibility of an incumbent firm's exclusionary threat. While this is a theoretical possibility, we believe that firms that want to tie goods contractually would generally find less risky forms of commitment than to integrate them physically.

than the benefits from contractual tying. Since technological integration will typically involve goods that are functional complements, in the sense that they are often used together, this seems plausible. Consider pencils and erasers, cameras and lenses, cars and engines, or computers and monitors. Although this is a biased sample because these are technological bundles that have survived in the market, there is a plausible argument in each case that the benefits of integration exceed the benefits of a contractual tie.

At the risk of belaboring the point, take the case of pencils and erasers, probably the simplest integrated product commonly used at work. The integrated product obviously offers benefits that are not provided by the contractual tie of a pencil and an eraser. The connected eraser does not reduce the utility of the pencil, and it provides certainty that the most important functional complement to the pencil will always be there. This example suggests that even the most trivial cases of integration, bordering on a mere “bolting together,” can provide substantial benefits beyond the contractual tie.¹⁴⁴

Lastly, consider the probabilities of false convictions and false acquittals. If false conviction costs, relative to false acquittal costs, are higher under technological integration than under contractual tying, as we have suggested, then we should avoid the legal standard that has the higher ratio of false conviction to false acquittal probability. Given this, we should prefer the lax to the strict legal standard in the area of technological integration.

Recall that we are considering the choice between two extremes: a strict legal

¹⁴⁴ The integrated pencil-eraser example also carries an important lesson for the legal standard governing technological integration. Any test that removes immunity for instances of mere “bolting together” should do so only when the bolting provides no significant benefits beyond what a consumer could gain on his own by purchasing the two goods on the market and pasting them together. In other words, the *Leasco* standard (*see supra* part II.A.3) should be applied not with a view to the ease with which the goods can be integrated, but with a view toward the benefits consumers derive.

standard involving a combination of the balancing test of *Microsoft III* and the proof standard of *Caldera*, and a lax legal standard involving a combination of the sole-purpose test of *Leasco* with the proof standard of *Microsoft II*. The *Leasco* test declares the defendant the winner if there is a substantial technological benefit, while the *Microsoft III* test requires the court to go further and balance the benefits of technological integration against its competitive harms. The strict legal standard, as defined, clearly has a higher ratio of false conviction to false acquittal probability.

The upshot of this argument is that the relatively lax sole-purpose standard applied to technological tying in most circuits seems to be justifiable on error cost grounds. Of course, we do not have enough information to be certain of this, because we cannot observe the relevant error costs and probabilities. However, the decision of courts to settle on the least interventionist of the three substantive legal standards available (per se, rule of reason, sole purpose) appears consistent with plausible a priori judgments regarding base-rate probabilities, error rates, and error costs.

One might argue that a different standard for technological integration is justifiable but that courts have gone too far by giving the technological integrator more freedom than the law should allow. However, there is no reason to believe that any of the stricter standards available (rule of reason, per se illegality) could be applied without generating significant false conviction costs. Consider the rule of reason test of *Microsoft III*. The seller's ex ante judgment regarding prospective consumer benefits may turn out to be incorrect ex post. In many of these cases, the product will not survive in the market. However, in the cases where it does survive, the seller faces the risk under *Microsoft III* that a court will later determine that the consumer benefits were insufficient

to outweigh competitive harms to rivals.¹⁴⁵ Facing this risk, many firms contemplating the integration of two products will do so only when they can be relatively sure that a court would not later find that the additional utility was insufficient. This is bound to deter product innovation efforts.¹⁴⁶

It does not advance the case for a strict standard to say that courts already examine product design decisions under product liability law. First, there may be too many false convictions in the product liability context,¹⁴⁷ and, if this is the case, there is no reason to transfer the same process to the antitrust arena. Second, there are substantial differences between the product liability and antitrust contexts that make it inappropriate to think that whatever courts do in one setting they can do in the other. In the product liability setting, courts typically refuse to engage in risk-utility analysis when the risk characteristics are so obvious that the product meets “consumer expectations.”¹⁴⁸ There is no analogous safe harbor in the antitrust setting.¹⁴⁹ In addition, excluding latent-risk cases like asbestos or silicone implants, the risks considered in the product liability context are often fairly obvious, as in the case of lawnmower with an exposed blade. The

¹⁴⁵ As a concrete example of this danger, return to the *Caldera* case (*see supra* part II.A.4.b). The *Caldera* court applied the substantive standard of *Leasco* with a more stringent proof standard (significant technological improvement). In refusing to grant summary judgment, the court relied heavily on claims that the integration was technologically easy, *Caldera*, 72 F. Supp.2d at 1324, rather than focusing on the benefits the integration provided to consumers.

¹⁴⁶ Put another way, there is no reason to believe that an unambiguous improvement (or “free lunch”) can be had by moving to a stricter standard. Another alternative to consider is the combination of the sole-purpose test with the more demanding proof standard of *Caldera*. To the extent that this proof standard raises the ratio of the false conviction to the false acquittal probability, it is probably undesirable and certainly not an unambiguous improvement over the lax standard.

¹⁴⁷ PAUL RUBIN, TORT REFORM BY CONTRACT 62- 63 (1993).

¹⁴⁸ *See, e.g.*, PROSSER & KEETON ON THE LAW OF TORTS §99 at 698-99 (W. Page Keeton, Dan B. Dobbs, Robert E. Keeton & David G. Owen eds., 5th ed. 1984).

¹⁴⁹ This is not to deny the existence of “screens” of any sort in the antitrust context. Firms that have little or no market power are effectively exempt from tying and Section 2 claims. However, the key difference is the predictability of the legal test. For the firms that are subject to the test (i.e., that may be sued), the “competitive balancing test” seems to be more uncertain than the risk-utility test in products liability law.

potential competitive risks (e.g., entry deterrence) in antitrust, however, are relatively uncertain and highly contingent on the way rivals and consumers react. In light of the thicker blanket of uncertainty in the antitrust context, a competitive risk-utility test could easily create significantly larger innovation disincentives than we observe in the product liability setting.

To this point we have considered whether the sole-purpose test is preferable to a more stringent standard, such as the rule of reason, for the general category of technological integration. Is the case of software bundling different? The D.C. Circuit in *Microsoft III* refused to follow the result of the *IBM cases*, which generally follow the *Leasco* standard, on the ground that those cases involved the bundling of software and hardware.¹⁵⁰ The implication of *Microsoft III* is that the bundling of software to software, or more specifically a software application to a software platform, should be treated under a different test than that applied to other cases of product integration (*Leasco*). We can see no reason for creating such a distinction. As the D.C. Circuit implicitly acknowledged, the process of “creative destruction” observed in many innovative industries is no less intense in software.¹⁵¹ To the extent a non-interventionist legal standard protects the innovative process from being burdened by litigation, the case for adopting the *Leasco* standard would seem to be even stronger for software bundling.

In terms of our framework – which examines the base-rate probability of harm, relative error probabilities, and relative error costs – we see no reason to treat software bundling as less deserving of the non-interventionist standard than other types of product integration. Software applications have become part of the operating system over time

¹⁵⁰ *Microsoft III*, 253 F.3d at 91-92.

for pretty much the same reason as the eraser-pencil integration: to provide certainty and coordination in operations among complementary tools.¹⁵² As long as this benefit cannot be achieved through contractual bundling, we should expect the ratio of false conviction to false acquittal costs to be larger for software integration than for software contractual bundling. In short, the error cost rationale for the *Leasco* standard appears to be no weaker in the area of software integration.

B. The Substitution Critique

Lessig has argued that particularly in the case of computer software, different standards for contractual and technological tying will distort product design decisions.¹⁵³ If the standards are different, a company that would prefer to do contractual tying to exclude competitors might choose product integration instead in order to be on more solid legal ground. Under such circumstances, not only does an objectionable form of tying escape legal sanction, but there is an additional cost to society. The seller's preference for contractual tying likely reflects the judgment that putting the tied products in the same box is cheaper than integrating them technologically. If so, then even though the best outcome is not to have tying at all (again, on the assumption that the seller's use tying to harm competition), contractual tying is a better outcome than technological tying.

To evaluate Lessig's "substitution critique," we first lay out the decision-theoretic assumptions under which product integration and contractual tying should be treated

¹⁵¹ *Id.* at 93-95 (referring in various passages to dynamic innovation in the software market).

¹⁵² See Steven J. Davis, Jack MacCrisken, & Kevin M. Murphy, *Economic Perspectives on Software Design: PC Operating Systems and Platforms*, available at <http://gsbwww.uchicago.edu/fac/steven.davis/research>.

¹⁵³ See *Microsoft III*, 97 F. Supp. 2d, Brief of Professor Lawrence Lessig as *Amicus Curiae* (filed Feb. 1, 2000).

differently. We initially assume that a firm has only one natural tying strategy (i.e., contractual or technological) so that choosing one based on the difference in legal standards is not an issue.

The decision-theoretic approach entails evaluating each rule based on a weighted error rate, with weights reflecting the relative costs of different classes of error. To implement this analysis, one selects a benchmark type of error. In what follows, we let a false conviction be the benchmark.

As described in Part III.A, one of the key insights of decision theory is that the fraction of cases that are harmful is a relevant consideration in formulating the legal rule. Table 1 summarizes the notation and provides an assumed value for each variable. In order to assess the Lessig critique, one must begin with values under which it would be optimal to have different standards for different classes of tying assuming that sellers could not substitute technological for contractual tying. These values have that feature.

Table 1

Nature of Information	Hypothesized Value
% of technological ties that are harmful	1%
% of contractual ties that are harmful	5%
Strict standard probability illegal given benign	1%
Strict standard probability legal given harmful	0%
Lax standard probability illegal given benign	0%
Lax standard probability legal given harmful	20%
Ratio of cost of false acquittal to false conviction	3

Given these values, we can compute the weighted error rates for each standard and rule. For the strict standard for contractual tying, the weighted error rate is:¹⁵⁴

¹⁵⁴ To be precise, let the notation $C()$ indicate the cost of other errors relative to a false conviction. Thus, if "A" stands for a false acquittal, then $C(A) = 3$ means a false acquittal is as costly as three false convictions. The choice of benchmark is simply a matter of labeling and does not have any substantive implications. The conclusions are the same when we view a false acquittal as being three times as costly as a false

$$95\% \times 1\% + 5\% \times 0\% \times 3 = 0.95\%$$

For the lax standard for contractual tying, the weighted error rate is:

$$95\% \times 0\% + 5\% \times 20\% \times 3 = 3.00\%$$

The strict standard is therefore better for contractual tying. For the strict standard for technological tying, the weighted error rate is:

$$99\% \times 1\% + 1\% \times 0\% \times 3 = 0.99\%$$

For the lax standard for technological tying, the weighted error rate is:

$$99\% \times 0\% + 1\% \times 20\% \times 3 = 0.60\%$$

The lax standard is therefore better for technological tying.

While there is no reason to believe that these particular assumptions are realistic, they do make clear the types of implicit assumptions that justify a different standard for technological and contractual tying. In this particular set of parameters, the difference entails the difference in the fraction of all cases that are benign. Although not embodied in this particular set of values, an alternative justification would be that the ratio of the cost of a false acquittal to the cost of a false conviction is lower for technological tying. Such an assumption would be justified if the benefits from technological integration were typically greater than the benefits (reduced transactions cost or greater convenience) from contractual tying. The third possible justification would be that the rates of false

conviction as when we view a false conviction as being one third as costly as a false acquittal. Each rule has a weighted error rate for each class of tying. Let $w(i,j)$ be the weighted error rate of applying rule i to class j , where $i = s$ indicates a strict legal standard, $i = \ell$ indicates a lax legal standard, $j = b$ indicates contractual tying, and $j = t$ indicates technological tying. For example, $w(\ell,t)$ indicates the weighted error rate from applying a lax standard to technological tying. Let $H(j)$ be the percentage of all cases of tying in class j that are harmful. In addition, we need to know the error rates associated with each type of rule. Let $FC(i)$ and $FA(i)$ be the rates of false convictions and false acquittals for rule i . As we define the terms here, the error rates are conditional probabilities. For example, $FC(s)$ is the percentage of benign cases for which the strict standard generates false convictions; and $FA(s)$ is the percentage of harmful cases for which the strict standard generates false acquittals. With these terms defined, the general formula for the weighted error rate is: $w(i,j) = [1-H(j)] FC(i) + H(j) FA(i) C(A)$.

convictions or false acquittals would be different for the two different types of tying.

With this example as a base case, we can now assess the implication of Lessig's argument that different standards for technological and contractual tying create a perverse incentive for firms that would normally use contractual tying to choose technological tying instead. Qualitatively, of course, the effect he focuses on is a real possibility. As with many of the other issues in this debate, however, the implications cannot be inferred from the qualitative point alone. The frequency of such switching and the costs of it when it occurs are essential inputs to the proper conclusions.

If all firms could substitute technological ties for illegal contractual ties, then it would be impossible to have a stricter standard for contractual ties than for technological ties. Of course, under such circumstances, a uniform lax standard for both might yield better results than a uniform strict standard. Suppose that 90% of all instances of bundling are technological. The weighted overall error rate for the strict standard would then be:¹⁵⁵

$$10\% \times [95\% \times 1\% + 5\% \times 0\% \times 3] \\ + 90\% \times [99\% \times 1\% + 1\% \times 0\% \times 3] = 0.986\%$$

The weighted overall error rate for the lax standard would be:

$$10\% \times [95\% \times 0\% + 5\% \times 20\% \times 3] \\ + 90\% \times [99\% \times 0\% + 1\% \times 20\% \times 3] = 0.840\%$$

It follows that the lax standard is preferable.

¹⁵⁵ Define $W(i_b, i_t)$ to be the weighted over-all error rates where i_b is an index for the legal standard used for contractual tying and i_t is an index for the legal standard for technological tying. In contrast to $w(i, j)$, which is an error rate for a single class of tying (i.e., contractual or technological), $W(i_b, i_t)$ is an error rate for both classes of tying pooled together into one group. Also, let T be the fraction of all instances of tying that are technological. The general formula (assuming a uniform standard for the two classes of tying) is: $W(i_b, i_t) = (1-T)\{[1-H(b)] FC(i_b) + H(b) FA(i_b) C(A)\} + T\{[1-H(t)] FC(i_t) + H(t) FA(i_t) C(A)\}$

In reality, of course, it is not always possible (or worthwhile) to substitute technological tying for contractual tying. If only a fraction of firms that would like to use contractual ties would switch to technological ties in response to a difference in the legal standard, then it is feasible to have different standards. To extend our analysis to consider these cases, three more pieces of information are necessary. Naturally, one is the fraction of illegal contractual cases that would switch to technological tying under a mixed standard. The other necessary pieces of information are the relative costs of the two additional classes of inefficient outcomes created by the possibility of switching. Both classes entail using technological rather than contractual tying simply to take advantage of the mixed legal standard.¹⁵⁶ The difference between them concerns whether the tie is inherently harmful.

Table 2 is an extension of Table 1 that adds the information needed to evaluate the Lessig argument, the notation, and a set of hypothesized values.

Table 2

Nature of Information	Hypothesized Value
% of technological ties that are harmful	1%
% of contractual ties that are harmful	5%
Strict standard probability illegal given benign	1%
Strict standard probability legal given harmful	0%
Lax standard probability illegal given benign	0%
Lax standard probability legal given harmful	20%
Ratio of cost of false acquittal to false conviction	3
% of ties that are inherently technological	90%
Cost of harmful switch under mixed standard	4
Cost of beneficial switch under mixed standard	0.5
% of illegal contractual ties that switch under mixed standard	7.5%

¹⁵⁶ That is, contractual tying would be used under a lax standard for contractual tying. Under a strict standard, however, the tie is illegal.

With these assumptions, the weighted over-all error rate with a strict standard for technological tying and a lax one for contractual tying is:¹⁵⁷

$$10\% \times [95\% \times 1\% \times (92.5\% + 0.5 \times 7.5\%) + 5\% \times (0\% \times 3 + 7.5\% \times 4)] \\ + 90\% \times [99\% \times 0\% + 1\% \times 20\% \times 3] = 0.781\%$$

This weighted over-all error rate for the mixed standard is lower than the 0.84% derived above for the universal lax standard, which is in turn less than the 0.986% for the universal strict standard. Given these assumed parameter values, therefore, a strict standard for contractual tying and a lax standard for technological tying is optimal even though: (1) the discrepancy in the standard induces some cases of product integration simply to avoid the standard; and (2) the relative costs of such cases are quite high.

The above example does not prove that the optimal legal standard is strict for contractual tying and lax for technological tying.¹⁵⁸ It is easy to assume other values for the parameters in which the opportunity to switch makes it optimal to have a uniform standard even though a mixed standard would be best if switching were impossible. Nevertheless, the Lessig critique cannot stand as an entirely theoretical point. It is only valid to the extent that the effect underlying it is sufficiently important empirically to

¹⁵⁷ Let M be the fraction of illegal contractual cases that would switch to technological tying under a mixed standard. Let $C(HS)$ be the cost (relative to a false conviction) of a harmful switch and $C(BS)$ be the cost (again, relative to a false conviction) of a benign switch. A harmful switch is similar to a false acquittal. Absent the legal asymmetry, however, the seller would have an incentive to make the efficient choice between a contractual and a technological tie. A harmful switch is therefore worse than a false acquittal and we should expect $C(HS) > C(A)$. A beneficial switch is better than a false conviction because the benign tie is allowed to exist. It is nonetheless worse than keeping the tie contractual and making it legal. Since all costs are measured relative to a false conviction, $1 > C(FS) > 0$. The general formula is:

$$W(s, \ell) = (1-T) \{ [1-H(b)] FC(s) [(1-M) + M C(BS)] + H(b) \{ FA(s) C(A) + [1-FA(s)] M C(HS) \} \} + T \{ [1-H(t)] \times FC(\ell) + H(t) \times C(A) \times FA(\ell) \}.$$

¹⁵⁸ Indeed, our arguments in the earlier parts of the text can be interpreted as favoring a uniform “lax” standard. The new approach to contractual tying suggested in part IV.B.4 would make the standards for contractual and technological tying roughly congruent. Both standards would effectively place a high burden of proof on plaintiffs.

outweigh other considerations. Moreover, to the extent that the opportunity to switch from contractual to technological tying makes a uniform standard necessary, the appropriate uniform standard is not necessarily a strict one.

V. Conclusion

In this article, we have reviewed both legal doctrine toward tying and the development of the academic literature on tying doctrine from the Chicago critique of classical doctrine to post-Chicago revisionism. As we have argued, the post-Chicago critiques are more compelling as attacks on the logic of the Chicago School than on the substance of tying doctrine as it exists.

Indeed, to the extent that the primary message of the Chicago critique is that existing doctrine is overly hostile to tying, the post-Chicago literature is arguably more in agreement with the Chicago School than seems to have been recognized. Even though we suspect that many post-Chicago School writers would not support per se legality of either technological or contractual tying, we reiterate that nothing in the literature justifies the current per se illegality of tying even under the sorts of tightly prescribed conditions that the courts have been seeking to articulate. All the post-Chicago literature has done is to establish that if one rules out any beneficial effects of tying, there are some conditions under which tying could theoretically be harmful to consumers. It has, in our view, justified focusing on complementary goods and restricting attention to those instances where market analysis suggests that the tied good is susceptible to market power. Within this broad class of cases, however, it has not identified a narrow set of assumptions in which tying is likely to be particularly harmful.

The broad class of cases identified by the post-Chicago literature –

complementary goods, market power in the tying good, and the potential for market power in the tied good – creates a fundamental dilemma for tying policy. Given this set of conditions, the plausible market outcomes are complementary (or successive) monopoly and integrated monopoly. Since tying doctrine necessarily places limits on one (or possibly a small number) of firms in a market but not others, it risks creating a bias for complementary monopoly. To be sure, more complicated economic analysis suggests that the case for integrated monopoly is not as airtight as the simple analysis makes it appear. Still, in deciding legal doctrine toward tying, courts must judge whether these qualifications in the literature overturn the main thrust of the basic economics of how complementarity affects incentives.

Indeed, more generally, the courts need to make a judgment about the relative frequencies of harmful tying under a lax legal standard on the one hand and the beneficial tying that will not occur under a stricter standard. In so doing, they should recognize that tying is so pervasive even in competitive markets that there is ample evidence that procompetitive tying is a common occurrence. This is particularly the case with technological tying, since technological tying often is synonymous with improving a product by adding features to it.