

January 2012

A Cost-Benefit Approach to Patent Obviousness

Tun-Jen Chiang

Follow this and additional works at: <https://scholarship.law.stjohns.edu/lawreview>

Recommended Citation

Chiang, Tun-Jen (2008) "A Cost-Benefit Approach to Patent Obviousness," *St. John's Law Review*: Vol. 82 : No. 1 , Article 2.

Available at: <https://scholarship.law.stjohns.edu/lawreview/vol82/iss1/2>

This Article is brought to you for free and open access by the Journals at St. John's Law Scholarship Repository. It has been accepted for inclusion in St. John's Law Review by an authorized editor of St. John's Law Scholarship Repository. For more information, please contact selbyc@stjohns.edu.

A COST-BENEFIT APPROACH TO PATENT OBVIOUSNESS

TUN-JEN CHIANG†

INTRODUCTION	40
I. DEVELOPMENT OF THE LAW OF OBVIOUSNESS	43
A. <i>From Hotchkiss to Cuno</i>	43
B. <i>Section 103 and Graham v. John Deere Co.</i>	46
C. <i>The Teaching-Suggestion-Motivation Test</i>	50
D. <i>KSR International Co. v. Teleflex, Inc.</i>	53
E. <i>A Summary of Obviousness Law</i>	54
II. THE ECONOMICS OF PATENTS	57
A. <i>The Benefits of Patents</i>	57
1. The Acceleration Benefit	57
2. The Problem of Dissipating Surplus	59
3. Calculating the Benefit	61
B. <i>The Costs of Patents</i>	62
III. A NEW TEST OF PATENTABILITY	64
A. <i>Balancing the Benefits and Costs</i>	64
B. <i>Defining Independent Invention</i>	67
1. Independence from the Patentee	68
2. Independence from the Patent System	68
3. Dedication of the Invention to the Public Domain	70
IV. OBJECTIONS AND COMPLICATIONS	72
A. <i>The Affect on Incentives</i>	72
B. <i>Difficulty of Determining Variables</i>	75
1. The Advantage of Ex Post Verification	75
2. Validity Determinations in Initial Examination	77

† Associate, Quinn Emanuel Urquhart Oliver & Hedges, LLP. I thank Judges Timothy Dyk and Richard Posner, and Professors John Duffy, Mark Lemley, and Douglas Lichtman, for their comments on prior drafts of this Article. The views expressed herein are my own.

3. Validity Determinations in Litigation and Reexamination	80
C. <i>The Confiscation Problem</i>	86
D. <i>Delay Between Conception and Disclosure</i>	88
V. SUGGESTIONS FOR REFORM	94
A. <i>Invalidating Patents Based on Subsequent Independent Invention</i>	94
1. Doctrinal Basis for Considering Independent Invention	94
2. Independent Invention as a Secondary Consideration	98
B. <i>Reconsidering the Definition of "Prior Art"</i>	100
CONCLUSION	104

INTRODUCTION

The standard for patentability, codified as the "obviousness" standard,¹ holds that an invention is not patentable if it "would have been obvious at the time the invention was made to a person having ordinary skill in the art . . ."² People, however, have different opinions on what is "obvious," on what is "innovative," and subjectivity has proven impossible to remove from the process. In the 150-year history of the standard, courts have articulated a variety of tests to determine obviousness, all to no avail.³ The Supreme Court's most recent effort, after deriding the prevailing test in the lower courts for the last

¹ Nonobviousness is not the only requirement for a valid patent. For example, a patent must be within the statutory class of patentable subject-matter. 35 U.S.C. § 101 (2000); see *Diamond v. Diehr*, 450 U.S. 175, 185 (1981) ("Excluded from such patent protection are laws of nature, natural phenomena, and abstract ideas."). A patent must also describe the invention in sufficient detail to enable others to practice it. 35 U.S.C. § 112 (2000). Nevertheless, nonobviousness has been frequently recognized as the "ultimate condition of patentability." See NONOBVIOUSNESS—THE ULTIMATE CONDITION OF PATENTABILITY (John F. Witherspoon ed., 1980); Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CAL. L. REV. 805, 812 (1988).

² 35 U.S.C. § 103(a) (Supp. IV 2004).

³ *Great Atl. & Pac. Tea Co. v. Supermarket Equip. Corp.*, 340 U.S. 147, 151 (1950) ("[T]he profession [has come] to employ the term 'combination' to imply [innovation's] presence and the term 'aggregation' to signify its absence . . . [T]heir employment as tests to determine invention results in nothing but confusion."); see, e.g., *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 282 (1976) ("new or different function" test); *Cuno Eng'g Corp. v. Automatic Devices Corp.*, 314 U.S. 84, 91 (1941) ("flash of creative genius" test).

twenty years as “gobbledygook,”⁴ managed to replace it only with the admonition that the test for obviousness is “flexible.”⁵

The confusion springs partly from the fact that the obviousness inquiry as framed misses the point. What matters to society is not whether an invention is obvious or innovative *per se*. Most people would agree that a Rube Goldberg machine is difficult to create, innovative, and not obvious—but it creates no benefit for society. What matters to society is whether allowing a patent for a particular invention brings more innovation benefits to society than the patent costs.⁶ And unlike debates about whether an invention is obvious or innovative to a hypothetical person, economic benefits and costs can be objectively measured. As such, patentability can and should be determined by balancing the costs and benefits of making a patent available for a particular invention. This Article outlines the assessment of these costs and benefits.

In assessing the benefits of a patent, courts and commentators often casually speak of patents as providing incentives to “create” inventions.⁷ It is important to emphasize that the social benefit of patents is not the creation of inventions as such. Virtually every invention will be created sooner or later. The true benefit of a patent system is that it speeds up the inventive process, that is, patent incentives *accelerate* inventions. If the cure for AIDS would have taken 100 years to develop without the prospect of a patent, we hope that by offering a

⁴ Transcript of Oral Argument at 41, *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007) (No. 04-1350).

⁵ *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1739 (2007).

⁶ See *Roberts v. Sears Roebuck & Co.*, 723 F.2d 1324, 1345–46 (7th Cir. 1983) (en banc) (Posner, J., dissenting) (“[T]he costs as well as benefits of patent protection are relevant to deciding which inventions should be patentable. The balance tips against protection when the invention is the sort that was likely to be made, and as soon, even if no one could have patented it.”); ROBERT P. MERGES & JOHN F. DUFFY, *PATENT LAW AND POLICY: CASES AND MATERIALS* 614 (4th ed.) (“if an idea is so obvious that people in the field would develop it without much effort . . . , granting the patent will have social costs . . . without necessarily having any social benefit . . .”); see also John H. Barton, *Non-Obviousness*, 43 *IDEA* 475, 491–94 (2003) (discussing some general cost-benefit principles regarding obviousness).

⁷ See, e.g., A. Samuel Oddi, *Beyond Obviousness: Invention Protection in the Twenty-First Century*, 38 *AM. U. L. REV.* 1097, 1101 (1989) (“[A] patent system produces a net benefit to society *provided* patents are granted only for those inventions induced by the patent system. These ‘patent-induced’ inventions are ones that would not have been made *but for* the availability of patents.”).

patent and the prospect of monopoly profits, the cure will be developed in, say, 10 years. More specifically still, the benefit is not only that we *receive* the invention earlier, it is also that we can *use* the invention during this entire period even though the invention is under monopoly.⁸ Paying monopoly prices for 100 years is better than having no cure for 100 years.

It follows that the widespread perception that patents are socially costly simply due to their conferring a monopoly is also misguided. Society benefits from inventions even under monopoly conditions—if society would not otherwise have had the invention at all. The cost of a patent accrues only when society could have otherwise had the same invention in perfect competition without a patent. Stated another way, the patent system incurs costs only if the invention would have been independently invented during the life of the patent. Only after independent invention occurs—or rather, would have occurred—does the monopoly cost of a patent accrue. This monopoly cost must then be balanced against the patent's benefits.

An invention should receive a patent if the accrued benefits before independent invention outweigh the costs after independent invention. The Supreme Court recently moved towards this concept, noting that awarding patents “to advances that *would occur* in the ordinary course without real innovation retards progress”⁹ As I shall demonstrate, the benefits of awarding patents correspond to the economic concept of consumer surplus, and the costs are the difference between the consumer surplus in monopoly (with the patent) and the

⁸ The value of use *during* the patent term is frequently overlooked by the courts, which often cite only the benefit of using the invention after patent expiration. *See, e.g., Universal Oil Prods. Co. v. Globe Oil & Refining Co.*, 322 U.S. 471, 484 (1944) (“[T]he quid pro quo is disclosure of a process or device in sufficient detail to enable one skilled in the art to practice the invention once the period of the monopoly has expired”). *But cf. Brenner v. Manson*, 383 U.S. 519, 534–35 (1966) (“Unless and until a process is refined and developed to this point—where *specific benefit exists in currently available form*—there is insufficient justification for permitting an applicant to engross what may prove to be a broad field.” (emphasis added)). This oversight is unfortunate. As this Article demonstrates, the primary determinant of whether benefits outweigh costs is use of the invention *during* the patent term.

⁹ *KSR*, 127 S. Ct. at 1732 (emphasis added). This “would occur” standard is important because it moves away from the approach of emphasizing only what is already known at the time of invention. *See, e.g., Cross Med. Prods., Inc. v. Medtronic Sofamor Danek, Inc.*, 424 F.3d 1293, 1324 (Fed. Cir. 2005).

consumer surplus under perfect competition (with independent invention). Because both are measurable in a given market for a patented invention, patentability reduces to an objective, empirical question.

This Article redefines the patentability standard using economic principles, offering determinable criteria for courts that have struggled to articulate them. Part I outlines the history of the struggle to define a standard for patentability, later codified as the obviousness requirement. Part II discusses the economic costs and benefits of a patent grant. Part III outlines the test, including the important criterion of independent invention. Part IV discusses some complications to the analysis that do not materially change the test. Finally, Part V suggests some modifications to current law in light of the considerations described.

I. DEVELOPMENT OF THE LAW OF OBVIOUSNESS

A. *From Hotchkiss to Cuno*

The early American patent statutes did not have an express obviousness requirement—all that was required was novelty and usefulness.¹⁰ Even relatively trivial changes satisfied a bare novelty standard, causing predictable problems:

The most frivolous and useless alterations in articles in common use are denominated improvements. . . . Implements and utensils, as old as the civilization of man, are daily, by means of some ingenious artifice, converted into subjects for patents. If they have usually been made straight, some man of genius will have them made crooked. . . . If, from time immemorial, their form has been circular, some distinguished [artisan] will make them triangular. . . .¹¹

The requirement of some *substantial* innovation was a judicial gloss on the bare novelty standard, developing over time. Although some early cases had hinted at a requirement stricter than bare novelty,¹² it was *Hotchkiss v. Greenwood* that finally

¹⁰ See Patent Act of 1836, ch. 357, 5 Stat. 117; Patent Act of 1793, ch. 11, 1 Stat. 318; Patent Act of 1790, ch. 7, 1 Stat. 109.

¹¹ *Thompson v. Haight*, 23 F. Cas. 1040, 1041 (C.C.S.D.N.Y. 1826) (No. 13, 957).

¹² See *Evans v. Eaton*, 20 U.S. 356, 431 (1822) (“If [two machines] were the same *in principle*, and merely differed in form and proportion,” it was not

articulated the requirement clearly.¹³ In *Hotchkiss*, the patentee was the inventor of a method of making doorknobs made of clay or porcelain. The problem was that this method had been used on metal knobs, and the patentee was left to argue that "the novelty consisted in the substitution of the clay knob in the place of one made of metal or wood."¹⁴ The Court was not impressed:

[U]nless more ingenuity and skill in applying the old method . . . to the clay or porcelain knob than were possessed by an ordinary mechanic acquainted with the business, there was an absence of that *degree of skill and ingenuity* which constitute essential elements of every invention. In other words, the improvement is the work of the skilful mechanic, not that of the inventor.¹⁵

By requiring a "degree of skill and ingenuity,"¹⁶ the Court established what would be known, for the next hundred years, as the "invention" requirement.

The revolutionary implications of *Hotchkiss* were not appreciated for some time.¹⁷ There were now three requirements for patentability: novelty, usefulness, and inventiveness.¹⁸ The inventiveness requirement, however, proved difficult to define in any positive sense. All the Court could issue was a series of pronouncements of what would *not* be inventive and thus was not patentable.

patentable. (emphasis added)); *Hovey v. Stevens*, 12 F. Cas. 609, 612 (C.C.D. Mass. 1846) (No. 6,745); *Davis v. Palmer*, 7 F. Cas. 154, 159 (C.C.D. Va. 1827) (No. 3,645) ("If, by changing the form and proportion, a new effect is produced, there is not simply a change of form and proportion, but a change of principle also."). These cases relied in part on a provision from the 1793 statute—something of a forerunner to the obviousness standard—stating that "simply changing the form or the proportions of any machine, or composition of matter, in any degree, shall not be deemed a discovery." Patent Act of 1793, ch. 11, 1 Stat. 318.

¹³ 52 U.S. 248, 261 (1850).

¹⁴ *Id.* at 265.

¹⁵ *Id.* at 267 (emphasis added).

¹⁶ *Id.*

¹⁷ See Edmund W. Kitch, *Graham v. John Deere Co.: New Standards for Patents*, 1966 SUP. CT. REV. 293, 303–327 (1966) (summarizing the history).

¹⁸ *Thompson v. Boisselier*, 114 U.S. 1, 11 (1885).

[I]t is not enough that a thing shall be new, in the sense that in the shape or form in which it is produced it shall not have been before known, and that it shall be useful, but it must, under the constitution and the statute, amount to an invention or discovery.

Id.

Following *Hotchkiss*, the Court had little difficulty in establishing the principle that “use of one material instead of another in constructing a known machine is, in most cases, so obviously a matter of mere mechanical judgment, and not of invention, that it cannot be called an invention.”¹⁹ Similarly, the Court held that “change[s] of form, proportions, or degree, or the substitution of equivalents, doing the same thing as the original invention by substantially the same means, is not such an invention as will sustain a patent, even though the changes of the kind may produce better results.”²⁰ The Court also declared that “application by the patentee of an old process to a new subject, without any exercise of the inventive faculty, and without the development of any idea which can be deemed new or original in the sense of the patent law” would not be patentable.²¹ Finally, the Court established the principle that the “mere aggregation of separate devices, each of which performs the function for which, when used separately, it was adapted” was not patentable,²² unless the combination produced “a new and beneficial result, never attained before.”²³ The “new result,” however, could not be the “[p]erfection of workmanship, however much it may increase the convenience, extend the use, or diminish expense.”²⁴

Explaining how an inventive “new result” could do more than increase convenience, extend useful life, and diminish expense proved difficult. Eventually, in the 1941 decision *Cuno Engineering Corp. v. Automatic Devices Corp.*,²⁵ the Court decided that the difference between workmanship and inventiveness was a “flash of creative genius.”²⁶ This unfortunate phrase caused endless confusion in the lower courts, and many suggested that corporate sponsored laboratory research was essentially unpatentable because such research necessarily involved multiple scientists and step-by-step

¹⁹ *Hicks v. Kelsey*, 85 U.S. 670, 673 (1873).

²⁰ *Dunbar v. Myers*, 94 U.S. 187, 199 (1876).

²¹ *Brown v. Piper*, 91 U.S. 37, 41 (1875).

²² *Stephenson v. Brooklyn Cross-Town R.R. Co.*, 114 U.S. 149, 157 (1885).

²³ *Loom Co. v. Higgins*, 105 U.S. 580, 591 (1881).

²⁴ *Reckendorfer v. Faber*, 92 U.S. 347, 356–57 (1875).

²⁵ 314 U.S. 84 (1941).

²⁶ *Id.* at 91.

experimentation with no single "flash" of genius.²⁷ Finally, in *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*,²⁸ the Supreme Court acknowledged that it had not, could not, and would not articulate a precise test for its inventiveness requirement:

While this Court has sustained combination patents, it never has ventured to give a precise and comprehensive definition of the test to be applied in such cases. The voluminous literature which the subject has excited discloses no such test. . . . In course of time the profession came to employ the term "combination" to imply its presence and the term "aggregation" to signify its absence, thus making antonyms in legal art of words which in ordinary speech are more nearly synonyms. However useful as words of art to denote in short form that an assembly of units has failed or has met the examination for invention, their employment as tests to determine invention results in nothing but confusion.²⁹

B. *Section 103 and Graham v. John Deere Co.*

At the same time that *Great Atlantic* was pending in the Supreme Court, efforts for a major reform of patent law were pending in Congress. This effort included a codification of the

²⁷ See *Potts v. Coe*, 140 F.2d 470, 472-74 (D.C. Cir. 1944); *Picard v. United Aircraft Corp.*, 128 F.2d 632, 636 (2d Cir. 1942) ("Unless we are to mistake for invention the slow but inevitable progress of an industry through trial and error . . . there was no invention in this."); see also William Douglas Sellers, *The Flash of Genius Doctrine Approaches the Patent Office*, 7 ENG'G & SCI. MONTHLY 3, 4 (1944) ("If the doctrine of *Potts v. Coe* is to be recognized and given effect it is doubtful that many patents owned by corporations having research organizations are of any validity."). Other courts deemed such a result unacceptable and simply announced that they would refuse to follow the "flash of genius" test. See *Chi. Steel Foundry Co. v. Burnside Steel Foundry Co.*, 132 F.2d 812, 817 (7th Cir. 1943).

The test of "flash of genius" has been applied to curtail the field of patentable discovery and to eliminate from the protection of patents, all products . . . which were . . . the product of prolonged study and step by step advance. In short, it would eliminate nearly all the advances of history
Id. (emphasis added).

²⁸ 340 U.S. 147 (1950).

²⁹ *Id.* at 150-51; see also *id.* at 150 & n.5 (noting that the "Index to Legal Periodicals reveals no less than sixty-four articles relating to combination patents and the theory and philosophy underlying the patent laws," but the "voluminous literature which the subject has excited discloses no . . . test" for the standard to be applied).

standard of patentability. The first version of what went on to become 35 U.S.C. § 103 read:

Conditions for patentability, lack of invention

A patent may not be obtained though the invention is not identically disclosed or described in the material specified in section 22 of this title [which went on to become 35 U.S.C. § 102], if the differences between the subject matter sought to be patented and said material are such that the subject matter as a whole would be obvious to an ordinary person skilled in the art.

Patentability as to this condition shall be determined by the nature of the contribution to the advancement of the art, and not by the nature of the mental processes by which such contribution may have been accomplished.³⁰

This section went through some minor amendments, and was eventually passed as section 103 of the Patent Act of 1952.³¹ One early amendment was to replace the phrase “lack of invention” with a new “nonobviousness” standard.³² This was no doubt motivated, in part, by a hope on the part of some participants in the legislative process that the codified standard would avoid the confusing morass of “inventiveness” precedent that had accumulated since *Hotchkiss*.³³ At the same time, Congress did not specifically repudiate any prior judicial decisions except *Cuno*.³⁴ Section 103, in its final form, read:

³⁰ STAFF OF H.R. COMM. ON THE JUDICIARY, 81ST CONG., PROPOSED REVISION AND AMENDMENT OF THE PATENT LAWS: PRELIMINARY DRAFT WITH NOTES § 23 (Comm. Print 1950).

³¹ 35 U.S.C. § 103 (1952).

³² Compare STAFF OF H.R. COMM. ON THE JUDICIARY, 81ST CONG., PROPOSED REVISION AND AMENDMENT OF THE PATENT LAWS: PRELIMINARY DRAFT WITH NOTES § 23 (Comm. Print 1950), with H.R. 9133, 81st Cong. § 103 (2d Sess. 1950).

³³ See Giles S. Rich, *Laying the Ghost of the “Invention” Requirement*, 1 AM. PAT. L. ASS’N Q.J. 26 (1972), reprinted in 14 FED. CIR. B.J. 163, 170 (2004) (“The first policy decision underlying Section 103 was to cut loose altogether from the century-old term ‘invention.’”).

³⁴ The committee report, in commenting on Section 103, made little fanfare of the shift from “invention” to “nonobviousness.” All it said on prior decisions was: “[Section 103] paraphrases language which has often been used in decisions of the courts, and the section is added to the statute for uniformity and definiteness. This

Conditions for patentability; non-obvious subject matter

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.³⁵

The Supreme Court first interpreted the new, codified, obviousness standard in *Graham v. John Deere Co.*³⁶ The *Graham* Court first reaffirmed that the newly enacted section 103 was a mere codification of the prior law dating from *Hotchkiss*,³⁷ save for the legislative overruling of the "flash of genius" test.³⁸ Surveying its prior cases, the Court recounted: "[A]s this Court has observed, '(t)he truth is, the word ("invention") cannot be defined in such manner as to afford any substantial aid in determining whether a particular device involves an exercise of the inventive faculty or not.'"³⁹ The Court then proceeded to lay down a new approach to determining patentability:

The *Hotchkiss* formulation, however, lies not in any label, but in its functional approach to questions of patentability. In practice, *Hotchkiss* has required a comparison between the subject matter of the patent, or patent application, and the background skill of the calling. It has been from this comparison that patentability was in each case determined.⁴⁰

section should have a stabilizing effect and minimize great departures which have appeared in some cases." S. REP. NO. 82-1979 (1952), *reprinted in* 1952 U.S.C.C.A.N. 2394, 2400.

³⁵ Patent Act of 1952, Pub. L. No. 82-593, § 103, 66 Stat. 792. This remains the statutory standard of obviousness today. 35 U.S.C. § 103(a) (2000).

³⁶ 383 U.S. 1 (1966).

³⁷ *Id.* at 17 ("We conclude that the section was intended merely as a codification of judicial precedents embracing the *Hotchkiss* condition . . .").

³⁸ *See id.* at 15-16 & n.7 (repudiating the flash of genius test).

³⁹ *Id.* at 11-12 (quoting *McClain v. Ortmayer*, 141 U.S. 419, 427 (1891)).

⁴⁰ *Id.* at 12.

According to the Court, obviousness could be determined using a simple four step analysis. First, “the scope and content of the prior art are to be determined.”⁴¹ Second, the “differences between the prior art and the claims at issue are to be ascertained.”⁴² Third, “the level of ordinary skill in the pertinent art [is to be] resolved.”⁴³ Finally, “[a]gainst this background, the obviousness or nonobviousness of the subject matter is determined.”⁴⁴

The *Graham* formulation gave some structure to the obviousness inquiry. The Court’s opinion, however, provided little insight into how, against the background facts, “the obviousness or nonobviousness of the subject matter” was to be determined. The opinion gave all the appearance of expecting a solution to appear out of thin air once the formula was followed.⁴⁵ The lack of an articulable rule meant that determinations of obviousness took the appearance—and arguably the reality—of resting on judicial whim, where the validity of a patent was heavily dependent on the court that was deciding the case,⁴⁶ a

⁴¹ *Id.* at 17.

⁴² *Id.*

⁴³ *Id.*

⁴⁴ *Id.*

⁴⁵ In a grudging and opaque concession to the reality that the inquiry was ultimately a subjective one, the Court acknowledged that: “What is obvious is not a question upon which there is likely to be uniformity of thought in every given factual context.” *Id.* The court nonetheless expressed confidence that “strict observance of the requirements laid down here will result in that uniformity and definiteness which Congress called for in the 1952 Act.” *Id.* This confidence was soon proven wrong.

⁴⁶ A Commission reported to Congress in 1975 that patent validity determinations were perceived to be strongly dependent on whether one appears before a favorable judge: “Nowhere is the quest more vigorously pursued than for the right forum to rule on validity. Patentees now scramble to get into the 5th, 6th and 7th Circuits since the courts there are not inhospitable to patents whereas infringers scramble to get anywhere but in these circuits.” Comm’n on Revision of the Fed. Court Appellate Sys., *Structure and Internal Procedures: Recommendations for Change*, 67 F.R.D. 195, 370 (1975). The problem of different circuits treating the same patent differently did not originate with *Graham*; rather, *Graham* itself involved a circuit split in which the Fifth Circuit had upheld the very patent that the Eighth Circuit later invalidated. *Compare* *Jeoffroy Mfg., Inc. v. Graham*, 219 F.2d 511, 520 (5th Cir. 1955), *with* *John Deere Co. v. Graham*, 333 F.2d 529 (8th Cir. 1964), *aff’d*, 383 U.S. 1 (1966). However, *Graham* did little to resolve this situation.

result that the drafters of section 103 had clearly sought to avoid.⁴⁷

C. *The Teaching-Suggestion-Motivation Test*

Partly in response to the widespread perception that the validity of a patent was mostly dependent on the forum of its adjudication,⁴⁸ Congress created the Court of Appeals for the Federal Circuit in 1982 and vested in that court exclusive jurisdiction over patent-related appeals from both the patent office and district courts.⁴⁹ With the creation of the Federal Circuit, the Supreme Court largely withdrew from the field of patent law.⁵⁰ The Court did not decide a single case substantially

⁴⁷ See S. REP. NO. 82-1979 (1952), reprinted in 1952 U.S.C.C.A.N. 2394, 2400 (noting that section 103 was intended to promote "uniformity and definiteness" and "have a stabilizing effect" on the law).

⁴⁸ See H.R. REP. NO. 97-312, at 22 (1981) ("At present, the validity of a patent is too dependant upon geography (i.e., the accident of judicial venue) to make effective business planning possible."); *supra* note 46 and accompanying text; see also Rochelle Cooper Dreyfuss, *The Federal Circuit: A Case Study in Specialized Courts*, 64 N.Y.U. L. REV. 1, 7 (1989) (citing Thomas Cooch, *The Standard of Invention in the Courts, in DYNAMICS OF THE PATENT SYSTEM* 34, 56-59 (William Ball ed., 1960)).

⁴⁹ See 28 U.S.C. § 1295(a)(1) (2000) (appeals from district courts); 28 U.S.C. § 1295(a)(4)(A) (appeals from the Patent and Trademark Office). *But see* Holmes Group, Inc. v. Vornado Air Circulation Sys., Inc., 535 U.S. 826, 834 (2002) ("Not all cases involving a patent-law claim fall within the Federal Circuit's jurisdiction.").

⁵⁰ Between 1982 and 2000, the Supreme Court decided eleven cases involving patents. The cases were: *Dickinson v. Zurko*, 527 U.S. 150 (1999) (standard for reviewing Patent and Trademark Office actions); *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55 (1998) (standard for on-sale bar); *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17 (1997) (doctrine of equivalents); *Markman v. Westview Instruments, Inc.*, 517 U.S. 370 (1996) (interpretation of patent claims); *Asgrow Seed Co. v. Winterboer*, 513 U.S. 179 (1995) (scope of the seed saving exemption under the Plant Variety Protection Act); *Cardinal Chem. Co. v. Morton Int'l, Inc.*, 508 U.S. 83 (1993) (whether an invalidity counterclaim may be dismissed as moot upon finding non-infringement); *Eli Lilly & Co. v. Medtronic, Inc.*, 496 U.S. 661 (1990) (reviewing the scope of 35 U.S.C. § 271(e)(1)); *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141 (1989) (preemption of state laws); *Christianson v. Colt Indus. Operating Corp.*, 486 U.S. 800 (1988) (scope of the Federal Circuit's patent law jurisdiction); *Dennison Mfg. Co. v. Panduit Corp.*, 475 U.S. 809 (1986) (vacating the Federal Circuit's determination of non-obviousness for failure to articulate whether deference was given to the trial court); *Gen. Motors Corp. v. Devex Corp.*, 461 U.S. 648 (1983) (reviewing an award of prejudgment interest). See generally John F. Duffy, *The Festo Decision and the Return of the Supreme Court to the Bar of Patents*, 2002 SUP. CT. REV. 273 (2002) (reviewing cases).

affecting the obviousness doctrine between 1977 and 2006.⁵¹

In the absence of Supreme Court intervention, the Federal Circuit developed its own structure for obviousness analysis. The first step requires the party challenging patentability to prove a *prima facie* case of invalidity.⁵² If a *prima facie* case is made, the patentee can then rebut this case by providing facts supporting non-obviousness, such as demonstrating unexpected results,⁵³ that the prior art teaches away from the claimed invention,⁵⁴ that the invention proved to be commercially successful,⁵⁵ or that others had attempted and failed to make the invention.⁵⁶ When rebuttal evidence is provided, the *prima facie* case dissolves and obviousness is determined in the totality of circumstances as under *Graham*.⁵⁷

The key to this three-step process, however, was always proving the initial *prima facie* case because the Federal Circuit created a difficult evidentiary hurdle. In order to establish a *prima facie* case of obviousness, the party challenging patentability must prove a “teaching,” “suggestion,” or “motivation” to modify prior art references into the claimed invention.⁵⁸

The teaching-suggestion-motivation test achieved limited objectivity, but at a heavy cost. To the extent that the test required *explicit* suggestions to combine elements to achieve an

⁵¹ *Dennison* presented the issue of the standard of obviousness. See 475 U.S. at 809–10 (“The [Federal Circuit] . . . ruled that the references cited by the District Court did not teach the innovations introduced by respondent . . .”). The Supreme Court, however, remanded for clarification on whether the Federal Circuit was giving any deference to the district court’s factual findings. *Id.* at 811. When the case returned the Court denied certiorari. *Dennison Mfg. Co. v. Panduit Corp.*, 481 U.S. 1052 (1987).

⁵² 35 U.S.C. § 282 (2006) (stating that an accused infringer in litigation bears burden of proving invalidity); *In re Kumar*, 418 F.3d 1361, 1366 (Fed. Cir. 2005) (“During examination, the examiner bears the initial burden of establishing a *prima facie* case of obviousness.”).

⁵³ See *In re Geisler*, 116 F.3d 1465, 1469–70 (Fed. Cir. 1997).

⁵⁴ See *id.* at 1471.

⁵⁵ See *In re Piasecki*, 745 F.2d 1468, 1475 (Fed. Cir. 1984).

⁵⁶ See *In re Wright*, 569 F.2d 1124, 1127 (C.C.P.A. 1977).

⁵⁷ See *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992); *In re Spada*, 911 F.2d 705, 708 (Fed. Cir. 1990).

⁵⁸ *In re Kahn*, 441 F.3d 977, 986 (Fed. Cir. 2006); see also *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577 (Fed. Cir. 1984) (“[T]eachings of [prior art] references can be combined *only* if there is some suggestion or incentive to do so.”).

invention, it was objective.⁵⁹ For example, if an invention is the combination of A and B in a single package, people can disagree over whether the idea was ingenious or obvious. On the other hand, if the legal question was transformed to whether there was a piece of paper that explicitly said, verbatim, "combine A and B in a single package," the inquiry became purely factual and objective. The problem with requiring such a degree of explicitness and specificity, however, is that the obviousness inquiry reduces to a simple novelty inquiry. It would require the prior art reference to describe the invention exactly.

To the extent that the patented invention *differed* from the prior art's explicit teachings, however, the teaching-suggestion-motivation test could do very little to help unless it was to require patent grants for every novel invention. Obviousness, to have any meaning, involves bridging the difference between the prior art and the patented invention through something that is not explicitly in the prior art itself. In a series of decisions after the Supreme Court granted certiorari in *KSR International Co. v. Teleflex, Inc.*,⁶⁰ the Federal Circuit emphasized that there may be "implicit motivation" from many sources to provide that bridge.⁶¹ The problem is that once this "implicit motivation" standard is accepted, the obviousness question lands back in square one; it is merely a matter of semantics to switch from asking whether

⁵⁹ Some Federal Circuit cases have suggested that the teaching, suggestion, or motivation had to be very explicit. *See, e.g., Winner Int'l Royalty Corp. v. Wang*, 202 F.3d 1340, 1348 (Fed. Cir. 2000) ("Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in whatever form, must nevertheless be 'clear and particular.'" (quoting *In re Dembiczak*, 175 F.3d 994, 999 (Fed. Cir. 1999) (citation omitted))); *Standard Oil Co. v. Am. Cyanamid Co.*, 774 F.2d 448, 454 (Fed. Cir. 1985) ("A person of ordinary skill in the art is . . . presumed to be one who thinks along the line of conventional wisdom in the art . . .").

⁶⁰ 126 S. Ct. 2965 (2006) (granting petition for certiorari).

⁶¹ *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1366–71 (Fed. Cir. 2006) (stating that there existed an implicit motivation to combine old elements because the resulting combination was "cheaper, faster, and more convenient"); *Alza Corp. v. Mylan Labs., Inc.*, 464 F.3d 1286, 1294–95 (Fed. Cir. 2006) (stating that implicit motivation could be based on expert testimony that persons of skill would have expected the invention to work successfully); *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1309 (Fed. Cir. 2006) (asserting that implicit motivation to use one package instead of multiple packages exists because "of the well-known practice of packaging items in the manner most convenient to the purchaser").

substituting a clay doorknob for a metal doorknob was “non-inventive,” to asking whether it was “obvious,” to asking whether it was “implicitly motivated.” All of these standards proved to be masks for subjective opinions, either of experts,⁶² judges,⁶³ or juries.⁶⁴

D. KSR International Co. v. Teleflex, Inc.

The Supreme Court’s decision in *KSR International Co. v. Teleflex Inc.*⁶⁵ substantially adopted the Federal Circuit’s teaching-suggestion-motivation test, but removed the more bright-line rules that the Federal Circuit had previously laid down. The Court held that there should be “an apparent reason to combine the known elements in the fashion claimed by the patent at issue” and that “this analysis should be made explicit.”⁶⁶ The Court also held, however, that “the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.”⁶⁷

The *KSR* Court quite clearly rejected the strong version of the teaching-suggestion-motivation test, one that would have required the prior art to explicitly teach the differences—and one that would have rendered § 103 dead-letter as there would be no differences to bridge.⁶⁸ Ultimately, *KSR*’s holding is rather akin to the “implicit motivation” standard that the Federal Circuit had already adopted in response to the Court’s grant of certiorari.⁶⁹ The problem with this “flexible” approach to

⁶² See *Alza*, 464 F.3d at 1294 (permitting implicit motivation to be based on expert testimony).

⁶³ *Great Atl. & Pac. Tea Co. v. Supermarket Equip. Corp.*, 340 U.S. 147, 153–54 (1950) (stating that the “standard of invention” is a question of law).

⁶⁴ *Winner Int’l*, 202 F.3d at 1348 (“Whether motivation to combine the references was shown we hold a question of fact.”).

⁶⁵ 127 S. Ct. 1727 (2007).

⁶⁶ *Id.* at 1741.

⁶⁷ *Id.*

⁶⁸ *Compare* *Standard Oil Co. v. Am. Cyanamid Co.*, 774 F.2d 448, 454 (Fed. Cir. 1985) (“A person of ordinary skill in the art is . . . presumed to be one who thinks along the line of conventional wisdom in the art . . .”), *with KSR*, 127 S. Ct. at 1742 (“A person of ordinary skill is also a person of ordinary creativity, not an automaton.”).

⁶⁹ See *KSR*, 127 S. Ct. at 1743 (2007) (“We note the Court of Appeals has since

obviousness endorsed by the Supreme Court is the same as it has always been: Whether something is implicitly motivated and obvious is nothing more than a subjective, inscrutable judgment call. Judges, juries, and experts will have endless debates on this matter of opinion; but it cannot be objectively proved.

E. A Summary of Obviousness Law

Judge Giles Rich of the Federal Circuit once described the pre-codification "invention" standard as the "plaything of the judiciary [that] meant anything the judges chose to make it mean."⁷⁰ The codified standard is unfortunately no different. The court that decided in 1999 that a pumpkin face on a trash bag was nonobvious⁷¹ was a very different court from the one that decided in 2006 that a new method of dyeing textiles that eliminated two steps in the traditional process was obvious;⁷² yet both explicitly purported to be applying the same test.⁷³ Both the teaching-suggestion-motivation test and § 103 have proven to be extremely malleable.

As a brief survey of the history of the obviousness standard shows, the problem is a lack of objective criteria to determine obviousness. Although § 103 purports to create an objective test by referencing a hypothetical person, the subjective opinion of a hypothetical person is still subjective: Why, exactly, does the substitution of clay for metal doorknobs not demonstrate

elaborated a broader conception of the TSM test than was applied in the instant matter." (citing *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1367 (Fed. Cir. 2006); *Alza Corp. v. Mylan Labs., Inc.*, 464 F.3d 1286, 1291 (Fed. Cir. 2006))). The Federal Circuit has taken this quote to be essentially a *carte blanche* affirmation of the teaching-suggestion-motivation test. See *Takeda Chem. Indus., Ltd. v. Alphapharm Pty., Ltd.*, 492 F.3d 1350, 1355 (Fed. Cir. 2007). Whether the Supreme Court will see *KSR* as the same ringing endorsement of the teaching-suggestion-motivation test as the Federal Circuit remains to be seen.

⁷⁰ Giles S. Rich, *Why and How Section 103 Came to Be*, 14 FED. CIR. B.J. 181, 186 (2004).

⁷¹ See *In re Dembiczak*, 175 F.3d 994, 1000 (Fed. Cir. 1999).

⁷² See *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1372 (Fed. Cir. 2006).

⁷³ The Federal Circuit's insistence that its holding in *DyStar* was entirely consistent with its prior cases did not appear convincing to the Supreme Court. See *KSR*, 127 S. Ct. at 1743 ("We note the Court of Appeals has since elaborated a broader conception of the TSM test . . .").

ingenuity?⁷⁴ Who is to say that such a substitution required less brilliance than the substitution of carbon for metal filament in the light bulb?⁷⁵ And if some expert was to so opine, how could he be proven wrong? Even when everyone agrees on the precise difference between clay and metal down to the last atom, people disagree on the significance of such a difference. With subjective judgment comes the concern that, in hindsight, everything looks obvious and insignificant.⁷⁶ Because a subjective judgment is ultimately inscrutable, the hindsight bias cannot be isolated and removed.⁷⁷

The problem of subjectivity in the obviousness standard is similar to that in the reasonableness standard of tort law.⁷⁸ Like the obviousness standard, reasonableness references the hypothetical judgment of a hypothetical person to create semantic objectivity.⁷⁹ In tort law, courts struggled to give the standard of a “reasonable and prudent person” useful meaning, beyond telling jurors that the reasonable person was just like them and allowing jurors to exercise subjective judgment.⁸⁰

⁷⁴ *Hotchkiss v. Greenwood*, 52 U.S. 248, 267 (1850).

⁷⁵ See U.S. Patent No. 223,898 (filed Jan. 27, 1880) (Edison’s patent for the light bulb, claiming “[a]n electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires, as set forth.”).

⁷⁶ See *Graham v. John Deere Co.*, 383 U.S. 1, 36 (1966) (noting the need “to resist the temptation to read into the prior art the teachings of the invention in issue”); *Loom Co. v. Higgins*, 105 U.S. 580, 591 (1881) (“Now that [the invention] has succeeded, it may seem very plain to any one that he could have done it as well. This is often the case with inventions of the greatest merit.”).

⁷⁷ See Gregory Mandel, *Patently Non-Obvious II: Experimental Study on the Hindsight Issue Before the Supreme Court in KSR v. Teleflex*, 9 YALE J.L. & TECH. 1, 16 (2007) (discussing hindsight bias in obviousness determinations, and finding that the teaching-suggestion-motivation test does nothing to mitigate hindsight bias in jurors).

⁷⁸ See *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1566 (Fed. Cir. 1987) (describing the person of ordinary skill as “not unlike the ‘reasonable man’ and other ghosts in the law”); see also *Graham*, 383 U.S. at 18 (“What is obvious is not a question upon which there is likely to be uniformity of thought in every given factual context. The difficulties, however, are comparable to those encountered daily by the courts in such frames of reference as negligence and scienter . . .”).

⁷⁹ *Wilkerson v. McCarthy*, 336 U.S. 53, 61 (1949) (stating that the standard for reasonableness is “what a reasonable and prudent person would have done under the same circumstances”).

⁸⁰ See RESTATEMENT (SECOND) OF TORTS § 290 cmt. e (1965).

In general, the actor is required to know everything with respect to the risk of harm which is a matter of common knowledge in the community in

What appears reasonable and prudent to one person appears reckless to another. And the phenomenon that in the hindsight of an accident everything looks unreasonable remains a widely recognized problem.⁸¹

In the tort context, economic thinking led to Learned Hand's formulation of reasonableness in *United States v. Carroll Towing Co.*,⁸² which stated that "if the probability [of accident] be called P; the injury, L; and the burden [of avoiding the accident], B; liability depends upon whether B is less than L multiplied by P: i.e., whether B [$<$] PL."⁸³ The switch from inherently subjective notions of "reasonableness" to a mathematical formulation with determinable (albeit difficult to determine⁸⁴) variables marked an important advance that forms the foundation of much of modern tort scholarship.⁸⁵ Similar to the Hand formulation, patentability can be assessed using a mathematical formulation, replacing ill-defined and subjective notions of "obviousness," "ingenuity," or "implicit motivation" with objective measures of benefits and costs, as demonstrated below.

which his conduct occurs. There is a close relation between the minimum standard of knowledge required in negligence cases and those matters of which a court will take judicial notice because they are generally known.

Id.; cf. RICHARD A. EPSTEIN, CASES AND MATERIALS ON TORTS 165–87 (8th ed. 2004) (discussing the traditional, "common sense, intuitive meaning of negligence" and the later "judicial effort to impart a more precise economic meaning to the term").

⁸¹ See Kim A. Kamin & Jeffrey J. Rachlinski, *Ex Post ≠ Ex Ante: Determining Liability in Hindsight*, 19 LAW & HUM. BEHAV. 89, 99 (1995); Merrie Jo Stallard & Debra L. Worthington, *Reducing the Hindsight Bias Utilizing Attorney Closing Arguments*, 22 LAW & HUM. BEHAV. 671, 678–79 (1998); see also Reid Hastie et al., *Juror Judgments in Civil Cases: Hindsight Effects on Judgments of Liability for Punitive Damages*, 23 LAW & HUM. BEHAV. 597, 609 (1999).

⁸² 159 F.2d 169 (2d Cir. 1947).

⁸³ *Id.* at 173.

⁸⁴ Hand himself was cognizant of the difficulties in determining the variables to his formula. See *Moisan v. Loftus*, 178 F.2d 148, 149 (2d Cir. 1949). Hand's own reservations about his formula have not prevented Law and Economics scholars from adopting it as a foundation for economic analysis of tort law.

⁸⁵ See RICHARD A. POSNER, TORT LAW: CASES AND ECONOMIC ANALYSIS 1–9 (1982) ("This casebook is premised on the belief that the Hand formula—more broadly, economic analysis—provides a unifying perspective in which to view all of tort law."); EPSTEIN, *supra* note 80, at 165 ("Although Learned Hand disclaimed the formulation of any 'general rule' for negligence, his decision in *Carroll Towing* has spawned a burgeoning academic literature on the economic interpretation of negligence and, by implication, the entire tort law.").

II. THE ECONOMICS OF PATENTS

A. *The Benefits of Patents*

1. The Acceleration Benefit

The traditional theory of intellectual property was that the rights provided a reward for making investments that “created” inventions. At the time of the Patent Act of 1952, the economic debate over patents reflected this “creation” theory. In a report to Congress surveying the economic literature on patents, Fritz Machlup wrote:

Are the consumers—the non-patent-owing people—worse off for [the patent system]?

“No; they are not,” says one group of economists. Patents are granted on inventions which *would not have been made* in the absence of a patent system; the inventions make it possible to produce more or better products than could have been produced without them

“Wrong,” says another group of economists. Many of the inventions for which patents are granted *would also be made* and put to use without any patent system. The consumers could have the fruits of this technical progress without paying any toll charges. Even if *some* inventions are made and used thanks only to the incentives afforded by the patent system, consumers must pay for *all* patented inventions

This is but one of the fundamental conflicts in the economics of the patent system.⁸⁶

As the italicized portions demonstrate, the “creation” dispute rested on a dichotomy. Patent proponents asserted that patents created inventions whole, opponents asserted that patents created nothing at all. What both sides ignored was that while virtually every invention would be created sooner or later even

⁸⁶ STAFF OF S. SUBCOMM. ON PATENTS, TRADEMARKS, & COPYRIGHTS, S. COMM. ON THE JUDICIARY, 85TH CONG., AN ECONOMIC REVIEW OF THE PATENT SYSTEM 44–45 (Comm. Print 1958) (emphasis added).

without a patent system, patents created incentives for additional research investment, leading to inventions being made sooner than they otherwise would be.⁸⁷ The patent system creates no inventions, it *accelerates* them.

One of the first authors that contributed to this modern understanding was Yoram Barzel, in his paper *Optimal Timing of Innovations*.⁸⁸ As the title itself suggests, innovation is a matter of timing, not creation. Barzel suggested that the patent system created incentives for multiple firms to race for a patent, affecting the timing of when an invention would be developed.⁸⁹ Implicit in this idea was that patents affected when, not if, an invention would be created. In response to Barzel, Edmund Kitch crystallized this concept:

If the purpose is to reward the inventor for his invention, then why shouldn't he be awarded all of the present value of his invention? The simplicity of this argument breaks down, however, if we take the view that *the inventor's contribution is not the invention itself—which eventually would have been made by someone else—but the time of the invention*. The patent should reward not for the whole value of the invention, but for the value of being first.⁹⁰

Kitch, however, did not fully realize the implications of his theory, believing that the social value of an invention affected the term—and scope—of the optimal patent but not whether it

⁸⁷ DONALD S. CHISUM ET AL., *PRINCIPLES OF PATENT LAW* 67 (3d ed. 2004) (“[T]he inventor’s contribution is often not the invention itself—which would have eventually been invented by someone else—but rather the timing of the invention. In this case, the patent should not be reward for the entire value of the invention, but rather for the value of early discovery and disclosure.”).

⁸⁸ Yoram Barzel, *Optimal Timing of Innovations*, 50 *REV. ECON. & STAT.* 348, 348 (1968). This insight did not necessarily originate with Barzel, as others suggested the trade-off between research expenditures and patent rents at almost the same time. See, e.g., F. M. Scherer, *Time-Cost Tradeoffs in Uncertain Empirical Research Projects*, 13 *NAVAL RES. LOGISTICS Q.* 71 (1966).

⁸⁹ See Barzel, *supra* note 88, at 350–51 (discussing the timing of innovation); see also Jennifer F. Reinganum, *The Timing of Innovation: Research, Development, and Diffusion*, in 1 *HANDBOOK OF INDUSTRIAL ORGANIZATION* 849, 853–54 (Richard Schmalensee & Robert D. Willig eds., 1989) (“Invention is a costly activity, with the cost of invention by any given date being a decreasing convex function of the time prior to invention.”).

⁹⁰ Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 *J.L. & ECON.* 265, 284–85 (1977) (emphasis added).

should be granted.⁹¹ Further, Kitch suggested that the reward of the patent should be for “the whole value” of being first, or, in economic terms, the entire surplus during acceleration.⁹² What Kitch ignored in this calculation was the very concern that the rest of his article was dealing with: the problem of dissipating producer surplus.⁹³

2. The Problem of Dissipating Surplus

As Barzel demonstrated, the acceleration of an invention in the patent system is accomplished through the mechanism of the patent race.⁹⁴ A patent race occurs when the prospect of monopoly rent encourages multiple firms to make the investment in research; the first to create the invention obtains the patent—and the losers get nothing. To Barzel and Kitch, the patent race was a problem because innovation races between multiple firms led to wasteful duplication of research.⁹⁵ Wasteful duplication would result in the producer surplus from an eventual invention becoming completely dissipated beforehand.⁹⁶

Barzel suggested that a government auction system giving one firm complete control of an invention “before resources are committed to the innovating activity” would prevent wasteful duplication from occurring.⁹⁷ Following Barzel’s analysis, Kitch

⁹¹ *Id.* at 285 (“This would suggest long patents for ‘big jumps’ and short patents for ‘little jumps.’”).

⁹² *Id.* at 284–85.

⁹³ See John F. Duffy, *The Marginal Cost Controversy in Intellectual Property*, 71 U. CHI. L. REV. 37, 53 (2004) (“[S]etting the reward equal to the full social surplus of the invention is clearly not efficient because competition among inventors will [then] dissipate all of the social surplus.”).

⁹⁴ Barzel, *supra* note 88, at 348–49 (“[C]ompetition between potential innovators to obtain priority rights (and profits) from innovations can result in premature applications of discoveries.”).

⁹⁵ *Id.* at 349 (“[C]ompetition among potential innovators may deprive innovations of all their special economic value.”); see also Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475, 491–92 (2006).

⁹⁶ D.G. McFetridge & M. Rafiquzzaman, *The Scope and Duration of the Patent Right and the Nature of Research Rivalry*, 8 RES. L. & ECON. 91, 93 (1986) (“[C]ompetition for a patent will be pushed to the point at which the value of resources expended by rival inventors is just equal to the expected present discounted value of the royalty or other income of the patentee.”).

⁹⁷ Barzel, *supra* note 88, at 352 n.11. Barzel did not address whether multiple firms would dissipate surplus by competing to win the auction.

suggested that the patent system could itself grant broad rights and foreclose later research by rivals, thus itself functioning as the auction that Barzel had envisioned.⁹⁸ Both authors focused on centralizing rights to the invention as a solution to the dissipation of rents.⁹⁹

The difficulty with the centralization approach is that a broader patent necessarily means even more rents for the patentee and this pushes rival competitors to accelerate an invention even harder to secure the patent, resulting in even more wasteful duplication and rent dissipation.¹⁰⁰ The patent system does not, and probably cannot, grant exclusive control over an invention sufficiently early to prevent a race between multiple competitors from dissipating rents.¹⁰¹

As John Duffy later pointed out, however, patent racing does not dissipate *all* the benefits of an invention, but only the producer surplus.¹⁰² In the aggregate, "firms will neither gain nor lose from investing in innovation,"¹⁰³ and thus the multiple racing firms will spend only their portion of the expected surplus.¹⁰⁴ Society's benefit from the invention is what remains: the consumer surplus.¹⁰⁵ It is not the social surplus, because the

⁹⁸ Kitch, *The Nature and Function of the Patent System*, *supra* note 90, at 265–66.

⁹⁹ *Id.* at 276–79.

¹⁰⁰ See Donald G. McFetridge & Douglas A. Smith, *Patents, Prospects, and Economic Surplus: A Comment*, 23 J.L. & ECON. 197, 198–201 (1980); see also Aditya Bamzai, Comment, *The Wasteful Duplication Thesis in Natural Monopoly Regulation*, 71 U. CHI. L. REV. 1525, 1535–38 (2004).

¹⁰¹ See Bamzai, *supra* note 100, at 1526–34. *But see* Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation*, 78 VA. L. REV. 305, 316–17 (1992) (theorizing that if the patent right was granted early enough, the best inventor would be able to patent first and prevent a patent race from starting).

¹⁰² John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 473 (2004) [hereinafter Duffy, *Rethinking the Prospect Theory of Patents*].

¹⁰³ *Id.*

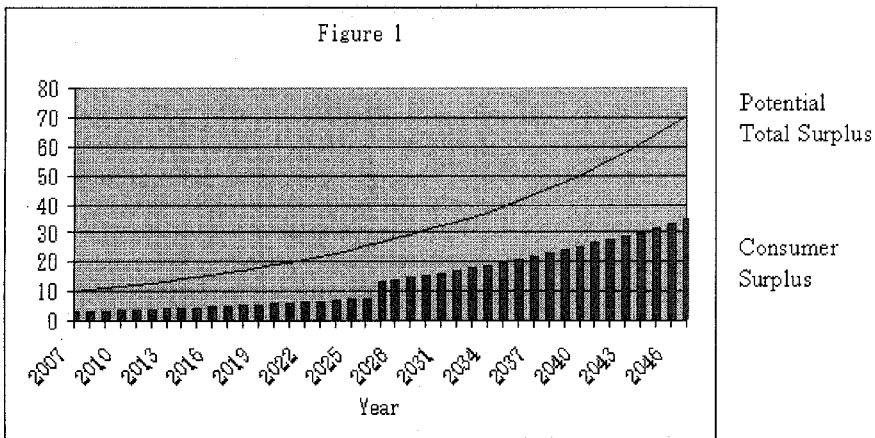
¹⁰⁴ McFetridge & Rafiquzzaman, *supra* note 96, at 93.

¹⁰⁵ See *id.* ("When inventive activity is competitive, the transfer of surplus from users to inventors eliminates the surplus."); see also RICHARD T. RAPP & LAUREN J. STIROH, NAT'L ECON. RESEARCH ASSOCS., STANDARD SETTING & MARKET POWER 2, presented at *Competition and Intellectual Property Law and Policy in the Knowledge-Based Economy: J. Hearings Before the U.S. Dep't of Justice & Fed. Trade Comm'n* (Apr. 18, 2002), <http://www.ftc.gov/os/comments/intelpropertycomments/nera.pdf> ("The value of a new technology, product or product characteristic can be approximated by the value to consumers of its advantage over the next best alternative . . .").

producer surplus is dissipated. By shifting producer surplus to consumer surplus, more wealth is preserved from dissipation.¹⁰⁶

3. Calculating the Benefit

The benefit of a patent, economically, is the social wealth that is preserved from dissipation, i.e., the consumer surplus as demonstrated above. Assume, then, that a patentee conceives an invention and files for a patent, and that if the patent is granted today, the invention disclosed would produce a potential total surplus of \$10 in this year and that the surplus grows at 5 percent per year.¹⁰⁷ Assume that the surplus is evenly divided between consumers and producers in perfect competition but that the consumer surplus shrinks to 30 percent under monopoly conditions, the producer surplus taking 60 percent, leaving a deadweight loss of 10 percent. Assume finally that any patent on the invention would issue immediately and would last for twenty years. Figure 1 would represent consumer surplus, projected indefinitely:



In this hypothetical, the consumer surplus will continue to grow indefinitely. Although the annual consumer surplus receives a significant boost at year 2027 when the patent expires,

¹⁰⁶ Duffy, *Rethinking the Prospect Theory of Patents*, *supra* note 102, at 473–74.

¹⁰⁷ I am assuming here that the steps of (1) conception by the patentee, (2) filing the patent application, and (3) granting and publishing the patent, all occur immediately. In reality, the period between the patentee's conception and the publishing of the patent may be several years. I discuss the effect of relaxing this assumption in Part IV.D.

thus shifting the market to perfect competition, during the period of monopoly there is still consumer surplus. Under the assumptions above, the consumer surplus during the patent term, under monopoly conditions, is \$99.20. A monopoly consumer surplus is better than the alternative: no consumer surplus at all.¹⁰⁸

The model above is unrealistic because the benefit of a patented invention will not continue increasing forever. This is not important; the annual consumer surplus can vary across time. Indeed, such variations occur not only between years but also within years. Mathematically, the consumer surplus of an invention can be stated as a function of time t , $B(t)$. The variable t can be expressed in any unit of time, whether it be days, weeks, months, or years; the function would be defined as the consumer surplus for any particular value of t . The cumulative consumer surplus over a period is thus the area under the curve, expressed mathematically as the integral, $\int B(t)$.

B. *The Costs of Patents*

Patents are most frequently criticized for imposing a monopoly deadweight loss for their entire term; indeed, both courts and commentators frequently assume that this is the cost of patents.¹⁰⁹ But unless society has some alternative where it has both the invention and does not pay a deadweight loss, this "cost" is illusory. If the only alternatives are having the invention under monopoly and not having the invention at all, society is unambiguously better off having the invention under monopoly.¹¹⁰

¹⁰⁸ See *infra* text accompanying note 110.

¹⁰⁹ See, e.g., *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 152 (1989) ("The tension between the desire to freely exploit the full potential of our inventive resources and the need to create an incentive to deploy those resources is constant."); JANICE M. MUELLER, AN INTRODUCTION TO PATENT LAW 20 (2003) ("The introduction of patent rights will result in a reduction in the quantity of widgets supplied."); Richard Gilbert & Carl Shapiro, *Optimal Patent Length and Breadth*, 21 RAND J. ECON. 106, 107 (1990) ("When increasing the length of the patent . . . there is a constant tradeoff between the additional reward to the patentee and the increment to deadweight loss . . .").

¹¹⁰ As one commentator has put it:

A "monopoly" of tea bags is not bad, if the prospect of that "monopoly" was what induced the tea bag invention. The only product "monopolized" and sold at too low quantities is a product that would be sold in even lower

It is only after when the invention would have been dedicated to the public domain by an independent inventor that society receives the potential for a third option: having the invention under perfect competition. The difference in social welfare between perfect competition and monopoly, when competition is a potential option, is the cost of a patent.

What are the differences between competition and monopoly? In standard economics, monopoly is different from perfect competition in two ways. First, monopoly causes a deadweight loss.¹¹¹ Second, monopoly causes a transfer of part of the consumer surplus to the monopolist producer—the monopoly rent.¹¹² Ordinarily, economists do not consider wealth transfers from consumers to producers as a cost because simple wealth transfers do not affect the overall level of social welfare.¹¹³ In the context of patent racing, however, the transfer of surplus from consumers to producers will result in dissipation of the surplus.¹¹⁴ Therefore, the cost of a patent is the difference in consumer surplus between monopoly and perfect competition, or, in other words, the sum of the deadweight loss and the monopoly rent. Thus, contrary to conventional thinking, the cost of a patent is not the deadweight loss over the entire patent term. The cost of patent protection is the deadweight loss *plus the monopoly rent to producers*—I shall call this sum the “monopoly cost”—but only *after* independent invention would have occurred.

The monopoly cost at a particular time t depends on the elasticity of demand and supply. Variations in monopoly cost over time can be expressed as a function $C(t)$. The cumulative monopoly cost over a period would thus be the integral, $\int C(t)$.

quantity—zero—if there were no “monopoly.” Too few tea bags is better than no tea bags.

JOHN W. SCHLICHER, *PATENT LAW: LEGAL AND ECONOMIC PRINCIPLES* § 5:36 (2d ed. 2006).

¹¹¹ PAUL A. SAMUELSON & WILLIAM D. NORDHAUS, *ECONOMICS* 182–83 (16th ed. 1998).

¹¹² *See id.* at 182.

¹¹³ Herbert Hovenkamp, *Antitrust's Protected Classes*, 88 MICH. L. REV. 1, 14 (1989) (“When wealth is merely transferred, society as a whole is neither better nor worse off.”).

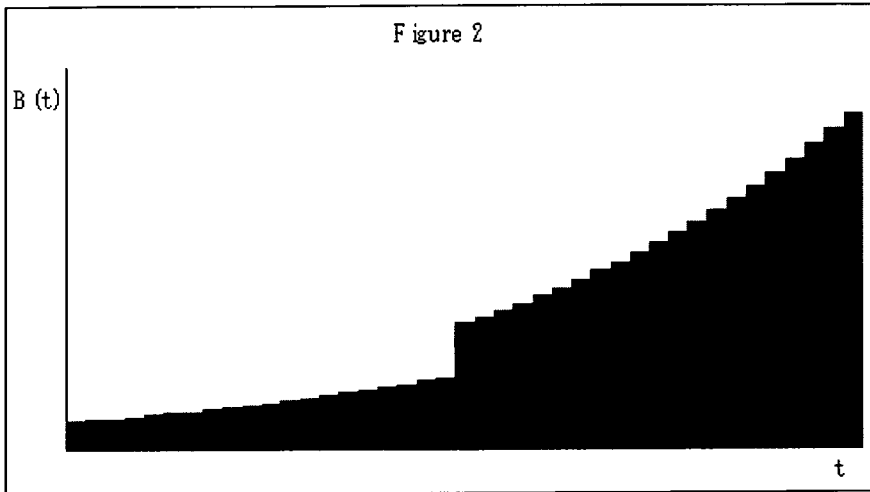
¹¹⁴ McFetridge & Rafiquzzaman, *supra* note 96, at 93.

III. A NEW TEST OF PATENTABILITY

A. *Balancing the Benefits and Costs*

A patent is a bargain between society and inventors.¹¹⁵ In return for creating and disclosing inventions, society rewards the inventor with patent rents. Society has no reason to offer losing bargains.¹¹⁶ As such, patents should only be available when the patent incentive creates more social benefits than granting the patent exacts in costs.

As shown above, the benefit to society is the consumer surplus, expressed as a mathematical function $B(t)$. This is shown below in Figure 2:



The benefit of a patent accrues from the moment the invention is first made available until the time when independent invention would have occurred, and is the cumulative consumer surplus during this period. There is a sharp up-tick in the benefit of a patent to society at the moment when the patent expires and the invention enters perfect

¹¹⁵ *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 63 (1998) (“[T]he patent system represents a carefully crafted bargain that encourages both the creation and the public disclosure of new and useful advances in technology, in return for an exclusive monopoly for a limited period of time.”).

¹¹⁶ *Cf. Graham v. John Deere Co.*, 383 U.S. 1, 5–6 (“[Congress may not] enlarge the patent monopoly without regard to the innovation, advancement or social benefit gained thereby.”).

competition. Mathematically, the benefit can be expressed as a definite integral:

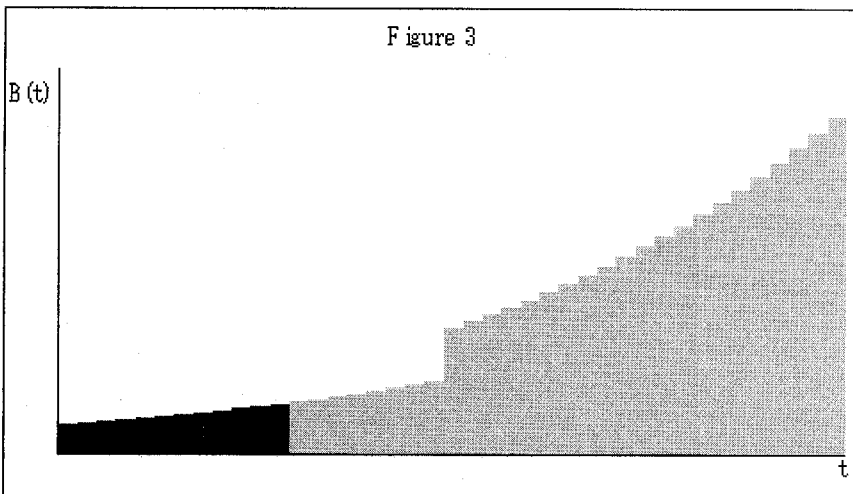
$$\int_P^I B(t) \quad (\text{Equation 1})$$

Where

I = Time of independent invention, as a value of time t ; and

P = Time of patentee invention, as a value of time t .

The integral appears as the highlighted area in Figure 3.



Correspondingly, a patented invention incurs monopoly cost until the patent expires (there is no monopoly after patent expiration). As noted above, monopoly loss is not a true cost until society has an alternative, i.e., perfect competition through independent invention. Thus, the cost of a patent is the cumulative monopoly cost between the time of independent invention and the time of patent expiration. Expressed mathematically, it is:

$$\int_I^E C(t) \quad (\text{Equation 2})$$

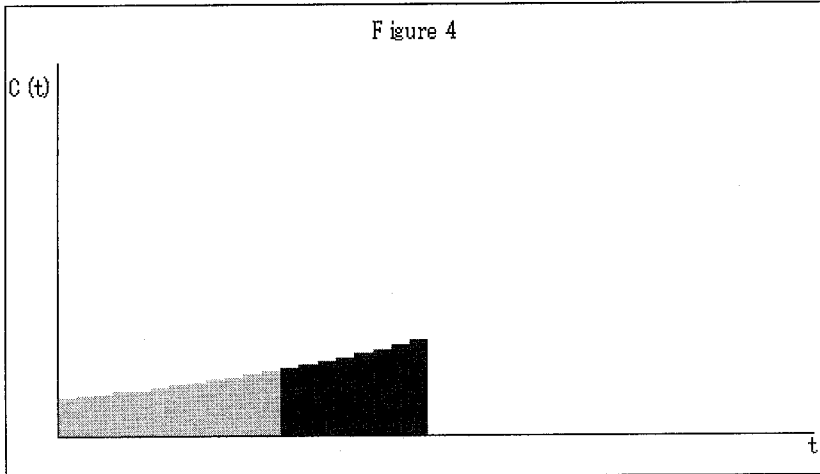
Where

E = The time of expiration of the patent, as a value of time t ;

and

I = The time of independent invention, as a value of time t .

The integral representing the cumulative cost appears as Figure 4:



A patent should issue if benefits exceed costs. Given a fixed patent term and scope,¹¹⁷ this means a patent should issue only if the consumer surplus from an invention during the period between the patentee's invention and a later independent invention equals or exceeds the monopoly cost after independent invention. That is, if:

$$\int_p^I B(t) \geq \int_I^E C(t) \quad (\text{Equation 3})$$

The use of "equals or exceeds" is necessary because costs may equal benefits. One such case is where benefits and costs both equal zero; for example, if the patentee can perfectly price discriminate (leading to zero consumer surplus) but independent invention occurs at or after patent expiration (leading to zero

¹¹⁷ It is important to assume fixed patent term and scope because the patent length and breadth also affect the cost-benefit balance. This assumption is justified because the obviousness test cannot change the patent term or scope. See *infra* text accompanying note 140.

cost).¹¹⁸ So long as independent invention would occur only at or after patent expiration, the patent should always be granted.¹¹⁹

B. *Defining Independent Invention*

It should be evident that the time of independent invention, I , is a critical determinant of patentability.¹²⁰ The time when society would otherwise have received the same invention through an independent inventor marks the boundary between when a patentee does unambiguous good (giving society something it otherwise would not have) to when the patentee causes social harm by exacting monopoly costs. Independent invention must contribute the same invention as the patentee, but do it for *free*. This entails three conditions: (1) independence from the patentee; (2) independence from the patent system; and (3) public disclosure and dedication to the public domain. A decision-maker evaluating a patent application under the test outlined in this Article must project the timing of when an independent inventor with these three characteristics will emerge.

¹¹⁸ Equation 3 implicitly assumes that $I \geq P$ and $E \geq I$. If independent invention occurs before P , the benefit function would yield a nonsensical answer; as would the cost function if independent invention occurred after E . It is sufficient to say that the patent should *never* be granted if $I < P$ (as there would be no benefit), and should *always* be granted if $E < I$.

¹¹⁹ The fact that Equation 3 dictates that we should always grant the patent if independent invention would occur after patent expiration allows us to ignore the additional benefit of the invention entering the public domain through patent expiration, since the patent would always be granted even without considering this factor. This avoids the many complexities that would arise if patentability was to affect the optimal timing of innovation. See *infra* Part IV.A.

¹²⁰ Several commentators have previously suggested using independent invention as a personal defense to patent infringement. See Stephen M. Maurer & Suzanne Scotchmer, *The Independent Invention Defence in Intellectual Property*, 69 *ECONOMICA* 535 (2002), and Vermont, *Independent Invention as a Defense to Patent Infringement*, *supra* note 95. In a recent article, Professor Vermont notes that using independent invention to invalidate would mean “pirates would [then] free-ride on the efforts of reinventors.” Samson Vermont, *The Angel Is in the Big Picture: A Response to Lemley*, 105 *MICH. L. REV.* 1537, 1542 (2007). This is not a bad thing: If independent inventors dedicate their inventions to the public—as they must to fit within the definition of independent invention that I have proposed—such dedication to the public domain is *designed* to permit free-riding by others.

1. Independence from the Patentee

The intuition for this requirement is simple: a purported independent inventor who simply copies the patentee's patent verbatim and publishes it has contributed absolutely nothing. A rival who benefits from the patentee's research, even when deriving less than the extreme example given above, cannot claim independent invention because the patentee is still part of the invention process. If society had not offered the patent, the patentee would not have existed¹²¹ and the rival's invention would thus have taken more time to independently replicate whatever the patentee contributed. Projecting a time of independent invention necessarily asks, for this requirement, "when would an independent inventor who received absolutely nothing from the patentee have invented the same invention?"

2. Independence from the Patent System

While independence from the patentee is intuitive, an independent inventor must do more: he must not be a participant in the patent race for the invention.

Patent races are an inevitable part of the patent system.¹²² At the same time, research leading to a patent is a winner-take-all race. The first inventor to an invention receives the patent and the twenty-year monopoly;¹²³ every other budding inventor not only fails to win the patent, but instead suffers the loss of all sunk investments due to the patent's power to exclude them from the market.¹²⁴ Thus, the loser has a powerful incentive, after the fact of losing, to invalidate the patent that issues on the invention.

At the same time, due to the incremental nature of scientific progress in general, and exacerbated by the competition of the patent race in particular, many inventors come very close to each other in achieving the same breakthroughs. This has been witnessed in many important inventions in history: Edison and

¹²¹ More accurately, he would invent only much later when the cost of research has decreased sufficiently to match the reduced (perfectly competitive) producer surplus.

¹²² See *supra* text accompanying note 100.

¹²³ See 35 U.S.C. § 154(a)(2) (2000).

¹²⁴ See Gideon Parchomovsky, *Publish or Perish*, 98 MICH. L. REV. 926, 931-32 (2000).

Swann with the light bulb, Bell and Gray with the telephone.¹²⁵ Such simultaneous inventions occur with neither researcher stealing the research of the other. But if these simultaneous inventions were to invalidate the resulting patent, no patent would issue on many inventions. Because of the predictability of patent racing, before investing in research, Firm A can predict that its rival Firm B will create nearly-simultaneous breakthroughs with regularity and that the simultaneous breakthrough will destroy the prospect of a patent for both. Firm A will thus not invest in the research; nor will Firm B under the same rationale. Thus, the incentives of the patent system would be seriously harmed, as only a firm with an extremely dominant advantage in research, without fear of rivals entering the race, would pursue the patent.¹²⁶

Thus in framing the inquiry under Equation 3, the inquiry is not how long it would have taken anyone to develop the same invention. Rather, the inquiry asks, “when would an independent inventor, *one not motivated by the prospect of patenting the invention*, have developed the same invention?” Of course, it is difficult to discern the subjective motivations of purported independent inventors. But an inventor who is interested in filing for patent protection will presumably not voluntarily subject himself to a statutory bar if he believes he can still patent the invention.¹²⁷ Thus, an invention disclosed into the public domain and voluntarily subjected to a statutory bar, without the purported independent inventor knowing of any limitation on patentability, i.e., without knowing that another party has beat him to the patent, is likely to be genuinely independent of the patent system.

¹²⁵ See Duffy, *Rethinking the Prospect Theory of Patents*, *supra* note 102, at 461–62 (describing the development of the telephone by multiple inventors).

¹²⁶ If rivals could agree to divide the market for research, this would not be a problem. But such an arrangement would be suspect under the antitrust laws. See U.S. DEP’T OF JUSTICE & FED. TRADE COMM’N, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY §§ 3.2.3 & 5.1 (1995), available at www.usdoj.gov/atr/public/guidelines/0558.pdf (noting that horizontal agreements to reduce output in “innovation markets” may be per se illegal); see also Duffy, *Rethinking the Prospect Theory of Patents*, *supra* note 102, at 460 & n.79.

¹²⁷ See *infra* text accompanying note 177. It may be possible to relax this requirement somewhat by permitting other reliable evidence of lack of interest in patenting, such as a longstanding corporate policy against seeking patent protection.

This test may be under-inclusive in practice. Once we have a patent system, there may be independent inventors who are not motivated by the patent system—in the sense that they would do the exact same thing if there were no patent system—but who nonetheless choose to apply for a patent once they develop an invention.¹²⁸ On matters of practical proof,¹²⁹ these independent inventors would be excluded from eligibility even though, considering independent invention in theory, they should be included. But it is difficult to devise a practical test for determining non-reliance on the patent incentive without requiring abstention from the patent system itself.

3. Dedication of the Invention to the Public Domain

Lastly, it is important to note that an independent inventor must contribute the same thing as the patentee, which is to disclose the invention into the public domain. It is not enough that the same invention would be independently conceived—society does not receive the invention in perfect competition unless it is disclosed. Thus, an inquiry into independent invention must further ask: “When would the independently conceived invention have been fully disclosed into the public domain?”

The public disclosure requirement serves an additional function of preventing strategic use of the trade secret system. The trade secret system is another form of incentive for innovation.¹³⁰ If General Motors invented a new method of manufacturing cars cheaply, it can enjoy rents either by patenting the method or by using the method in secret and gaining a competitive advantage—both serve to encourage research into new assembly methods. Disclosing the invention in a patent, however, means the invention will fall to the public domain in 20 years. A trade secret, by contrast, can last indefinitely. For this reason, an inventor who files for a patent

¹²⁸ See Barton, *supra* note 6, at 492 (noting that “there are industries in which the level of research is set by economic forces, and then patents are obtained on the basis of whatever invention has occurred”).

¹²⁹ See *infra* Part IV.B.3 (discussing proving independent invention in actual litigation).

¹³⁰ See *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 493 (1974) (finding that encouragement of innovation is a policy objective of trade secret law).

will have priority over one who keeps the invention a trade secret, even if the trade secret holder was the first to conceive.¹³¹ This creates the effect that a prior inventor who keeps an invention a trade secret will not only lose the trade secret, but will also be excluded from the market if a patent issues to a competitor.¹³²

The trade secret holder thus has the same incentive as a patent race rival—to disclose his trade secret and pass it off as an “independent” invention to invalidate the competitor’s patent and avoid being excluded from the market. The problem with this type of strategic disclosure is the same as in the patent-racing context: If the patent had not been available, there would have been no incentive to disclose the trade secret. We thus need to separate the purported independent inventor who is really a trade secret holder in disguise from the true independent inventor who would have dedicated the invention to the public domain regardless of whether a patent was available.

In reality, this inquiry is difficult because an invention starts as a trade secret by default, it remains a trade secret absent disclosure,¹³³ and no one but a mind-reader can determine with certainty why a purported independent inventor is disclosing his invention.¹³⁴ But just as a patent seeking inventor is unlikely to voluntarily subject himself to a statutory bar if unaware of a rival winning the patent race, so too an opportunistic trade secret holder is unlikely to voluntarily disclose his trade secret if he is not aware of an imminent patent on the same invention.

¹³¹ 35 U.S.C. § 102(g) (2000); *Palmer v. Dudzik*, 481 F.2d 1377, 1385–86 (C.C.P.A. 1973).

¹³² *See* *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1550 (Fed. Cir. 1983) (“As between a prior inventor who benefits from a process by selling its product but suppresses, conceals, or otherwise keeps the process from the public, and a later inventor who promptly files a patent application . . . the law favors the latter.”); *see also* *Apotex USA, Inc. v. Merck & Co.*, 254 F.3d 1031, 1038 (Fed. Cir. 2001).

¹³³ Howard T. Markey, *Why Not the Statute?*, 65 J. PAT. OFF. SOC’Y 331, 333 (1983).

¹³⁴ This is not a problem for some inventions that are self-disclosing. For example, the idea of an online auction, such as eBay, becomes understood by anyone who sees it in public use. In such cases, the trade secret holder cannot enjoy secret rents. *See generally* Katherine J. Strandburg, *What Does the Public Get? Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 107–11 (2004) (exploring the patent system’s differing incentives for self-disclosing and non-self-disclosing inventions).

Independence from the trade secret system can thus be proven by requiring disclosure of the invention while the independent inventor is ignorant of the patentee.

In summary, independent invention is the time when another inventor will *disclose* the same invention to the public domain, while ignorant of the patentee and the patentee's disclosure, and without intending to file for a patent himself on the invention.

IV. OBJECTIONS AND COMPLICATIONS

A. *The Affect on Incentives*

An important consideration for any change to the patent system is how patent incentives would be affected. By this I do not mean whether it will generally enhance or reduce the incentive for research *per se*. Patents generally increase the incentive for research.¹³⁵ The question is whether the incentive is *optimal* in light of the costs of patents.

A patent is in the nature of a unilateral offer for contract between society and inventors.¹³⁶ Society promises that if an inventor accelerates and discloses an invention that creates more social benefits than costs, society will reward the inventor with a patent of fixed term and scope. In many ways, this is no different than the government promising that a contractor who builds a fighter plane capable of flying at 2,000 mph will receive \$100 million dollars. Society must offer sufficient reward—in longer and broader patents that create more monopoly rent, or simply in cash—such that a firm can justify the investment in research—in fighter planes or anything else.¹³⁷ At the same time, society has

¹³⁵ This should be qualified somewhat. When there are many overlapping patents, the transaction costs of the patent system may reduce the incentives for research. This is often referred to as the "patent thicket" problem. *See, e.g.,* Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 *SCIENCE* 698, 698–99 (1998); Chris Holman, *Clearing a Path Through the Patent Thicket*, 125 *CELL* 629, 630 (2006).

¹³⁶ *Cf. Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 150–51 (1989) ("The federal patent system . . . embodies a carefully crafted bargain for encouraging the creation and disclosure of new, useful, and nonobvious advances in technology and design in return for the exclusive right to practice the invention for a period of years.").

¹³⁷ At the same time, broader scope and longer term increases the cost under

no reason to subject itself to a losing bargain. A condition of the patent contract should be that social benefits must exceed social costs. I shall call this the “patentability condition,” and it corresponds to the formula in Equation 3.

The patent contract offered to inventors has additional terms, most importantly the patent length and breadth. Optimizing the patent term and scope is complex.¹³⁸ Longer patents may create such enormous incentives that research funds are diverted from other places where they could have been more socially efficiently invested (a cost); at the same time, those same incentives may cause inventions to be created earlier such that the patent expires earlier (a benefit).¹³⁹ The test for patentability, however, is not concerned with the optimization of the patent contract. The patent term and breadth are *fixed* under other provisions of the statute.¹⁴⁰ Welfare effects flowing from these additional conditions, such as the benefit of early patent expiration,¹⁴¹ are therefore not considered under Equation 3.

Determining the validity of patents—either in the patent office or in litigation—is concerned only with whether the patent contract (including the patentability condition) has been satisfied. Validity analysis should not alter the overall patent bargain itself. Determining whether an invention should be patentable is thus no different from determining whether any seller has satisfied the terms of his contract, for example, whether a proffered plane really travels at 2,000 mph. Society

Equation 3 because the monopoly is both broader and longer-lasting after independent invention. As such, a firm wishing to meet the criteria under Equation 3 must devote even more resources, to achieve even earlier invention, in order to meet the criteria of Equation 3 for a longer-term patent. An equilibrium may be achieved where patent research is beneficial; or it may be that achieving a sufficiently early value of P and E to satisfy Equation 3 is not worth the increased cost of research under any circumstance—assuming a constant value of I throughout—in which case the equilibrium result is simply that everyone, including the patentee, is better off if we wait for independent invention and the patentee makes no investment.

¹³⁸ See generally Gilbert & Shapiro, *supra* note 109.

¹³⁹ Duffy, *Rethinking the Prospect Theory of Patents*, *supra* note 102, at 466–68.

¹⁴⁰ See 35 U.S.C. § 154 (Supp. II 2002) (term of a patent); 35 U.S.C. § 271 (Supp. III 2003) (defining patent infringement); 35 U.S.C. §§ 281–289 (2000 & Supp. II 2002) (providing remedies for infringement).

¹⁴¹ See generally Duffy, *Rethinking the Prospect Theory of Patents*, *supra* note 102.

has the option to reject unpatentable inventions just as a buyer who receives goods delivered by a seller has the option to reject nonconforming goods.¹⁴² Assuming that the statutory patent term and breadth achieves a given cost-benefit balance, the question is whether subsequent application of the patentability test distorts the balance already achieved.

In a world of certainty, market-participant research firms will themselves determine the correct allocation of resources for research in light of the bargain offered by the patent system.¹⁴³ A research firm will not undertake research unless it can achieve the invention at a sufficiently early time for P and E (expiration being dependent on filing) such that the resulting invention satisfies the patentability condition.¹⁴⁴ Enforcing the patentability condition of Equation 3 then offers optimal incentives, as does enforcement of any other freely negotiated contract. Including the patentability condition as part of the contract was also efficient, as above, because society has no reason to grant patents that diminish welfare, while it should certainly encourage patents for inventions that enhance welfare.

The complication is uncertainty. Firms must predict the eventual values of the variables in Equation 3: the cost of research and the corresponding monopoly rent they will get. These predictions must be made at the time of deciding to make investments in research—but the payday comes when the invention is complete. Inevitably some predictions will be wrong. How is this risk to be allocated?

As a general rule, the risk of mistake should be allocated to the party best able to avoid the mistake, or, if the mistake cannot be reasonably avoided, to the superior risk-bearer.¹⁴⁵ Here, the mistake can be of two kinds. First, the research firm may misestimate any of the variables, resulting in the research being more costly, the invention created being unpatentable under Equation 3, or the monopoly rent being less than projected.¹⁴⁶ All

¹⁴² U.C.C. § 2-601 (2004).

¹⁴³ Cf. R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 2–3 (1960) (describing market allocation in zero transaction cost environment).

¹⁴⁴ Additionally, the research firm will also undertake research only if Equation 3 can be satisfied at a sufficiently low research cost for the firm such that the firm makes more in expected monopoly rent than it expends in research costs.

¹⁴⁵ See RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* § 4.4 (7th ed. 2007).

¹⁴⁶ Or vice versa, i.e., the invention is even more profitable than initially

of these mistakes are more easily avoided by the research firm. On the other hand, the mistake can also be made by the Patent Office or the court deciding whether the invention is patentable; that is, one could wrongfully reject the patent. The research firm can do relatively little about Patent Office mistakes. If it were possible, this risk should be allocated on the Patent Office.

It is not possible, however, to make the Patent Office or its examiners pay directly for their mistakes.¹⁴⁷ The risk can only be directly allocated to the research firm or to consumers.¹⁴⁸ While the research firm can do little to correct Patent Office errors, it can probably do more than consumers can—by exerting political pressure on the Patent Office *ex post* as described in Part IV.B.1. As for the superior risk-bearer, risk for research firms is ultimately borne by the firm's shareholders, who can diversify the risk in capital markets. The risk for consumers depends on the nature of the patent at issue; while consumers are usually diversified, a single patent may affect only a segment of consumers. At a minimum, there is no reason to prefer reallocating the risk from diversified shareholders to consumers. On balance, the entire risk is more appropriately allocated to the research firm.

B. *Difficulty of Determining Variables*

1. The Advantage of Ex Post Verification

As with any theoretical standard, applying the theory to reality requires empirical data that is not usually available. The key variables of benefit, cost, and timing of independent invention are difficult to predict before the patent is issued. It is important, however, to emphasize that a key advantage of the objective test described in this Article over the traditional "ingenuity" test is that the variables can be determined at all. The traditional test of whether a *hypothetical* person *would have*

thought. The potential variance is the economic concept of risk.

¹⁴⁷ See *Barr v. Matteo*, 360 U.S. 564, 571–74 (1959) (holding that government employees enjoy absolute immunity for their official conduct).

¹⁴⁸ Consumers suffer higher prices and reduced output from wrongfully patented inventions. Competitors and potential competitors also split some of the loss with consumers for a wrongful patent. However, these competitors are not in a materially different position than the patentee.

found a given invention "obvious" is an inquiry inherently incapable of verification. One may disagree with the opinion of a judge, juror, examiner, or expert on the issue, but that opinion cannot be objectively disproved.

In contrast, the costs, benefits, and timing of independent invention are facts capable of real-world verification. If the Patent Office predicts that independent invention will occur in two years for an invention and rejects the patent on that basis, in two years we can see whether the Patent Office predicted accurately. In the long-run, the Patent Office will be able to adjust its projections in light of past experiences. While we may not have *perfect* information for *every* patent application even after patent expiration—for example, we cannot be sure of the precise timing of independent invention if a patent is granted since the patentee's disclosure might preempt the emergence of actual independent inventors—we can use statistical studies across large samples to determine the overall performance of the patent system. Are there too many patents that later prove invalid? Or are patent applications routinely rejected using projections that later turn out to be incorrect?

Verification allows political accountability because repeat-players in the patent system have a keen interest in correct outcomes. If the Patent Office and courts systematically under-predict benefits, over-predict costs, and estimate independent invention occurring sooner than what eventually turns out to be the case, research firms such as pharmaceutical companies will surely bring political pressure to correct this trend using empirical evidence of the errors. On the other hand, if the Patent Office and courts systematically over-predict benefits, under-predict costs, and estimate independent invention occurring later than what eventually turns out to be the case, frequent accused infringers such as software firms and generic drug companies will likely bring the same political pressure to bear.

Of course, the patentability test is not just a matter of *ex post* verification. The validity of a patent must be decided before the evidence is fully available. It is useful to separately discuss the problems at the two stages of an obviousness determination: the initial patent office determination of whether a patent should be granted and subsequent disputes over the patent's validity.

2. Validity Determinations in Initial Examination

A prospective estimation of the likely benefits and costs of a patent will be difficult for the overwhelming majority of patents before they issue.¹⁴⁹ In practice, this means that the Patent Office should not even attempt such an estimation for most patents because the average patent is likely to have no value or cost of any significance that justifies such expenditure of administrative resources to examine it.

The consensus among economists and antitrust scholars is that the overwhelming majority of patents grant no economic rents of any significance.¹⁵⁰ This is because while patents confer a legal monopoly, they do not necessarily confer an economic monopoly.¹⁵¹ Stated simply, most patents are on inventions that are either entirely useless, or at least readily substitutable. And without economic monopoly a patent has no value or cost. Obviousness analysis that is costly should not be undertaken for the run-of-the-mill patent with low expected cost and the patent should simply be granted.¹⁵² Such a laid-back attitude towards

¹⁴⁹ See Giles S. Rich, *The Proposed Patent Legislation: Some Comments*, 35 GEO. WASH. L. REV. 641, 642, 648 (1967) (noting that “[u]nder Graham, relevant factors to be considered in determining section 103 non-obviousness include several that will rarely exist until after the grant of a patent” and advocating the granting of borderline patents).

¹⁵⁰ See HERBERT HOVENKAMP, *FEDERAL ANTITRUST POLICY: THE LAW OF COMPETITION AND ITS PRACTICE* § 10.3c (2d. ed. 1999) (“[M]ost patents confer absolutely no market power on their owners.”); Jean Olson Lanjouw, *Patent Protection in the Shadow of Infringement: Simulation Estimations of Patent Value*, 65 REV. ECON. STUD. 671, 672, 675 (1998); Mark Schankerman, *How Valuable Is Patent Protection? Estimates by Technology Field*, 29 RAND J. ECON. 77, 79 (1998); see also *Ill. Tool Works, Inc. v. Indep. Ink, Inc.*, 547 U.S. 28, 31 (2006) (abrogating presumption of market power in the holder of a patent).

¹⁵¹ See Rapp & Stiroh, *supra* note 105, at 2 (“Most patents are worth only a little because while the inventions they disclose may be novel and useful, they are minor, ‘commodity inventions’ for which close substitutes exist.”).

¹⁵² The question may arise regarding why the default rule should be to summarily grant the patent instead of summarily rejecting the patent; since the average patent has neither much value nor much cost, a rational patent-seeking firm loses very little incentive if it loses only an asset with low expected value anyway. There are several responses, the most important being that the reexamination procedure and litigation provide second chances to invalidate the wrongfully-issued patent that later turns out to be very costly to society, but there is no mechanism for subsequently granting a wrongfully rejected patent that years later turns out to be very valuable (assuming that the patent applicant gives up after the rejection due to the low ex ante expected return). See *infra* note 170.

examination, of course, will result in the occasional wrongfully issued patent that, contrary to initial expectations, eventually becomes very costly.¹⁵³ But unless the costly patent can be cheaply identified *ex ante* for serious examination, society will be better off overall with the occasional costly patent and low administrative costs for patent examination.¹⁵⁴

This does not necessarily mean, however, that we should disband the Patent Office and grant every patent application that comes. There are some patent applications that can be easily identified as likely to create large monopoly costs because they will confer true economic monopolies: A miracle drug that cures cancer is likely to fall into this category. These are the patent applications where an effort should be made to estimate future benefits and costs.¹⁵⁵ Luckily, within this narrow category of patent applications, there is reason to think that they generally will be capable of at least a rough estimation of their future benefits and costs. After all, the future potential monopoly cost has been roughly estimated as large already.¹⁵⁶ Undoubtedly in some cases there will be an invention where we can only generally predict that demand for an invention will be

¹⁵³ Such a lax approach to patent examination would call into question whether an issued patent should retain its presumption of validity that can only be overcome by clear and convincing evidence. See 35 U.S.C. § 282 (Supp. II 2002); *Am. Hoist & Derrick Co. v. Sowa & Sons, Inc.*, 725 F.2d 1350, 1360 (Fed. Cir. 1984); *cf. KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1745 (2007) (questioning the application of the presumption of validity when the relevant prior art was not before the Patent Office).

¹⁵⁴ See Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1510–11 (2001).

¹⁵⁵ Indeed, the limited empirical evidence available indicates that *ex ante* identification of valuable patents while they are still in the Patent Office may be quite common even today. See John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 438 (2004) (finding that *ex post* valuable patents tend to “cite more prior art,” “spend longer in prosecution,” and “contain more claims than ordinary patents”).

¹⁵⁶ To be sure, the relationship between the administrative cost of examination and our ability to estimate the future benefits and costs of an invention is not an independent one. That is, making an estimate, as part of the obviousness inquiry, increases the administrative cost of examination and implies that a difficult-to-apply standard of obviousness will decrease the number of patent applications that are seriously examined. At the same time, even without the increased cost of applying a complex obviousness standard, most patent applications will likely have sufficiently low expected cost of monopoly to not justify serious examination effort to reject them. See Lemley, *Rational Ignorance at the Patent Office*, *supra* note 154, at 1508–11.

strong, without any capability of even beginning to guess as to how strong, but such cases will likely be rare. Thus, the initial daunting problem of complete inability to determine the future costs and benefits of a patent poses a problem only rarely for the patents where it matters.

The other key variable—the timing of independent invention—also requires prospective estimation. Because an independent inventor necessarily does not seek a patent for his invention, the Patent Office will rarely have actual evidence of subsequent independent invention.¹⁵⁷ In the usual case, the only thing a patent examiner can do is make the hypothetical inquiry described in Part III: When would an independent inventor have disclosed the invention to the public domain?

Relevant factors to consider in this hypothetical inquiry will likely include the following: (1) the resources available to a hypothetical independent inventor—general knowledge, printed publications, and patents, except those derived from the patentee and strategic disclosures by rivals;¹⁵⁸ (2) the number of potential independent inventors—people of skill in the relevant field, excluding those who would seek a patent or trade secret for such an invention; (3) the differences between the prior art in (1) and the invention; (4) the difficulty and amount of work that would be required to achieve the invention; and (5) the general pace of scientific progress in the field and any special progress leading to the invention, independent of the patent system. The parallel with the *Graham* factors is evident.¹⁵⁹ The underlying evidence is therefore not materially different from that which is currently used to determine obviousness. Of course, the analysis is very different because the timing of independent invention is an objective fact whose accuracy can be verified later.

For most inventions, even very valuable ones, a rough estimate of costs and benefits is all we need, depending on when independent invention occurs. If independent invention will occur within one year of patentee invention, the benefits in that one year must outweigh nineteen years of monopoly cost—a difficult proposition to meet. Similarly, if independent invention

¹⁵⁷ The only way it could happen is if the patentee or the examiner fortuitously discovered the independent inventor's work during the patent examination process.

¹⁵⁸ See *infra* Part V.B.

¹⁵⁹ See *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

occurs nineteen years after invention, even rough calculation will likely show the benefits over nineteen years greatly outweighing one year of monopoly cost. And if independent invention is projected to occur after the patent expires, a further calculation of cost is not necessary. While there will be close cases where the rule is difficult to apply, an objective test that reaches the correct result in most cases is in all events better than the current "ingenuity" test, which is misaimed from the beginning and likely equally difficult to apply in practice.

3. Validity Determinations in Litigation and Reexamination

The validity of a patent can be contested after issuance by three primary routes: litigation,¹⁶⁰ *ex parte* reexamination,¹⁶¹ and *inter partes* reexamination.¹⁶² A patent can be challenged as many times—by different parties—as necessary before it is declared invalid,¹⁶³ though a party that previously lost in litigation cannot re-litigate validity under *res judicata* principles.¹⁶⁴ Repeated validity challenges may appear unfair to the patentee; however, it is no different than the unfairness arising from any other form of non-mutual collateral estoppel.¹⁶⁵ The patentee also receives offsetting advantages.¹⁶⁶

Determining the patent's validity after its issuance differs from the initial analysis in the Patent Office in two chief ways. First, we know that the patent is valuable because someone is willing to devote significant resources to contest its validity; most

¹⁶⁰ See 35 U.S.C. § 282(2) (Supp. II 2002) (providing an invalidity defense in an action for infringement).

¹⁶¹ See 35 U.S.C. §§ 301–307 (2000 & Supp. II 2002) (providing the procedure for *ex parte* reexamination).

¹⁶² See 35 U.S.C. §§ 311–318 (2000 & Supp. II 2002) (procedure for *inter partes* reexamination).

¹⁶³ A judgment of invalidity will bind the patentee through non-mutual collateral estoppel. See *Blonder-Tongue Labs., Inc. v. Univ. of Ill. Found.*, 402 U.S. 313, 350 (1971) (overruling the mutuality requirement of *Triplett v. Lowell*, 297 U.S. 638 (1936)).

¹⁶⁴ Similar principles apply to *inter partes* examination. See 35 U.S.C. §§ 315(c), 317(b) (2000 & Supp. II 2002).

¹⁶⁵ See *Parklane Hosiery Co. v. Shore*, 439 U.S. 322, 330–31 (1979).

¹⁶⁶ For example, the patentee in litigation receives a presumption of patent validity. 35 U.S.C. § 282 (2000). This presumption must be overcome by clear and convincing evidence of invalidity. *WMS Gaming, Inc. v. Int'l Game Tech.*, 184 F.3d 1339, 1355 (Fed. Cir. 1999).

typically, this “someone” will be an accused infringer.¹⁶⁷ Second, in the time between the initial grant and the second look, more information becomes available. The existence of an accused infringer will usually provide a wealth of data about the benefits of the invention. For example, an invention that allowed General Motors, as an infringer, to lower the cost of making a car by \$100 will create that amount of consumer surplus, less the cost of a license.¹⁶⁸ Moreover, in this period there may be an actual independent invention.

As an initial matter, we may question whether such subsequent information should be considered as part of litigation. Courts routinely struggle with the difficult question of whether subsequent events that show error in an initial projection should be admissible.¹⁶⁹ This has particular salience in the obviousness test because validity can be challenged repeatedly. If subsequent information can be considered, a patent granted based on information available in 2000 may be invalidated by information available in 2007; on the other hand, a patent rejected based on information available in 2000 will remain rejected forever—absent still-pending appeals, the patent application cannot be “revived” even if the information in 2007 indicates that it should

¹⁶⁷ In litigation, both the patentee and the accused infringer must expend significant amounts in legal fees. Even *ex parte* reexamination requires the third-party requester to locate prior art, prepare a submission to the patent office detailing why the patent is invalid, and obtain the PTO Director’s certification that there is a “substantial new question of patentability.” 35 U.S.C. §§ 302–03 (2002).

¹⁶⁸ In this sense GM is the “consumer” of the invention, though it will also pass some of the surplus to the ultimate consumers through reduced prices. I am assuming, of course, that the invention can be implemented without any cost at all except the cost of a license from the patentee.

¹⁶⁹ Compare *Okerlund v. United States*, 365 F.3d 1044, 1051–52 (Fed. Cir. 2004) (finding no error in the district court refusing to admit evidence that an expert’s tax valuation prediction turned out to be wrong) and *Morris v. Comm’r*, 761 F.2d 1195, 1201 (6th Cir. 1985) (“[T]he measure of the tax must be determined according to the situation as it existed on the date [in question], and not according to subsequent events . . .”), with *First Nat’l Bank of Kenosha v. United States*, 763 F.2d 891, 894 (7th Cir. 1985) (holding that evidence of later actual sales prices was admissible).

have been granted.¹⁷⁰ This asymmetry leads to a bias toward invalidity if subsequent information is considered.

While the invalidity bias is a real problem, the reason to consider subsequently available information is compelling: obviousness analysis likely cannot be done otherwise. An accurate determination of future costs and benefits based solely on the information available prior to patent issuance will be difficult and uneconomical for the vast majority of patents.¹⁷¹ Few inventions have a readily foreseeable market at the time of patent issuance, one that would permit estimations of consumer surplus and monopoly cost. A rule of evidence that excluded all post-issuance—or, more extremely, all post-conception—information will likely reduce the patent system to little more than a random lottery since the data necessary to make an informed judgment of patentability simply is not available at that early time for most inventions.¹⁷²

Accepting that subsequent events informing the valuations of benefit, cost, and independent invention must be considered, how should they be analyzed? If the patentee practices the

¹⁷⁰ Historically, in the U.S. patent system a patent could never be completely and finally rejected. See Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. REV. 63, 64 (2004). In response to a nominally “final” rejection, the applicant faced the choice of abandoning the prosecution or paying a new fee to keep going. See 37 C.F.R. §§ 1.113–1.114 (2006). Very recently, the PTO enacted new rules that require permission to keep going after the fourth “final” rejection, without which the applicant would be denied priority to the original filing date. Changes to Practice for Continued Examination Filings, Patent Applications Containing Patentably Indistinct Claims, and Examination of Claims in Patent Applications, 72 Fed. Reg. 46,716, 46,841 (Aug. 21, 2007) (to be codified at 37 C.F.R. pt. 1). Whether under the old or new rule, there is no reason for the applicant to pay a new fee unless there is some prospect of overcoming the rejection and a final rejection was thus designed to provoke abandonment by the applicant. An abandoned application can only be revived in very limited circumstances. See 37 C.F.R. § 1.137 (2006). The later-demonstrated incorrectness of the rejection that provoked the abandonment is not one of those circumstances.

¹⁷¹ See *supra* text accompanying notes 150–154.

¹⁷² It is notable that the current law considers many later developments in determining obviousness, under the rubric of “secondary considerations.” Secondary considerations include, for example, later copying of the invention by others. *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1572 (Fed. Cir. 1996). They also include later commercial success of the invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Though rarely invoked, subsequent independent invention by others is also occasionally considered as a secondary consideration. See *infra* Part V.A.1.

invention, the patentee's own sales and profits will provide important information on supply and demand for the invention, laying the foundation for estimates of $B(t)$ and $C(t)$. The presence of an accused infringer provides more of the same type of information. While we cannot have a perfect estimate of the cost of monopoly unless the patentee actually manages to exclude competitors (or charge them license fees), having established markets allows economic experts to make estimates of the relevant variables; such expert market analysis is routine in antitrust cases.¹⁷³

The most important subsequent development occurs if actual independent invention takes place. As defined previously, an actual independent invention takes place if another inventor creates the same invention (1) without contribution from the patentee or anything derivative of the patentee, (2) without intending to patent the invention, and (3) dedicates the invention to the public domain while remaining ignorant of the patentee.¹⁷⁴ The occurrence of actual independent invention sets the maximum value for I .¹⁷⁵ The earlier I is, the less time there is to accrue benefit and the more time there is to accrue cost. Thus if the invention is unpatentable using the time of actual independent invention as I , it cannot be patentable if I was an earlier value. An accused infringer, therefore, should strive to demonstrate independent invention—including by pointing to his own activities if they were done without contribution from the patentee. The challenge is to define the criteria for admissible evidence.

Of the three conditions of independent invention, dedication to the public domain is easiest to ascertain. An invention can be dedicated to the public domain in manifold ways, such as by publishing the idea or publicly demonstrating the idea to others.

¹⁷³ See 2 PHILLIP E. AREEDA, ROGER D. BLAIR & HERBERT HOVENKAMP, *ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION* ¶ 393 (2d ed. 2006). The expert testimony is concededly less than perfectly reliable. However, the objective nature of the inquiry at least allows meaningful analysis and cross-examination.

¹⁷⁴ See *supra* Part III.B.

¹⁷⁵ In a world without patent incentives, independent invention may have occurred earlier, such as by another inventor who in reality discontinued research upon learning of the patentee's disclosure; but there is no reason independent invention would have occurred later in a hypothetical world than in reality.

Because there is a required element of publicity, the evidence is usually easily verified. The requirements of independence from the patentee and the patentee's disclosure, and demonstrating ignorance up to the time of dedication, are more difficult to prove because the purported independent inventor must demonstrate a negative. This difficulty can be overcome by rigorously documenting the sources of information received by researchers and publication committees. In this respect, it is notable that firms already routinely instruct their scientists not to search patents for fear of willful infringement liability.¹⁷⁶

The biggest problem is determining whether the purported independent inventor is truly independent from the patent system; that is, whether he had intended to patent the invention and only abandoned that plan upon discovering that another inventor had already won the race. This problem arises because patent applications can be filed up to one year after disclosure.¹⁷⁷ Thus, the mere fact of disclosure does not necessarily reflect an intent to forgo patenting; only the expiration of the one-year grace period raises a 102(b) statutory bar.

To conclusively establish non-reliance on the patent system, the independent inventor would have to disclose the invention without knowledge of the patentee's disclosure and fail to file a patent for one year while still remaining ignorant of the patentee's disclosure for the entire period. In cases where this occurs, there is no problem; we have a genuine independent inventor. But a per se requirement that the purported independent inventor remain ignorant for one entire year after public disclosure would permit strategic behavior by the patentee: A patentee could strategically prevent evidence of an otherwise genuine independent invention from emerging by specifically disclosing his patent to the independent inventor during the one year period.

The assessment of non-reliance in circumstances where the subsequent inventor receives knowledge of the patentee within one year after disclosure must depend on a factual

¹⁷⁶ Mark A. Lemley & Ragesh K. Tangri, *Ending Patent Law's Willfulness Game*, 18 BERKELEY TECH. L.J. 1085, 1100-01 (2003) ("[I]n-house patent counsel and many outside lawyers regularly advise their clients not to read patents if there is any way to avoid it.").

¹⁷⁷ See 35 U.S.C. § 102(b) (2000).

determination. If the subsequent inventor appears to have made the disclosure as a prelude to patent filing (for example, the disclosure touts the invention as a tremendous improvement over the prior art), that cannot be considered a genuine independent invention. In contrast, a firm intending to market a product that it independently invented—and wishing to prevent an unknown patentee from strategic ex post disclosure within one year—might publicly renounce the option of filing a future patent application to preserve its independent inventor status.¹⁷⁸ Another method would be filing a statutory invention registration, which discloses the invention but waives the right to patent protection.¹⁷⁹ Firms uninterested in patent protection might also publicize a corporate policy that the firm will not seek patents; a longstanding policy of such nature may provide sufficient reliability to be given credence.

Against the potential strategies outlined above for independent inventors wishing to preserve their status, a strategy remains available to the patentee to preempt independent invention. The patentee can make it impossible to remain ignorant of his patent by saturating the field with knowledge of his patent. This strategy will effectively prevent the emergence of harmful evidence of actual independent invention because any conception will not be demonstrably independent of the patentee. This patentee strategy is less problematic, however, because society receives many collateral benefits from widespread publicizing of a patent. For example, a patentee who publicizes his patent will find it more difficult to practice the widely-criticized “troll” strategy, where the holder of a patent over a small component waits until an industry sinks large investments in a product incorporating the component and then asserts the patent to extort the value of avoiding forfeiture of that investment.¹⁸⁰ Widespread knowledge of the patent impedes this strategy because potential infringers would not, ex

¹⁷⁸ An abandonment of the invention renders it unpatentable. 35 U.S.C. § 102(c).

¹⁷⁹ See 35 U.S.C. § 157 (2000).

¹⁸⁰ See generally Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991 (2007) (discussing the troll strategy).

ante, sink large investments into a product if it anticipated being excluded from the market later.¹⁸¹

C. *The Confiscation Problem*

Once the variables are determined, inevitably some patent applications will result in rejection. For example, the Patent Office may determine that independent invention will occur in five years and the benefits in the meantime do not justify a patent due to large costs after independent invention occurs. What happens in the five years until independent invention arrives? Do we publish the application so that we can have the invention today?

Initially, the temptation to confiscate may be strong. Because we are rejecting the patent, the incentive effect of the patent system is already lacking. The next inventor contemplating researching a similar invention—in the sense of similar economic risk, cost, and benefits rather than technical similarity—will have a lower incentive to seek a patent whether or not we publish the rejected patent application. Even if the rejection was incorrect, the risk of wrongful rejections is best placed on the patentee to provide incentives for patentees to apply political pressure on the Patent Office to minimize future errors.¹⁸²

The problem with this analysis is that it ignores the incentives and benefits of the trade secret system. A rejection of the patent under the test in Part III indicates that the acceleration benefits do not outweigh the costs of a *patent*, nothing more. The inventor, however, may still create more benefits for society with a trade secret than the cost of a trade secret.¹⁸³ By disclosing the application while denying the patent,

¹⁸¹ *But see id.* at 2003–05 (suggesting that even prior knowledge of a somewhat valuable but likely invalid patent would still result in an inflated royalty). One statutory change that would increase this benefit would be to change the marking requirement, 35 U.S.C. § 287 (2000), to require marking on publications disclosing a patented idea. Under current law, the patentee can saturate the field with a publication such as a scientific article that preempts future independent inventors, but practice the troll strategy if other firms do not realize that the idea in the article has been patented.

¹⁸² *See supra* Part IV.A.

¹⁸³ Because a trade secret evaporates upon public disclosure, the value of E (by analogy) would be the same as I , rendering $\int^E C(t)$ always equal to zero for trade

we would be confiscating the trade secret rents and thus the trade secret incentive.

Should the patentee have the option of returning to the trade secret system if his foray into the patent system is unsuccessful? In an environment of uncertainty, permitting an inventor to revert to the trade secret system if the patent application is rejected can be efficient, as the following hypothetical demonstrates. Assume that an invention costs \$100 to develop by time P , that independent invention will occur 5 years after P , and that the consumer surplus between P and I is \$70 whether the invention is used as a trade secret or patented. Assume also that the monopoly rent between P and I will be \$75 whether the invention is patented or kept secret, but that the monopoly rent between I and E is \$60 and is only available if the patent is granted (if the patent is rejected, the rent after I is zero). Finally, assume that the patentee believes that there is a 50% chance the examiner will correctly determine the cost after I to be \$65 (allowing the patent), and a 50% chance the examiner will determine the cost to be \$80 (rejecting the patent). The patentee intends to file an application upon conception, and the Patent Office will make a decision immediately.

If we allow the patentee to revert to the trade secret system in the event of patent rejection, the patentee's expected payoff is \$105.¹⁸⁴ The patentee will therefore undertake the research and produce the invention, creating an expected social benefit of \$37.50.¹⁸⁵ On the other hand, if we do not allow the patentee to revert to the trade secret system—forcing the patentee to

secrets. This does not mean that the trade secret system is superior to the patent system. In cases where the patent expires before independent invention occurs, a patented invention will fall into the public domain sooner than a trade secret, creating social benefits. See Duffy, *Rethinking the Prospect Theory of Patents*, *supra* note 102, at 444–45, 467.

¹⁸⁴ There is a 50% chance of entering the trade secret system for a payoff of \$75 and a 50% chance of receiving the patent for a payoff of \$135. $(\$75 \times 0.5) + (\$135 \times 0.5) = \$105$.

¹⁸⁵ $(\$70 - \$65) \times 0.5 + (\$70 \times 0.5) = \37.50 . It bears emphasis that this figure is somewhat artificial, because the trade secret system is not directly comparable to the patent system. See *supra* note 183.

choose—the expected payoff is \$75.¹⁸⁶ The patentee will thus not develop the invention at all.¹⁸⁷

The numbers can be changed to produce a situation where the confiscation of trade secret rents yields social benefits in the short run. If the value of the patent is high enough, and the risk of patent rejection low enough, and the value of the trade secret in comparison low enough, an inventor will surrender his trade secret rents for a ticket in the patent lottery. This potential situation, however, essentially increases the cost for inventors to enter the patent system, a cost that the same inventors will expect to recoup through higher monopoly profits.¹⁸⁸ Under Equation 3, a patent that is socially costly will already be rejected and forfeiting the firm's patent-related research costs maintains the overall incentive structure of the patent system. Forcing firms to surrender even more value, i.e., the trade secret rents not attributable to patent system incentives, reduces incentives and distorts the balance struck by Equation 3.

D. Delay Between Conception and Disclosure

In Part II.A, I defined the incentive benefit as accelerating the "invention." The benefit to society is the accrual of consumer surplus between the time of receiving the patentee's invention and the time when society otherwise would have received the same invention through an independent inventor. In more practical terms, however, society receives very little benefit from simple conception by the patentee. An invention usually requires a path of several steps: (1) the idea is conceived; (2) a working model is built; (3) a patent application is filed; (4) the idea is

¹⁸⁶ The patentee will choose the greater of the trade secret payoff (\$75) or the expected patent payoff ($\$135 \times 0.5 = \67.5). Because the trade secret payoff is greater, the patentee will not file for a patent.

¹⁸⁷ Changing the variables slightly, such as by increasing the monopoly rent between P and I from \$75 to \$101, will cause the patentee to develop the invention but not file for the patent if the patent system forces a choice.

¹⁸⁸ At first glance, offering trade secret holders the *option* of entering the patent system would appear to be a bad deal no matter what. The trade secret holder would presumably choose the higher reward, being whichever option earned the most in monopoly profits. Strandburg, *supra* note 134, at 112 ("[A]n inventor's choice to patent will ordinarily signify that patenting gives a longer period of exclusivity than trade secret protection."). One answer to this objection is that the disclosure provides the opportunity for others to improve upon the invention during the patent term, once it is disclosed. *Id.* at 112-13.

published in an article; (5) the patent is issued; and (6) the idea is embodied in a commercial product.¹⁸⁹ The delay between conception and eventual patent issuance creates the problem of defining a precise point for determining the value of P . When should the patentee receive credit for the accrual of consumer surplus?

Initially, the answer may appear that P should start at the time of conception. After all, the patentee cannot affect the time of independent invention, I , and thus any consumer surplus from the moment of conception is a benefit to society. The problem, however, with beginning the consumer surplus “clock” at conception is that it creates two perverse incentives: the incentive to delay disclosure and the incentive to delay filing a patent application.

The patent system is designed to encourage early disclosure and early filing. The most important reason is that filing sets the time for patent expiration.¹⁹⁰ Disclosure provides an incentive to file because filing must occur within one year of disclosure or the patent is forfeited.¹⁹¹ Incentives are needed to encourage early filing and disclosure because patentees have many reasons to delay filing as much as possible. For many inventions, the first few years are the least profitable because preparations must be made before a commercial embodiment can be sold: investors must be solicited, factories must be built or reconfigured, and, for pharmaceuticals, FDA approval must be obtained. More importantly, when an idea is first conceived, the inventor has a *de facto* monopoly over it as a trade secret. Absent disclosure or filing, this monopoly can last indefinitely through the trade secret system.¹⁹² Therefore, before either disclosure or filing occurs, the consumer surplus generated by the patentee’s invention is not attributable to the patent system’s incentives—it is a benefit of the trade secret system.¹⁹³ Accordingly, the consumer surplus accruing before either filing or disclosure has

¹⁸⁹ The steps are not necessarily always in this order; for example, the idea may be published before the patent application is filed.

¹⁹⁰ 35 U.S.C. § 154(a)(2) (2000) (setting expiration at 20 years from the filing of the earliest referenced application).

¹⁹¹ 35 U.S.C. § 102(b) (2002).

¹⁹² Markey, *supra* note 133, at 333.

¹⁹³ Strandburg, *supra* note 134, at 106 (noting that the trade secret system provides incentives to invent non-self-disclosing inventions).

occurred should not be considered in the balancing test of Equation 3, which is concerned with the benefits accruing from patent incentives.¹⁹⁴

It is also clear that after filing and disclosure have both occurred, any consumer surplus generated by the invention should be counted as part of Equation 3, even if the patent has not yet issued. The acceleration benefit of the patent system accrues even when the patent office is slow. The complication is in the two situations between the extremes: (1) when there is disclosure but no filing; and (2) when there is filing but no public disclosure.¹⁹⁵

What should the rule be when the patentee discloses the invention in an article but has not filed? Initially, one may very well conclude that this is no different from the situation of the inventor who neither discloses nor files; that is, the inventor is attempting to stretch out his monopoly by delaying the eventual expiration of the patent. Indeed, allowing the consumer surplus to begin accruing at the time of disclosure notwithstanding a later filing would create a strong incentive for an inventor to publish quickly after conception,¹⁹⁶ but also creates an equally strong incentive for the inventor to then wait exactly one year after publication before filing the patent application. The

¹⁹⁴ It should be noted that one policy implication is that the current 35 U.S.C. § 102(a) should be changed. Under 35 U.S.C. § 102(a), an inventor who conceives—but does not disclose—an invention before an independent inventor publishes the same invention can still obtain a patent, even if he files after the independent inventor discloses. This would yield no benefit, however, because P does not occur until disclosure or filing, meaning that P is later than I . Under Equation 3, the patent should never be granted if $P > I$. See *supra* note 118. Section 102(a) also makes it difficult to discern whether the patentee's disclosure was in good faith—we cannot tell whether the patentee had intended to keep the invention secret, filing only upon discovering the independent inventor's publication (though if the patentee was proven to be acting in such bad faith, he would lose priority under 35 U.S.C. § 102(g)).

¹⁹⁵ Under 35 U.S.C. § 122, a patent application is confidential for at least 18 months after filing. If the patentee certifies that he will not file for a patent on the invention overseas, the patent application can be kept confidential until issuance.

¹⁹⁶ Unlike every other major patent system, the United States is alone in having a first-to-invent priority system instead of a first-to-file priority system. 35 U.S.C. § 102(g). See *generally* *Falkner v. Inglis*, 448 F.3d 1357, 1361 n.2 (Fed. Cir. 2006), *cert. denied*, 127 S. Ct. 1151 (2007). Thus, the early publication of an article describing the invention—thereby preserving the evidence of early conception—is sufficient to establish priority entitlement to the patent even if a rival later files the first patent application.

inventor would thereby receive an effective 21-year monopoly because competitors will not invest in entering a market if they expected a pending patent to soon force them to forfeit that investment.¹⁹⁷

The difference is that the effective 21-year monopoly is the product of congressional choice. By enacting 35 U.S.C. § 102(b) and creating a one year grace period, Congress has essentially condoned the utilization of this mechanism in defining the patent term.¹⁹⁸ If Congress wishes to set the patent monopoly truly at 20 years—instead of the current effective monopoly of 21 years—it can do so in many ways: it can reduce the statutory term to 19 years and keep the one year grace period in section 102(b); it can keep the statutory term at 20 years and eliminate the grace period in section 102(b); or it can even change the statutory term to 19½ years and reduce the section 102(b) grace period to six months. There is no reason to use the test for obviousness to achieve indirectly what Congress could easily legislate directly and has chosen not to enact. Therefore, the time of disclosure would be the appropriate value for *P* when it is earlier than the patent application filing date.

What of the reverse situation, where the patentee has filed the patent application but has not publicly disclosed the invention? As stated previously, the incentives of the patent system are optimized when the entire consumer surplus before an independent invention is counted as a social benefit. Perverse incentives are not apparent: The patentee has opted out of the potentially indefinite trade secret monopoly because the invention will fall into the public domain when the patent expires. Although there is a benefit to having the patentee disclose the invention early for the progress of basic science, the specific invention will remain under a *de facto* monopoly whether or not there is disclosure.

¹⁹⁷ If competitors have actual notice of the pending application, the patent applicant may even be eligible for pre-issuance royalties upon patent issuance. See 35 U.S.C. § 154(d)(1).

¹⁹⁸ I am using the word “term” somewhat loosely here. Strictly speaking, the patent “term” is the period of time between patent issuance—not filing—and expiration. 35 U.S.C. § 154(a)(2). The patent expires at twenty years after filing. Thus, the technical patent “term” is 20 years *minus* the time taken prosecuting the patent. This term varies from patent to patent.

A second look, however, reveals countervailing considerations. There are at least three potential reasons why a patentee may wish to keep the invention secret despite filing. First, the cost of entry and exit in the market may be so low that competitors will choose to enter the market even if they must exit upon patent issuance. Thus, secrecy grants the patentee a temporary monopoly before issuance. Second, the patentee may conclude that it is more profitable to sue his rivals for infringement rather than to exclude them from the market, and secrecy encourages rivals to make sunk investments in an infringing product in the period before patent issuance. Third, the patentee can plausibly fear that his patent may be rejected and wish to retain the option of keeping the invention as a trade secret if no patent issues.¹⁹⁹

The first reason supports allowing the patentee to keep the invention secret until issuance. Were the rule otherwise, the patentee would be forced into a choice of either risking invalidity due to nothing more than the patent office's delay, or disclosing the application and compromising his exclusivity—effectively shortening the patent term due to the patent office's delay. Both options reduce the patentee's incentive for research.

The second reason is the modus operandi of so-called "patent trolls."²⁰⁰ Because the recovery from an ex post infringement suit can often exceed the royalty that is available through ex ante licensing,²⁰¹ a patentee can profit from accidental infringers who unknowingly sink investments in a product that is patented. By keeping the invention secret during the pendency of the patent

¹⁹⁹ See *Early Patent Publication: A Boon or Bane? A Discussion on the Legal and Economic Effects of Publishing Patent Applications After Eighteen Months of Filing*, 16 CARDOZO ARTS & ENT. L.J. 601, 613–14 (1998) (statement of Robert Rines).

²⁰⁰ See *supra* text accompanying note 180.

²⁰¹ This is because although patent infringement damages are calculated by reference to a "reasonable royalty," the calculation is often deliberately inflated above the level necessary to compensate the patentee. See, e.g., *Monsanto Co. v. McFarling*, 488 F.3d 973, 980 (Fed. Cir. 2007) (calculating reasonable royalty by considering the benefit to the infringer instead of the loss to the patentee). The permanent injunction also permits an inflated royalty to be recovered. *Lemley & Shapiro, supra* note 180, at 1991, 1996. The Supreme Court's recent decision in *eBay Inc. v. MercExchange, L.L.C.* gave district courts greater discretion to deny injunctions. 126 S. Ct. 1837, 1841 (2006). It remains to be seen whether this will substantially affect the profitability and effectiveness of the troll strategy.

application,²⁰² a patentee increases the chance that such accidental infringement will transpire.

There is little positive that can be said about allowing the patentee to keep his invention secret solely to lay a trap for the unwary. It is unlikely, however, that an incentive for early disclosure—by denying credit for consumer surplus generated before disclosure—would do much to alleviate the problem. The standard for a public disclosure in patent law is notoriously low, and a patentee can make a public disclosure under this standard with full confidence that an accidental infringer will never find it.²⁰³ Even published patents are rarely read,²⁰⁴ and it is by no means clear that articles disclosing inventions give notice that a patent is forthcoming on the same invention. And if published articles did have the effect of alerting readers to pending patents, the most likely result is that potential infringers would cease reading articles for fear of willful infringement liability, making a disclosure requirement ineffective.²⁰⁵

The third reason, that the patentee wishes to keep the backup option of reverting to the trade secret system if the patent is rejected, initially smacks of opportunism. Providing an option of reverting to the trade secret system, however, is likely beneficial.²⁰⁶ Although a rejection of the patent indicates that the invention did not create sufficient benefits to justify the cost

²⁰² Upon the patent's issuance, of course, the invention will be published. *Sessions v. Romadka*, 145 U.S. 29, 50 (1892) (noting that "all letters patent are recorded, with their specifications, in the Patent Office, a record which is notice to all the world"); see also *Boyden v. Burke*, 55 U.S. 575, 582 (1853) ("Patents are public records. All persons are bound to take notice of their contents.").

²⁰³ *In re Hall*, 781 F.2d 897, 899–900 (Fed. Cir. 1986) (holding that a single thesis in a university library is public disclosure); *In re Wyer*, 655 F.2d 221, 227 (C.C.P.A. 1981) (holding that an Australian patent application kept only on microfilm is public disclosure).

²⁰⁴ Douglas Lichtman, *Substitutes for the Doctrine of Equivalents: A Response to Meurer and Nard*, 93 GEO. L.J. 2013, 2022–23 (2005) (noting that few patents are ever actually read except in litigation or licensing); see also Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123, 142–46 (2006) (outlining reasons why potential infringers choose to remain rationally ignorant).

²⁰⁵ See Lemley & Tangri, *supra* note 176, at 1100–01. Alternatively, as Lemley and Shapiro have suggested, in cases of a likely-invalid patent on a valuable invention, the potential infringer may choose to deliberately infringe and then litigate the patent or pay an inflated royalty, even with prior notice. See Lemley & Shapiro, *supra* note 180, at 2003–05.

²⁰⁶ See *supra* Part IV.C.

of a patent, it may justify trade secret protection with lower costs. By rejecting the patent, the incentives for the patent system remain optimal even without disclosure.

In sum, the policy considerations generally favor defining *P* as the earlier of filing or disclosure. While the policy of deterring patent trolls gives some justification for a mandatory disclosure requirement, it would be difficult to separate the patent trolls from patentees who simply wished to have the option of reverting to a trade secret in the event of a rejection. Without persuasive evidence that a disclosure requirement would be effective against patent trolls, mandatory disclosure would likely do more harm than good.²⁰⁷

V. SUGGESTIONS FOR REFORM

The language of § 103 directs courts to consider “the differences between the subject matter sought to be patented and the prior art,”²⁰⁸ and codifies the standard as whether the invention is “obvious at the time the invention was made to a person having ordinary skill in the art.”²⁰⁹ Given this standard, a wholesale adoption of the test in Part III would be difficult to fit within the statutory formulation. Nevertheless, several doctrinal modifications are possible within the current statutory framework to conform patentability to the overall interest of the patent system in advancing long-term social welfare.

A. *Invalidating Patents Based on Subsequent Independent Invention*

1. Doctrinal Basis for Considering Independent Invention

Prior to the Federal Circuit's formation, its predecessor, the Court of Claims, had held that “[t]he fact of near-simultaneous invention, though not determinative of statutory obviousness, is strong evidence of what constitutes the level of ordinary skill in

²⁰⁷ One policy implication is that the publishing of pending patent applications after 18 months may not be beneficial. See 35 U.S.C. § 122(b). While publication might provide notice to competitors (if competitors do not fear willful infringement liability), it diminishes the incentives of patentees to enter the patent system in the first place.

²⁰⁸ 35 U.S.C. § 103(a) (2000).

²⁰⁹ *Id.*

the art.”²¹⁰ In one early decision, the Federal Circuit extended this doctrine so that even subsequent independent invention, just after the patentee, could be relevant to assessing obviousness.²¹¹ Regional circuit decisions pre-dating the Federal Circuit’s exclusive jurisdiction had similarly placed weight on subsequent independent invention.²¹²

The relevance of independent invention was drastically curtailed by the Federal Circuit’s 1984 decision in *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*²¹³ In *Lindemann*, the district court invalidated a patent primarily on the basis that “three individuals independently created the designs which resulted in development” of the claimed invention.²¹⁴ The Federal Circuit was not impressed:

Because the statute, 35 U.S.C. § 135, (establishing and governing interference practice) recognizes the possibility of near simultaneous invention by two or more equally talented inventors working independently, that occurrence may or may not be an indication of obviousness when considered in light of all the circumstances. In this instance, it clearly is not. Two of the three individuals were . . . the co-inventors listed on the ‘315 patent [the patent-in-suit]. The third was an Amhoist employee

²¹⁰ *Int’l Glass Co. v. United States*, 408 F.2d 395, 405 (Ct. Cl. 1969).

²¹¹ *In re Farrenkopf*, 713 F.2d 714, 719–20 (Fed. Cir. 1983) (“[Independent invention] occurred when the affiant would have had no motive to distort the truth and at a time which was nearly contemporaneous with (just after) appellants’ reduction to practice.”); see also *Concrete Appliances Co. v. Gomery*, 269 U.S. 177, 185 (1925).

The adaptation independently made by engineers and builders . . . and the independent patent applications, within a comparatively short space of time, . . . are in themselves persuasive evidence that this use, in combination of well known mechanical elements was the product only of ordinary mechanical or engineering skill

Id.

²¹² See, e.g., *Fred Whitaker Co. v. E.T. Barwick Indus., Inc.*, 551 F.2d 622, 628 (5th Cir. 1977) (“There is also evidence that at least two of Whitaker’s competitors, Pharr and Rossville, actually did try using continuous filament yarn in similar processes before learning about the Whitaker process and before the latter was patented in December 1961.”); *Custom Paper Prods. Co. v. Atl. Paper Box Co.*, 469 F.2d 178, 180 (1st Cir. 1972) (“[T]he facts that [defendant] made its machine without knowledge of Hincer, and did so in a relatively short time after it perceived a demand for a flared strip, are not ‘conclusive,’ but on the matter of obviousness these circumstances are not irrelevant.” (citation omitted)).

²¹³ 730 F.2d 1452 (Fed. Cir. 1984).

²¹⁴ *Id.* at 1460.

[the accused infringer] who claimed at trial to have proposed the split ram in January of 1979, more than five years after the invention was made by [plaintiff] Lindemann's assignors, nearly three years after the '315 patent issued, and well after Amhoist's employee Bleeland had in England observed and photographed a Lindemann shear embodying the claimed invention. Accepting, as we must, the district court's crediting of the testimony respecting independent suggestion by an Amhoist employee, that suggestion was simply too late to have been relevant to a determination of whether the invention would have been obvious at the time it was made²¹⁵

Although the Federal Circuit concluded with the statement that independent invention "may or may not be an indication of obviousness,"²¹⁶ it soon became clear that *subsequent* independent invention would rarely, if ever, become relevant to the obviousness determination.²¹⁷ In the next year, the Federal Circuit again held:

Development by others may also be pertinent to a determination of the obviousness of an invention; but the evidence presented was of activities occurring well after the filing date of the '926 patent application, and was not shown to apply to the time the invention was made, as required by 35 U.S.C. § 103.²¹⁸

Of course, independent invention that occurred prior to "the time the invention was made" would already invalidate the patent under 35 U.S.C. § 102, and thus independent invention ceased to be an important consideration in obviousness determinations.

Moreover, at the same time, the Federal Circuit began to insist upon a teaching, suggestion, or motivation as prerequisite proof for a *prima facie* case of obviousness.²¹⁹ As such,

²¹⁵ *Id.* at 1460–61 (citation omitted).

²¹⁶ *Id.* at 1460.

²¹⁷ Mark A. Lemley, *Should Patent Infringement Require Proof of Copying?*, 105 MICH. L. REV. 1525, 1534 (2007) (citing *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1380 n.4 (Fed. Cir. 1986)) ("[T]he Federal Circuit has minimized the significance of" subsequent independent invention.); see also Markey, *supra* note 133, at 337 (then-Chief Judge of the Federal Circuit expressing disapproval of giving "undue evidentiary weight to the virtually simultaneous making of the invention by more than one inventor").

²¹⁸ *Stewart-Warner Corp. v. City of Pontiac*, 767 F.2d 1563, 1570 (Fed. Cir. 1985) (citations omitted).

²¹⁹ See *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297

independent invention would only be relevant after the prima facie case had been successfully rebutted, when obviousness would be judged on the totality of the circumstances.²²⁰ A case where the prima facie case was established, rebutted, and the record contained relevant evidence of subsequent independent invention was predictably rare.

The exception that illustrated the rule finally arose in the 2000 case *Ecolochem, Inc. v. Southern California Edison Co.*²²¹ In *Ecolochem*, the district court found that there was a sufficient motivation to combine prior art references for one claim,²²² and the question considered by the Federal Circuit was whether the prima facie case of obviousness had been rebutted by secondary evidence.²²³ Against the patentee's secondary evidence of non-obviousness, the accused infringer submitted evidence of subsequent independent invention, upon which the district court relied.²²⁴ The Federal Circuit recognized that "[e]ssentially, the district court found that this secondary consideration factor favors obviousness"²²⁵ and affirmed with respect to the one claim where the prima facie had dissolved.²²⁶ At the same time, however, the Federal Circuit reversed the finding of obviousness with respect to other claims where it held there was no motivation to combine, without considering the evidence of independent invention.²²⁷

A rigid requirement of a teaching, suggestion, or motivation in every case relegated independent invention to a fringe doctrine. The Supreme Court in *KSR*, however, held that there need not be a rigid adherence to this requirement in every case, and in particular there is no need for a teaching to appear only in published articles or published patents.²²⁸ Rather, "design

(Fed. Cir. 1985); *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577 (Fed. Cir. 1984).

²²⁰ See *supra* text accompanying notes 52–57.

²²¹ 227 F.3d 1361 (Fed. Cir. 2000).

²²² *Id.* at 1364.

²²³ *Id.* at 1376.

²²⁴ *Id.* at 1379.

²²⁵ *Id.*

²²⁶ *Id.* at 1381.

²²⁷ *Id.* ("Given the absence of any proof of a motivation to combine, we hold that the remaining claims were not proven obvious . . .").

²²⁸ *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1741 (2007).

incentives and other market forces can prompt variations" in the prior art.²²⁹ Consideration of subsequent independent invention as a secondary factor would illustrate the real-life effects of such design incentives and other market forces.

2. Independent Invention as a Secondary Consideration

As the prior section demonstrates, independent invention is part of obviousness law, though its role has been largely forgotten due to the Federal Circuit's emphasis on proving a *prima facie* case of invalidity solely through prior teaching, suggestion, or motivation. If independent invention is accorded significant weight, the policy goals embodied in Equation 3 can be accomplished in many cases without substantially revising existing patent law. After all, if actual independent invention were to occur within one year, the consumer surplus within the first year would have to outweigh the monopoly cost in the 19 subsequent years to justify a patent, and such a lopsided benefit-cost ratio is unlikely for most inventions. Thus, the mere fact of independent invention within a short time of the patentee's conception would suggest a high likelihood of invalidity, without the necessity of delving into costs and benefits in many cases.

Independent invention, as defined in this Article, also assuages the concerns expressed by the Federal Circuit in *Lindemann*.²³⁰ Specifically, the *Lindemann* court articulated three concerns: (1) the patent statute contemplates that rival inventors could simultaneously invent, and establishes the interference procedure when two patent applications claim the same invention; (2) independent invention could be falsely claimed, even after the accused infringer has observed and photographed the patentee's product; and (3) independent invention may occur many years after the patentee files for the patent.²³¹

²²⁹ *Id.* at 1740.

²³⁰ By excluding patent race competitors from the mix, it also differs from the unmodified independent invention tests that have been proposed previously. See, e.g., Steven P. Smith & Kurt R. Van Thomme, *Bridge over Troubled Water: The Supreme Court's New Patent Obviousness Standard in KSR Should Be Readily Apparent and Benefit the Public*, 17 ALB. L.J. SCI. & TECH. 127, 204-08 (2007).

²³¹ See *Lindemann Maschinenfabrik GMBH v. Am. Hoist & Derrick Co.*, 730 F.2d 1452, 1460-61 (Fed. Cir. 1984).

There is no inconsistency between the interference procedure and independent invention as defined in this Article. The interference procedure governs when a subsequent inventor files a patent application for the invention.²³² An independent inventor, however, must not file a patent application. Indeed, to qualify as an “independent invention” as defined in Part III.B, the independent inventor must have demonstrably relinquished the option of filing a patent—through measures such as voluntarily creating a statutory bar to patenting—while remaining ignorant of the patentee and the patentee’s disclosure.²³³

The possibility of false claims of independent invention is overcome by the rigor of proof demanded. In *Lindemann*, the Federal Circuit displayed obvious skepticism that the subsequent invention was truly independent when the accused infringer had observed and photographed the patentee’s commercial product embodying the claimed invention.²³⁴ Indeed, such a claim would likely not meet the clear and convincing evidence standard required to prove invalidity.²³⁵ A rule that requires actual ignorance of the patentee and the patentee’s disclosure is probably inescapable.²³⁶ As noted in Part IV.B.3, the difficulty of demonstrating a negative—actual ignorance—can be overcome by carefully documenting the sources of information received by researchers and publication committees to show that the conception and the decision to dedicate the invention to the public domain were made while those involved had access to neither the patentee’s disclosure nor materials derivative of that disclosure.

²³² 35 U.S.C. § 135(a) (2000) (“Whenever an application is made for a patent which, in the opinion of the Director, would interfere with any pending application, or with any unexpired patent, an interference may be declared . . .”).

²³³ See *supra* Part IV.B.3.

²³⁴ *Lindemann*, 730 F.2d at 1461.

²³⁵ See *Am. Hoist & Derrick Co. v. Sowa & Sons, Inc.*, 725 F.2d 1350, 1360 (Fed. Cir. 1984). Even if the clear and convincing evidence rule is abandoned, see *supra* note 153, it is worth noting that independent creation in copyright law faces the same problem of verification, and yet independent creation of a copyrighted work need only be proven by a preponderance of the evidence. See, e.g., *Positive Black Talk, Inc. v. Cash Money Records, Inc.*, 394 F.3d 357, 372 (5th Cir. 2004) (citing *Granite Music Corp. v. United Artists Corp.*, 532 F.2d 718, 723–24 (9th Cir. 1976)).

²³⁶ See *supra* Part III.B.3.

Finally, the amount of time permissible between patentee disclosure or filing, i.e., *P*, and independent invention, *I*, is a matter of empirical research as to the typical distribution of benefits and costs over the life of an invention. It would be surprising, however, if many inventions accumulated sufficient benefit in their first or second years to outweigh the cost of eighteen or nineteen years of monopoly. On the other hand, the question becomes much closer when five years of accumulated consumer surplus is weighed against fifteen years of monopoly.²³⁷

The dedication of the same invention to the public domain—preferably with a foreclosure of the possibility of patent filing—by a subsequent independent inventor, with clear and convincing evidence that the subsequent inventor was ignorant of the patentee the entire time, is evidence of actual independent invention that can constitute an objective consideration described by *Graham*.²³⁸ When such independent creation occurs proximate in time to the patentee's own disclosure or filing—for example, within one year—there is a strong likelihood that society is paying more in monopoly costs than it could receive in consumer surplus from the patent. As such, the patent should be invalidated.

B. *Reconsidering the Definition of "Prior Art"*

Although section 103 prohibits patents on inventions that are "obvious" in light of "the prior art," it does not define what the prior art is.²³⁹ The Federal Circuit and its predecessor have defined the world of "prior art" by borrowing from select portions of Section 102,²⁴⁰ resulting in "prior art" being defined by the

²³⁷ See, e.g., *Lindemann*, 730 F.2d at 1461. In actuality, *Lindemann* would have involved balancing five years of consumer surplus (dating *P* from the time of patent filing) against fourteen years of cost because the patent term at the time was seventeen years from the date of *issuance*, and the purported independent invention occurred nearly three years after *issuance*. *Id.*; see 35 U.S.C. § 154 (1976).

²³⁸ *Graham v. John Deere Co.*, 383 U.S. 1, 18 (1966) (stating that secondary "indicia of obviousness or nonobviousness" may be relevant); see *Ecolchem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361, 1379 (Fed. Cir. 2000).

²³⁹ 35 U.S.C. § 103(a) (2000 & Supp. IV 2004).

²⁴⁰ See *In re Bass*, 474 F.2d 1276, 1290 (C.C.P.A. 1973) (defining section 103 prior art as prior art under sections 102(a), (b), (e), and (g)); see also *OddzOn Prods., Inc. v. Just Toys, Inc.*, 122 F.3d 1396, 1403–04 (Fed. Cir. 1997) (extending prior art to include section 102(f)).

earlier of the patentee's conception or one year prior to the filing date. Events subsequent to this critical date are essentially irrelevant to the obviousness inquiry.²⁴¹ At the same time, almost every patent and printed publication that is published before the critical date is considered "prior art," with the exception that printed publications that do not meet a minimal threshold of public accessibility are excluded.²⁴²

The classification as prior art of all public knowledge prior to the date of conception raises the possibility of wrongful *rejections* for the patentee. As demonstrated in Part III.B.2, a losing competitor who subsequently publishes the results of his research is not truly an "independent inventor," because this type of strategic behavior by a rival confers no favors on the public in the long-term. Invalidating the patent because of a subsequent disclosure by a rival who lost the patent race destroys patent incentives because firms can predict *ex ante* that multiple rivals are likely to finish close to them in the quest for a patent. If such a close finish between patent-seeking rivals means no patent issues to the winner, then no one will enter the race to begin with, and the patent incentive loses its force.

This intuition applies equally to disclosures prior to the patentee's conception. Research, by its nature, tends to be incremental, and incremental steps in isolation appear to be obvious. To take a simple example, if the research objective is a car that has a fuel economy of 100 miles per gallon ("mpg"), research breakthroughs might occur in one mpg increments, with each one mpg increment appearing "obvious."²⁴³ Thus, the patentee's 100 mpg car would be "obvious" because a rival

²⁴¹ See *Cross Med. Prods., Inc. v. Medtronic Sofamor Danek, Inc.*, 424 F.3d 1293, 1321, 1324 (Fed. Cir. 2005) (rejecting reliance on a subsequent patent application filed two months after the invention date); *Stewart-Warner Corp. v. City of Pontiac*, 767 F.2d 1563, 1570 (Fed. Cir. 1985) (finding the trial court's consideration of subsequent developments improper).

²⁴² See *In re Cronyn*, 890 F.2d 1158, 1160–61 (Fed. Cir. 1989).

²⁴³ Here, of course, I am using the word "obvious" in the common sense of the term, reflecting the obviousness test as currently interpreted. Thus, a one mpg difference between the prior art 99 mpg car (prior art encompassing everything before patentee conception) and the patentee's 100 mpg car would likely not be seen as sufficiently large to justify a patent. Applying the equation of Part III, of course, would require additional information about the benefits, costs, and time necessary to independently achieve the one mpg increase—not to mention the fact that a rival's prior publication would not be independent of the patent system's incentives.

created a 99 mpg car before the patentee, and the rival's 99 mpg car would have been "obvious" because another rival had created a 98 mpg car even earlier, and so on. The problem then is that no patent will ever issue on the 100 mpg car even if, cumulatively, the successive breakthroughs allow us to progress from 20 mpg to 100 mpg. Multiple rival firms racing for a 100 mpg car, publishing their interim findings, will preempt each other and make the patent ultimately unavailable.²⁴⁴ This harms the patent system because mutual preemption is a predictable result of patent racing, and patent racing is inevitable for valuable patents. The result is that nobody will make the investment in researching a 100 mpg car—at least not at the optimal level that the patent system is designed to induce. In a world where rivals race for patents, the ultimate patent survives this preemption gauntlet and remains available only when: (1) researchers do not publish their interim findings; or (2) there is a single, sudden large breakthrough that itself crosses a "nonobviousness" threshold. The first runs contrary to the purpose of patent laws in encouraging scientific disclosure and is unrealistic to expect in patent racing contexts where a losing firm has the strategic imperative to publish and preempt the patent.²⁴⁵ The second—requiring a single, sudden large breakthrough for patentability—is to restore the reviled "flash of genius" test in all but name.²⁴⁶

This concern is not merely theoretical. A recent Federal Circuit case, *PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*,²⁴⁷ illustrates the phenomenon, and a dissenting judge accused the court of restoring the "flash of genius" test.²⁴⁸ In *PharmaStem*, accumulated research had created a suspicion "that umbilical

²⁴⁴ See Parchomovsky, *supra* note 124, at 928. Parchomovsky considered the social welfare effects of this phenomenon to be ambiguous. See *id.* at 944–46.

²⁴⁵ *Id.* at 929 ("A firm will choose to publish its research results whenever it believes—correctly or incorrectly—that its competitors are likely to beat it to the patent application."). Parchomovsky raises the possibility that rival firms may agree to not preempt each other through bargaining. See *id.* at 948–49. This type of horizontal collusion between rivals, however, raises severe antitrust problems. See *supra* note 126.

²⁴⁶ See *supra* notes 25–27 and accompanying text.

²⁴⁷ 491 F.3d 1342 (Fed. Cir. 2007).

²⁴⁸ See *id.* at 1377–78 (Newman, J., dissenting).

cord blood is capable of hematopoietic reconstitution,”²⁴⁹ but the patentees were the first to achieve the result.²⁵⁰ The Federal Circuit nonetheless held that the invention was not patentable because “the inventors merely used routine research methods to prove what was already believed to be the case.”²⁵¹ The relegation of “routine research” to non-inventive and non-patentable status, of course, was the precise problem with *Cuno*²⁵² and the “flash of genius” test.²⁵³

The solution in cases of prior disclosure is not different from subsequent disclosure: A strategic disclosure by patent-seeking rivals designed to invalidate a patent should not be considered prior art for obviousness purposes.²⁵⁴ To do otherwise leaves firms at the risk that no patent will issue in the end—due to mutual preemption—losing the firms’ research investment and deterring the *ex ante* investment that patents are designed to induce.²⁵⁵

²⁴⁹ *Id.* at 1363 (majority opinion).

²⁵⁰ *See id.*

²⁵¹ *Id.*

²⁵² *Cuno Eng’g Corp. v. Automatic Devices Corp.*, 314 U.S. 84 (1941).

²⁵³ *See supra* text accompanying note 27. It is also unclear whether an unproven hypothesis would be patentable. *See Brenner v. Manson*, 383 U.S. 519, 531 (1966) (rejecting the proposition that “any process is ‘useful’ within the meaning of [35 U.S.C. §] 101 if it produces a compound whose potential usefulness is under investigation by serious scientific researchers”). *But see Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1228 (Fed. Cir. 1994) (stating that inventors do not need to know that an invention would work to conceive it). The cumulative result may be that a great deal of scientific research falls into a twilight zone where the hypothesis is not patentable (because it is only “under investigation”), and the proof is not patentable (because it is “routine research”).

²⁵⁴ A related, and more difficult, question is whether the publication should qualify as anticipation prior art under 35 U.S.C. § 102. The difference is that a § 102 disclosure must disclose the patentee’s subsequent invention exactly. A disclosing party making a strategic disclosure will create a § 102 rejection only if the disclosing party makes a strategic miscalculation: A § 102 disclosure means that the disclosing party in fact invented a fully patentable invention, i.e., contrary to its own belief, the disclosing party in fact won the patent race but then forfeited the results. It would be unlikely to diminish patent incentives greatly for society to take advantage only when firms commit strategic blunders of this type: The patentee loses nothing—if its rival had not committed the blunder, the rival would have received the patent—and the rival cannot complain since it deliberately, if mistakenly, forfeited the patent.

²⁵⁵ *See supra* Part III.B.2. *But cf.* Parchomovsky, *supra* note 124, at 944–46 (arguing that early strategic disclosure by a losing rival to preempt a later patent may enhance social welfare by freeing access to basic research and expanding the network of users for an invention). Parchomovsky nonetheless recognizes that strategic disclosure by rivals may, in some situations, diminish patent incentives. *Id.*

The analysis differs, however, between pre-conception patents and pre-conception publications. Unlike the post-conception scenario where a disclosure in a patent should never be considered as an independent invention, disclosures in a patent prior to the patentee should be considered prior art. This is because the prospect of an early and broad patent right that preempts later patents does not diminish incentives for research—it increases them.²⁵⁶ The increased patent racing incentive has beneficial effects for society.²⁵⁷

The interpretation of “prior art” under section 103²⁵⁸ should be modified such that a printed publication is not prior art if it was produced by a patent-racing rival to preempt a later patent by a competitor.²⁵⁹

CONCLUSION

The traditional approach to patentability has been to compare the patented invention to the prior art, and to ask whether the differences were sufficiently material to be patentable. This requirement has been variously described as asking whether the differences (and solutions for bridging the differences) were “inventive,” “ingenious,” “obvious,” “taught,” “suggested,” or “motivated.” Except where the prior art was required to *explicitly* describe the invention such that there were *no* differences, all of these tests were nothing more than semantic variations of essentially the same subjective inquiry. Objective science can describe the difference between a metal doorknob and a clay doorknob down to the last atom, but it will never be able to determine if substituting a metal doorknob with a clay doorknob is “obvious.”

The key to reframing the obviousness inquiry is to realize that the goal of patents is not to encourage invention in the

at 944.

²⁵⁶ See Kitch, *supra* note 90, at 276–80; McFetridge & Smith, *supra* note 100, at 198–201.

²⁵⁷ See Duffy, *Rethinking the Prospect Theory of Patents*, *supra* note 102, at 467.

²⁵⁸ 35 U.S.C. § 103 (2000 & Supp. IV 2004).

²⁵⁹ Congress has previously stepped in to overrule the Federal Circuit’s interpretation of “prior art” in section 103. Congress enacted 35 U.S.C. § 103(c)(2), excluding from obviousness prior art the non-public research of joint researchers, to partly overrule the Federal Circuit’s decision in *OddzOn Products*, 122 F.3d 1396 (1997). See H.R. REP. NO. 108-425, at 2, 4–5 (2004).

abstract, but to encourage innovations that create more benefit to society than the cost of a patent. Whether the patent creates more benefits than costs depends on what the alternative is—whether, if the patent were not available from the very beginning, society would nonetheless have received the same invention. More precisely, because virtually every invention will eventually be independently created without a patent, the inquiry is *when* society would have received the same invention had a patent never been available. Before such independent invention would have offered the same invention to society, the patent reward creates benefits in the form of consumer surplus. After the time of such independent invention, the patent exacts monopoly costs in the form of deadweight loss and dissipated surplus.

Determining when independent invention *would* have occurred, however, is a tricky inquiry because it must reconstruct a hypothetical world that entirely removes the incentives of the patent reward. If the patent had never been available, rival inventors in the patent race would not exist, and competitors holding trade secrets would not disclose them to preempt future patents. Removing these influences from the determination results in the requirements that an independent invention must be independent of the patentee, independent of the patent system, and result in a dedication of the invention to the public domain.

This Article redefines the patentability standard, offering determinable criteria for courts to determine whether the availability of a patent for an invention creates more consumer benefit than the patent exacts in monopoly costs. Because patents are ultimately offered for the purpose of enhancing overall social welfare, the obviousness standard should be reconsidered to incorporate these economic calculations. Even without a change in the statute, however, many of the economic policy objectives can be incorporated through greater consideration of independent invention as a secondary consideration, reinvigorating a dormant doctrine that courts have overlooked and underutilized.

