

# Cycles of Obviousness

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*ABSTRACT: In 2007, the Supreme Court’s decision in KSR v. Teleflex echoed earlier vicissitudes in the history of patent law when the Court considerably expanded the circumstances in which a patent could be found obvious. Here, we conduct the first comprehensive empirical study of pre- and post-KSR district court and Federal Circuit decisions. Not surprisingly, following KSR, we find a substantial increase in findings of obviousness as well as a major shift in doctrine supporting these decisions. Although we find that the Federal Circuit substantially altered course following KSR, its shift was less robust than in the district courts. We speculate that these differences between the Federal Circuit and district courts, as well as the vacillating historical meanings of the nonobviousness requirement, reflect divergent views among judges regarding the appropriate role nonobviousness should play in promoting patent law’s fundamental aim of incentivizing innovation. As such, we predict continued shifts and cycles of this critical component of patentability.*

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## I. INTRODUCTION

To be patentable, an invention must not only be novel, but also nonobvious.<sup>1</sup> This standard, referred to by Judge Learned Hand as the most “fugitive, impalpable, wayward, and vague a phantom as exists in the whole paraphernalia of legal concepts,” has undergone wildly shifting, often cycling, meanings throughout the history of patent law.<sup>2</sup> For instance, there was major

1. 35 U.S.C. § 103 (2012).

2. *Harries v. Air King Prods. Co., Inc.* 183 F.2d 158, 162 (2d Cir. 1950). Similarly, scholarly views as to the importance and function of the nonobviousness requirement have varied considerably. See also Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 YALE L.J. 1590, 1662 (2011) (“The existing framework for applying the obviousness doctrine can, with minor extensions and adjustments, accommodate the inducement standard’s insights.”); Rebecca S. Eisenberg, *Obvious to Whom? Evaluating Inventions from the Perspective of PHOSITA*, 19 BERKELEY TECH. L.J. 885, 890 (2004) (“The Federal Circuit has deployed judicial review in ways that make it harder to establish nonobviousness, diminish the role of nonobviousness in limiting what may be patented, and reduce the threat of patent invalidity.”); Edmund W. Kitch, *Graham v. John Deere Co.: New Standards for Patents*, 1966 SUP. CT. REV. 293, 301 (“The non-obviousness test makes an effort, necessarily an awkward one, to sort out those innovations that would not be developed absent a patent system . . . . [T]he focus has always been on the question whether the innovation could have been achieved by one of ordinary skill in the art, or whether its achievement is of a greater degree of difficulty.”); Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 283–84 (1977) [hereinafter Kitch, *Function of the Patent System*] (retreating from his earlier views and advocating a “substantial novelty” standard in order to promote the development of “prospect” patents); Glynn S. Lunney, Jr., *E-Obviousness*, 7 MICH. TELECOMM. & TECH. L. REV. 363, 385–86 (2001) (“Ideally, under this view, a patent should be given for an invention only if the invention would not have been developed but for the patent. If the claimed invention would have been developed, commercialized, and disclosed even without a patent, then granting or enforcing a patent would make little sense.” (footnote omitted)); Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CALIF. L. REV. 803, 846 (1988) (criticizing commercial success as an indicator of nonobviousness); Robert P. Merges, *Uncertainty and the Standard of Patentability*, 7 HIGH TECH. L.J. 1, 4, 20 (1992) (proposing that nonobviousness should be based on “uncertainty,” or the risk of failure inherent in the inventive process); A. Samuel Oddi, *Beyond Obviousness: Invention Protection in the Twenty-First Century*, 38 AM. U. L. REV. 1097, 1127 (1989) [hereinafter Oddi, *Beyond Obviousness*] (“These secondary considerations tend to objectify the issue of obviousness, but they have little value in discriminating patent-induced from nonpatent-induced inventions.”); A. Samuel Oddi, *Un-Unified Economic Theories of Patents—The Not-Quite-Holy Grail*, 71 NOTRE DAME L. REV. 267, 271–89 (1996) (surveying various theories of patent law and nonobviousness); Benjamin N. Roin, *Unpatentable Drugs and the Standards of Patentability*, 87 TEX.

shift in the standard for “inventiveness” from the earliest patent system, erected in the Venetian Republic in the early fifteenth century, to the British patent system, which was established in earnest in the sixteenth and seventeenth centuries.<sup>3</sup>

Specifically, beyond the usual “novelty” requirement—then, that the invention had not been previously known in the Venetian Republic—the “ingenuity” requirement appeared to require that if the invention would have arisen in the ordinary course of technological progress, it would not be patentable.<sup>4</sup> Although the exact contours of the ingenuity doctrine are still unknown, what is known is that the doctrine was more robust than the early British system’s standard for inventiveness, “substantial novelty.”<sup>5</sup> Unlike the Venetian ingenuity requirement, substantial novelty was in effect a much weaker bar, which only required substantial differences between the invention sought to be patented and already-known inventions.<sup>6</sup>

Scholars have contended that these differences likely arose because of the differing economic rationales for the patent system in the Venetian Republic and Britain.<sup>7</sup> Namely, the Venetian system focused on generating innovations from inventors within its border (at least by the sixteenth century), while the British system was mainly one of “importation,” providing incentives for merchants and others to import, market, and distribute inventive products into Britain.<sup>8</sup>

Recognizing the importance of patents, the framers of the U.S. Constitution adopted the IP Clause, which provides Congress the power to “promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.”<sup>9</sup> Notably, the power is limited to the promotion of “progress” for “Inventors” and their “Discoveries,” which implies that some innovation should be unpatentable despite being novel.<sup>10</sup> In the words of

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L. REV. 503, 504–05 (2009) (arguing that granting patents and obvious inventions may be necessary to bring drugs to market).

3. See Ted Sichelman & Sean O’Connor, *Patents as Promoters of Competition: The Guild Origins of Patent Law in the Venetian Republic*, 49 SAN DIEGO L. REV. 1267, 1279 (2012).

4. See *id.* at 1279–81.

5. See *id.* at 1270.

6. See *id.* at 1279–80.

7. See *id.*

8. See *id.*

9. U.S. CONST. art. I, § 8, cl. 8.

10. Richard L. Robbins, *Subtests of “Nonobviousness”: A Nontechnical Approach to Patent Validity*, 112 U. PA. L. REV. 1169, 1169 n.3 (1964) (“He who is merely the first to utilize the existing fund of public knowledge for new and obvious purposes must be satisfied with whatever fame, personal satisfaction or commercial success he may be able to achieve. Patent monopolies, with all their significant economics and social consequences, are not reserved for those who contribute so insubstantially to that fund of public knowledge.” (citing *Great Atl. & Pac. Tea Co. v. Supermarket Equip. Corp.*, 340 U.S. 147, 152–53 (1950))); Timothy R. Holbrook, *Patent Anticipation and Obviousness as Possession*, 65 EMORY L.J. 987, 994 (2016) (“The novelty requirement has existed

Thomas Jefferson, “[a]s a member of the patent board for several years . . . I know well the difficulty of drawing a line between the things which are worth to the public the embarrassment of an exclusive patent, and those which are not.”<sup>11</sup> As such, early patent doctrine in the United States was a hodgepodge of “inventiveness” rules, somewhat more rigorous than Britain’s substantial novelty doctrine, but not a general doctrine like the Venetian ingenuity standard.<sup>12</sup>

Yet, in 1851, in *Hotchkiss v. Greenwood*,<sup>13</sup> the Supreme Court adopted an “ingenuity” requirement that appeared to be quite similar to the “ingenuity” standard of the Venetian system.<sup>14</sup> According to the Court, an invention must require “ingenuity or skill being necessary . . . [greater] than that of an ordinary mechanic acquainted with the business, [or] the patent is void.”<sup>15</sup> The result of *Hotchkiss* was that a patent should be granted only when there is significant ingenuity at the time of conception.<sup>16</sup>

Following *Hotchkiss*, the doctrine again underwent major shifts in meaning, often times being so hard to pin down as resulting in an “I-know-it-when-I-see-it” analysis.<sup>17</sup> After extensive lobbying to Congress, Giles Rich and Pasquale Federico, co-authors of much of the 1952 Patent Act, effectively replaced the invention standard with the so-called requirement of

since the first patent statute, but non-obviousness evolved through the common law given the shortcomings of the novelty requirement, emerging initially as a requirement for inventiveness. . . . Little theoretical work has been done, however, to provide a coherent theory explaining both of these provisions.”).

11. THOMAS JEFFERSON, *Letter from Thomas Jefferson to Isaac McPherson (Aug. 13, 1813)*, in VI THE WRITINGS OF THOMAS JEFFERSON 181 (H.A. Washington ed., 1854), available at [www.let.rug.nl/usa/presidents/thomas-jefferson/letters-of-thomas-jefferson/jefl220.php](http://www.let.rug.nl/usa/presidents/thomas-jefferson/letters-of-thomas-jefferson/jefl220.php) [<https://perma.cc/J7V2-7ZKQ>].

12. See Sichelman & O’Connor, *supra* note 3, at 1279–80; see also John F. Duffy, *Inventing Invention: A Case Study of Legal Innovation*, 86 TEX. L. REV. 1, 18, 22–32 (2007) (“An embryonic requirement of nonobviousness or inventiveness also seems to appear, for the statute requires the device to be a ‘new and ingenious device’—in the original Italian, ‘nuovo et ingegnoso artificio.’”).

13. *Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248, 253 (1850).

14. See Oddi, *Beyond Obviousness*, *supra* note 2, at 1103–04, 1122–23 (explaining the requirements under the Venetian system and the nonobvious standard of *Hotchkiss v. Greenwood*).

15. *Hotchkiss*, 52 U.S. at 253.

16. See *id.*; Jeanne C. Fromer, *The Layers of Obviousness in Patent Law*, 22 HARV. J.L. & TECH. 75, 94–95 (2008) (“Evaluating obviousness of reduction to practice, then, is not necessarily about whether the patentee’s particular reduction to practice was obvious. Rather, like much of the objective inquiry to ascertain obviousness, the test should concern whether creating any one complete working model of the claimed invention—as opposed to every single one or the particular one that the patentee made—would have been obvious to a PHOSITA.”); see also Michael Risch, *America’s First Patents*, 64 FLA. L. REV. 1279, 1302 (2012) (discussing an 1842 pre-*Hotchkiss* district court patent case, *Howe v. Abbott*, and noting “to some extent, cases like *Howe* are really obviousness cases at a time before nonobviousness was a patent criterion”).

17. JANICE M. MUELLER, PATENT LAW 359 (5th ed. 2016) (“Judges in different courts around the United States came to treat ‘invention’ somewhat like obscenity . . . devoid of common guidelines or uniform analytical framework.”).

nonobviousness,<sup>18</sup> now codified in § 103 of the Patent Act.<sup>19</sup> Under § 103 in effect in 1952, a patent claim was rejected 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.”<sup>20</sup>

However, like the pre-1952 invention standard, lower courts also had difficulty interpreting § 103’s obviousness standard in a consistent fashion.<sup>21</sup> To resolve these differences, in 1966, the Supreme Court articulated instructive factors in *Graham v. John Deere*,<sup>22</sup> which allowed judges in principle to uniformly analyze technical issues.<sup>23</sup> Indeed, there was not much doctrinal development of the *Graham* test until the creation of the Federal Circuit in 1982.<sup>24</sup> Now the single court for nearly all appeals of patent cases, the Federal Circuit felt emboldened to depart from, or at least to substantially reconstruct, Supreme Court precedent in many doctrinal areas, including nonobviousness.<sup>25</sup> In this vein, the Federal Circuit developed a “teaching, suggestion, or motivation” (“TSM”) test as a gloss to the *Graham* test.<sup>26</sup> The test’s objective was to stop hindsight bias by focusing the decisionmaker, judge or jury, on the state of the art at the time the invention was made.<sup>27</sup> In essence, the test inquires whether at the time the invention was created, something would have taught, suggested, or motivated a person of ordinary skill to combine existing prior art elements.<sup>28</sup>

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18. *Id.* at 358 (“[Section] 103(a) provides the modern-day counterpart to the *Hotchkiss* requirement for invention.”).

19. 35 U.S.C. § 103 (2012).

20. 35 U.S.C. § 103(a) (1952).

21. See generally Note, *The Standard of Patentability—Judicial Interpretation of Section 103 of the Patent Act*, 63 COLUM. L. REV. 306 (1963) (describing the split of authority prior to *Graham*).

22. *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 17–18 (1966).

23. Emer Simic, *The TSM Test Is Dead! Long Live the TSM Test! The Aftermath of KSR, What Was All the Fuss About?*, 37 AIPLA Q.J. 227, 231 (2009) (“The Supreme Court’s objective *Graham* factors are instructive not only because they provide judges with a way to analyze technical issues, but also because they attempt to guard against the inevitable problem of hindsight bias in obviousness determinations.”).

24. See Lee Petherbridge & R. Polk Wagner, *The Federal Circuit and Patentability: An Empirical Assessment of the Law of Obviousness*, 85 TEX. L. REV. 2051, 2058–60 (2007).

25. See *id.*

26. See *id.*

27. See *id.*

28. Simic, *supra* note 23, at 232 (“The TSM test provides decision-makers with a broad range of sources to look for a teaching, suggestion, or motivation to combine, in order to protect the public from the issuance of patents that are not truly innovative.” (citation omitted)); see also MUELLER, *supra* note 17, at 359 (“Rigorous attention to the requirement for a TSM guards the improper use of hindsight in a nonobviousness analysis, that is, using the claimed invention as a blueprint or plan and merely lumping together multiple prior art references that each disclose some limitation of the claims.” (citing *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1369, 1351–52 (Fed. Cir. 2001))).

Over time, critics of the TSM test claimed the Federal Circuit favored patentees in obviousness determinations by requiring that the combination be motivated by an explicit reference in the prior art itself, with many claiming the test contradicted Supreme Court precedent.<sup>29</sup>

In response to these concerns, in 2007, the Supreme Court rejected the Federal Circuit's TSM test as the touchstone for obviousness. In *KSR Int'l Co. v. Teleflex Inc.*,<sup>30</sup> the Court held the TSM test was "too artificial and inflexible" and applying the standard would be "overly rigid and formalistic."<sup>31</sup> The Court went on to hold that a PHOSITA (a person having ordinary skill in the art), as a person of ordinary creativity, has more knowledge than what merely appears in the printed prior art.<sup>32</sup> Ultimately, *KSR* developed a set of "factors" including common sense, ordinary creativity, and market forces that courts and juries could more easily use to find obviousness.<sup>33</sup>

Unfortunately, for purposes of doctrinal clarity the Court did not end its analysis there. While acknowledging the need for flexible obviousness determinations that take into account a variety of factors,<sup>34</sup> the Court ultimately required a "reason" to combine prior art references in order to show that a patent claim is obvious.<sup>35</sup> This holding opened the door for resurrection of the TSM test, particularly at the Federal Circuit.<sup>36</sup> Indeed, shortly after the *KSR* opinion issued, a number of Federal Circuit cases announced that *KSR* was not so great a departure from the Federal Circuit's previous use of the TSM test.<sup>37</sup> Rather, according to at least some judges on

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29. See *infra* notes 148–52 and accompanying text (discussing these critiques); see also James W. Dabney, *KSR: It Was Not A Ghost*, 24 SANTA CLARA COMPUTER & HIGH TECH. L.J. 131, 144 (2007) ("The net effect of pre-*KSR* Federal Circuit precedent was to inject a strong bias [in favor of patentees] into the process of determining questions of patent claim validity under § 103."); John H. Barton, *Non-Obviousness*, 43 IDEA 475, 477 (2003) ("The non-obviousness standard has since been . . . greatly weakened in a very specific and relatively detailed body of patent law, developed primarily by the [Federal Circuit] . . .").

30. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007).

31. Fromer, *supra* note 16, at 87 ("*KSR* emphasized that the correct answer on obviousness can be obtained only by evaluating all crucial aspects of the inventive process . . . The Court held that a PHOSITA, as a person of ordinary creativity, knows more than what is contained in the printed prior art, and therefore relies on that wealth of knowledge in inventing.")

32. *KSR*, 550 U.S. at 398, 418; Fromer, *supra* note 16, at 85.

33. *KSR*, 550 U.S. at 420–21.

34. Fromer, *supra* note 16, at 84 (highlighting that "[t]he diversity of inventive pursuits and of modern technology counsels against limiting the analysis" of obviousness in inflexible ways).

35. *KSR*, 550 U.S. at 420 ("The question is not whether the combination was obvious to the patentee but whether the combination was obvious to a person with ordinary skill in the art. Under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.")

36. See *infra* Section II.D.

37. See *infra* notes 163–69 and accompanying text.

the Federal Circuit, the key was simply not implementing the *KSR* test in a “rigid and formalistic” manner.<sup>38</sup>

Scholarly commentators were unsure whether the Federal Circuit would follow these early opinions and adopt a modified form of TSM or whether it would take the Supreme Court’s effective rejection of its prior approach to heart.<sup>39</sup> In an attempt to answer this important question, a handful of post-*KSR* empirical studies analyzed the Federal Circuit’s decisions regarding nonobviousness.<sup>40</sup> These studies have generally found that the Federal Circuit substantially increased its findings of obviousness after *KSR*, and that while the court continues to use the TSM test, it is not the “overly rigid and formalistic” version rejected by the Supreme Court.<sup>41</sup>

Yet, of all the empirical studies on *KSR*, only one has examined how the district courts interpreted and applied the opinion, which was a student piece that examined merely four of the 94 district courts nationwide.<sup>42</sup> This substantial lacuna in the empirical literature regarding obviousness ultimately means that we still have little understanding of how the *KSR* opinion operates in trial courts, which—given that roughly 85% of patent cases settle or are dismissed—often act as the courts of last resort.<sup>43</sup> Thus, to the extent district courts interpret *KSR* differently from the Federal Circuit, research solely on how this appellate court operates would not translate into complete or even accurate knowledge of how obviousness functions as a doctrine following *KSR*.<sup>44</sup> Moreover, even though the Federal Circuit studies have exhaustively examined outcomes, no study has comprehensively analyzed the Federal

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38. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1260 (Fed. Cir. 2007) (“[T]he Supreme Court suggests, a flexible approach to the TSM test prevents hindsight and focuses on evidence before the time of invention.”).

39. *See infra* Part III; cf. Michael J. Meurer & Katherine J. Strandburg, *Patent Carrots and Sticks: A Model of Nonobviousness*, 12 LEWIS & CLARK L. REV. 547, 548 (2008) (“The question of obviousness is central to determining patentability, yet what it means for an invention to be obvious in light of relevant prior art is one of the most difficult puzzles in patent law.”).

40. *See infra* Part III.

41. *See* Christopher A. Cotropia, *Nonobviousness and the Federal Circuit: An Empirical Analysis of Recent Case Law*, 82 NOTRE DAME L. REV. 911, 914 (2007); Ali Mojibi, *An Empirical Study of the Effect of KSR v. Teleflex on the Federal Circuit’s Patent Validity Jurisprudence*, 20 ALB. L.J. SCI. & TECH. 559, 559 (2010); Jennifer Nock & Sreekar Gadde, *Raising the Bar for Nonobviousness: An Empirical Study of Federal Circuit Case Law Following KSR*, 20 FED. CIR. B.J. 369, 370 (2011); Petherbridge & Wagner, *supra* note 24, at 2055–56; Jason Rantanen, *The Federal Circuit’s New Obviousness Jurisprudence: An Empirical Study*, 16 STAN. TECH. L. REV. 709, 713 (2013); Simic, *supra* note 23, at 230; Brendan Seth O’Brien O’Shea, Note, *What Is Obvious: Empirical Assessment of KSR’s Impact*, 45 AIPLA Q.J. 517, 520 (2017).

42. *See* Mojibi, *supra* note 41, at 559–68 (finding that the Federal Circuit and the district courts are more likely to invalidate patents for obviousness after *KSR*).

43. *See* Jay P. Kesan & Gwendolyn G. Ball, *How Are Patent Cases Resolved? An Empirical Examination of the Adjudication and Settlement of Patent Disputes*, 84 WASH. U. L. REV. 237, 258–62 (2006) (presenting data on dismissals and settlement rates in patent cases).

44. *See* Mojibi, *supra* note 41, at 570–71 (noting that previous empirical studies of *KSR* had been limited to analyses of the Federal Circuit).



Circuit's pre- and post-*KSR* reasoning so as to provide quantitative measure of the apparent changes in the court's doctrine.<sup>45</sup>

This Article addresses the limitations in previous studies to make an important contribution to the scholarly literature, as well as to practitioners.<sup>46</sup> Specifically, we perform the first exhaustive empirical study of obviousness outcomes and doctrine before and after the Supreme Court's decision in *KSR* in both the Federal Circuit and all federal district courts.<sup>47</sup> Extending the analysis beyond the Federal Circuit to district courts, and analyzing both of these courts' doctrine in detail, are important contributions for at least two reasons.

First, our study shows that since *KSR* was decided, the Federal Circuit and the district courts implemented somewhat different doctrinal standards.<sup>48</sup> Although both the district courts and the Federal Circuit essentially eschewed the "rigid" form of the TSM test and are more apt to incorporate the reasoning of *KSR*, the Federal Circuit has somewhat counterbalanced this trend by relying somewhat less than the district courts on the unique features of the *KSR* opinion that point towards findings of obviousness.<sup>49</sup> One notable example is that the district courts have relied more heavily than the Federal Circuit after *KSR* on the factor that considers "design incentives or other market forces."<sup>50</sup>

These differences appear to explain, at least in part, the somewhat greater shift toward obviousness outcomes in the district courts as compared to the Federal Circuit following *KSR*.<sup>51</sup> Moreover, in view of our results, we reject the suggestion that judicial vicissitudes in crafting an appropriate nonobviousness doctrine reflect the nebulosity of the concept itself; rather, the seemingly recurring cycle of lowering and raising the threshold for nonobviousness (and related historical doctrines) most likely stems from different judicial attitudes regarding the precise role patents—and, hence, the nonobviousness bar—should play in spurring innovative activity.<sup>52</sup>

Second, beyond patent law, our analysis is important to demonstrate the interplay that can arise between a court of appeals and a district court in interpreting Supreme Court precedent.<sup>53</sup> The somewhat differing

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45. See *id.* (listing previous studies).

46. See *infra* Parts III–V.

47. See *infra* Part IV.

48. See *infra* Section IV.C.

49. See *infra* Section IV.C.

50. See *infra* Section IV.C.

51. See *infra* Part V.

52. See *infra* Section V.B.

53. See generally Toby J. Heytens, *Doctrine Formulation and Distrust*, 83 NOTRE DAME L. REV. 2045, 2046–47 (2008) (noting the Supreme Court's "need to craft rules that *can* and *will* be faithfully implemented by the lower court judges who have the last word in the overwhelming majority of litigated cases"); Richard M. Re, *Narrowing Supreme Court Precedent from Below*, 104 GEO.

implementation of supposedly the same body of law by courts of distinct levels within the judiciary provides empirical support for the thesis of Peter Lee and others that the Federal Circuit and district courts view themselves as serving differing roles in the adjudication of patent disputes.<sup>54</sup> In this regard, while the Federal Circuit tends to be more pro-patentee and less influenced by Supreme Court patent precedent than the district courts, at least in the area of nonobviousness, the Federal Circuit has nonetheless been substantially affected by Supreme Court doctrine.<sup>55</sup> At the same time, our data provides empirical support for the view—within the federal courts scholarship more broadly—that the diffusion of Supreme Court precedent is often patchy, with substantially varying interpretations across the judicial landscape.<sup>56</sup> In sum, our Article and results offer notable contributions not only to the historical and empirical scholarship in patent law, but also to legal scholarship more broadly.<sup>57</sup>

In Part II, we describe the historical origins of the nonobviousness doctrine, contending that the “ingenuity” requirement of the Venetian patent system was in many ways similar to the precursor of the modern nonobviousness standard adopted by the U.S. Supreme Court in *Hotchkiss v. Greenwood* in 1850.<sup>58</sup> In particular, we disagree with scholars who regard the Venetian standard as one merely centered on effort, and thus we reject the standard claim that the nonobviousness doctrine was “invented” in the United States.<sup>59</sup> Next, we discuss the vacillations of the nonobviousness doctrine from 1850 through 1952, when Congress amended the Patent Act to bring more

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L.J. 921, 925 (2016) (positing that “a lower court can legitimately narrow Supreme Court precedent by adopting a *reasonable* reading of it”).

54. See Peter Lee, *Patent Law and the Two Cultures*, 120 YALE L.J. 2, 42–48 (2010) (describing the Supreme Court’s holistic approach, which constrains the Federal Circuit’s more formalistic approach); see also John M. Golden, *The Supreme Court As “Prime Percolator”*: A Prescription for Appellate Review of Questions in Patent Law, 56 UCLA L. REV. 657, 694–97 (2009); David O. Taylor, *Formalism and Antiformalism in Patent Law Adjudication: Rules and Standards*, 46 CONN. L. REV. 415, 441–42 (2013).

55. See *infra* Part V.

56. See Tonja Jacobi & Emerson H. Tiller, *Legal Doctrine and Political Control*, 23 J.L. ECON. & ORG. 326, 339 (2007) (positing that legal doctrine can serve as an “instrument of political control by higher courts over lower courts” and explaining that a rational appellate court would choose between rules and standards based on the level of agreement between its policy preferences and those of lower courts); Re, *supra* note 53, at 926 (“Supreme Court precedent can and often should be viewed as effecting a kind of delegation to lower courts, affording them legitimate space for interpretive flexibility.”).

57. See *supra* notes 53–56.

58. See *Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248, 253 (1850).

59. See Duffy, *supra* note 12, at 22–23 (“The grants thus looked to the efforts of the individual being rewarded. If such ‘sweat of the brow’ were seen as a prerequisite to exclusive rights, then the Venetian patent system was employing a patentability standard that required more than mere novelty and utility, but the standard was subjective. . . . The historical evidence is strong that other jurisdictions did not independently invent the concept of patent law, but rather followed the Venetian example.”).

certainty to the doctrine. Subsequent to the 1952 Act, we discuss the Supreme Court's attempt to lay out a clearer test in the mid-1960s by adopting a three-part framework coupled with secondary factors to analyze nonobviousness as well as the Federal Circuit's adoption in the 1980s of its TSM test to prevent hindsight bias.<sup>60</sup> We then describe the Supreme Court's holding in *KSR*, particularly its departure from a variety of doctrine and principles held by the Federal Circuit under its TSM test.<sup>61</sup> Finally, we qualitatively describe some important cases from the Federal Circuit, in which that court has applied *KSR* in a somewhat inconsistent fashion.<sup>62</sup>

In Part III, we describe prior empirical studies of the nonobviousness doctrine and the limitations of those studies.<sup>63</sup> Specifically, we report the findings of the major studies that examine the Federal Circuit's approach to nonobviousness following *KSR*. Importantly, we explain that all but one study addressed nonobviousness in the district courts, and describe the substantial limitations of that study, including a dataset comprising opinions from just four of the 94 district courts.<sup>64</sup>

In Part IV, we describe our study methodology and present our major results.<sup>65</sup> First, using both descriptive and regression models, we find that both the district courts and the Federal Circuit have substantially increased their determinations of obviousness following *KSR*, though the increase in the Federal Circuit has been somewhat less than in the district courts.<sup>66</sup> Second, consonant with the shift in outcome, since *KSR*, the district courts and Federal Circuit have substantially altered their reasoning and overall doctrine, though again, the Federal Circuit somewhat less so than the district courts.<sup>67</sup>

In Part V, we discuss several limitations of our study, and then offer several reflections regarding the doctrinal, economic, and normative implications of the findings.<sup>68</sup> We suggest the differences between the Federal Circuit and district courts likely stem from differing views about the appropriate role nonobviousness should play in achieving patent law's major aim of promoting invention and the commercialization of invention.<sup>69</sup> Given the flexibility afforded by the *KSR* opinion itself, the less robust shift at the Federal Circuit should be viewed less as a flouting of the Supreme Court's opinion and more as a simple disagreement on how to best implement the

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60. See *infra* Sections II.A–C.

61. See *infra* Section II.C.

62. See *infra* Section II.D.

63. See *infra* Part III.

64. See *infra* Part III.

65. See *infra* Part IV.

66. See *infra* Section IV.B.

67. See *infra* Section IV.C.

68. See *infra* Part V.

69. See *infra* Section V.B.

dictates of the decision.<sup>70</sup> Rather than continuing to hold fast to its earlier “rigid” TSM test, as some commentators predicted, the Federal Circuit by-and-large has, like the district courts, followed the dictates of the Supreme Court’s decision, substantially increasing its findings of obviousness and shifting its doctrine to align with that espoused in the opinion.<sup>71</sup>

## II. THE CYCLES OF NONOBVIOUSNESS THRESHOLDS

In this Part, we lay the groundwork to understand the current judicial and academic debates over the appropriate nature and scope of the obviousness doctrine. We begin by recounting the historical lineage of the doctrine, then turn to more recent developments regarding the law of obviousness. In this discussion, in many ways, the vicissitudes of the doctrine mirror the contemporary struggle to come to terms with the optimal approach to obviousness.

### A. THE FIRST CYCLE: THE HISTORICAL ORIGINS OF OBVIOUSNESS

#### 1. The “Ingenuity” and “Substantial Novelty” Requirements

The first extant evidence of the systematic grant of exclusionary legal rights for technological inventions, including industrial devices and processes—“specifically and solely to encourage technological development”—originates from the Venetian Republic in the early fifteenth century.<sup>72</sup> Patent grants at the time, as well as the Venetian Patent Act of 1474, indicate that one of the several requirements for a grant was the “ingenuity” of the invention, above and beyond its mere novelty.<sup>73</sup> Specifically, the 1474 Act states:

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70. See Doni Gewirtzman, *Lower Court Constitutionalism: Circuit Court Discretion in a Complex Adaptive System*, 61 AM. U. L. REV. 457, 472 (2012) (“[L]ower courts have to make interpretive choices about whether a new Supreme Court ruling is applied broadly or narrowly . . . .”); Re, *supra* note 53, at 925; Patricia M. Wald, *Upstairs/Downstairs at the Supreme Court: Implications of the 1991 Term for the Constitutional Work of the Lower Courts*, 61 U. CIN. L. REV. 771, 778 (1993).

71. See *infra* Section V.B.

72. See Duffy, *supra* note 12, at 21; Ikechi Mgbeoji, *The “Terminator” Patent and Its Discontents: Rethinking the Normative Deficit in Utility Test of Modern Patent Law*, 17 SAINT THOMAS L. REV. 95, 104 (2004) (“Legal historians with a less ideological disposition are virtually unanimous in their conclusion that modern patents actually originated in medieval Florence and Venice.”).

73. ULF ANDERFELT, *INTERNATIONAL PATENT-LEGISLATION AND DEVELOPING COUNTRIES* (Martinus Nijhoff ed., The Hague 1971). The preamble of the Venetian Patent Act states: “We have among us men of great genius, apt to invent and discover ingenious devices; and in view of the grandeur and virtue of our City, more such men come to us every day from divers parts.” *Id.* (quoting the Venetian Patent Act of Mar. 19, 1474); see also Craig Allen Nard & Andrew P. Morriss, *Constitutionalizing Patents: From Venice to Philadelphia*, 2 REV. L. & ECON. 223, 234 (2006) (“[The Venetian statute] had a utilitarian purpose of encouraging innovation set forth in its preamble; provided inventors with exclusive rights if their inventions proved to be useful, novel, and non-obvious and were reduced to practice.” (citations omitted)).

[B]y authority of this Council, each person who will make in this city any new ingenious contrivance, not made heretofore in our dominion, as soon as it is reduced to perfection, so that it can be used and exercised, shall give notice of the same to the office of our Provisioners of [the] Common [*Provveditori di Comun*]. It being forbidden to any other in any territory and place of ours to make any other contrivance in the form and resemblance thereof, without the consent and license of the author up to ten years.<sup>74</sup>

Although the currently available historical record does not extensively delineate what the “ingenuity” requirement specifically entailed, historians have gleaned some insights. According to one authoritative historian, Giulio Mandich, the ingenuity requirement centered on “skill and experience,”<sup>75</sup> “pertinent thoughts and labors,”<sup>76</sup> or “efforts [and] study.”<sup>77</sup> Similarly, Luca Mola documented a specific application of this requirement by the quasi-executive agency, the *Provveditori di Comun*, that examined patent applications (then termed “supplications”): “[W]hen examining an invention, the *Provveditori di Comun* contacted guild authorities for their opinion on the matter.”<sup>78</sup> This limited evidence indicates that the “ingenuity” requirement served a function above and beyond mere novelty—namely, to ensure that patents were granted to inventions for required substantial efforts and more than ordinary skill.<sup>79</sup> Although John Duffy contends that the ingenuity requirement was more of a “sweat of the brow” standard that turned on subjective considerations, which he based heavily on then-available historical materials, more recent evidence indicates that this view is not entirely correct.<sup>80</sup> Specifically, it appears the “ingenuity” requirement, like the

74. Ikechi Mgbefoji, *The Juridical Origins of the International Patent System: Towards a Historiography of the Role of Patents in Industrialization*, 5 J. HIST. AND INT’L L. 403, 413–14 (2003) (discussing the Venetian patent statute of 1474, and noting “Professor Luigi Sordelli’s translation . . . is the most widely accepted version”).

75. Duffy, *supra* note 12, at 21 (quoting Giulio Mandich, *Venetian patents (1450–1550)*, 30 J. PAT. OFF. SOC’Y 166, 173 (1948)).

76. *Id.* at 22 (quoting Giulio Mandich, *Venetian patents (1450–1550)*, 30 J. PAT. OFF. SOC’Y 166, 173 (1948)); *see also* Sichelman & O’Connor, *supra* note 3, at 1279 (“The adoption of the patent system in Venice allowed . . . for the ‘democratization’ of invention . . . increasing the power of independent inventors.”).

77. Duffy, *supra* note 12, at 22 (quoting Giulio Mandich, *Venetian Patents (1450–1550)*, 30 J. PAT. OFF. SOC’Y 166, 173 (1948)). “Venetian patents . . . tended to emphasize ‘the heavy expense, assiduous labors, and burning of the midnight oil’ that the applicant undertook to create the invention.” *Id.* at 23.

78. LUCA MOLA, *THE SILK INDUSTRY OF RENAISSANCE VENICE* 188 (2000).

79. Giulio Mandich, *Venetian Patents (1450–1550)*, 30 J. PAT. OFF. SOC’Y 166, 173, 184 (1948) (“[I]t seems fair to him that after he produced this matter by his genius, industry and effort, others shall not take the fruit away from him.” (quoting Sen. Terra reg. 18 p. 80 r.; 1513, Jul. 29)).

80. Duffy, *supra* note 12, at 22.

obviousness requirement today, could be met without a showing of substantial effort.<sup>81</sup>

Yet, the level of skill and effort required to pass the threshold appears to have been substantially lower than that in the United States for nonobviousness, either now or historically.<sup>82</sup> In this regard, there are few extant examples of Venetian patent applications being rejected for lack of ingenuity.<sup>83</sup> Yet, given the focus of the Venetian patent system in producing commercially valuable inventions—rather than the generation of inventive knowledge, as in more modern patent systems—a relatively low threshold of inventiveness is sensible.<sup>84</sup> As Edmund Kitch has insightfully recognized, when obviousness serves the aims of commercialization rather than invention, society's interest is in generating a multiplicity of useful products.<sup>85</sup> Because products tend to mask the knowledge underlying them, by implication, products that are often built upon similar sets of knowledge may be quite different in their commercial embodiments.<sup>86</sup>

Although much of the framework of the Venetian patent system was replicated in large part throughout Europe;<sup>87</sup> the “ingenuity” requirement was seemingly discarded. For instance, in Britain, only “substantial novelty” was required for patenting.<sup>88</sup> Under the British standard, as long as the invention was substantially different from what preceded it (the “prior art”), it was unnecessary to ask whether the invention would have arisen in the ordinary course of technological development.<sup>89</sup> As such, the British standard set an even lower threshold than the Venetian standard.<sup>90</sup> Yet, as one of us has recognized in previous work, this lower standard was pragmatic given the major aim of the early British system—to import already-known inventions from foreign jurisdictions.<sup>91</sup> In other words, when there are no local inventors who are likely to make and build the invention through ordinary skill and

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81. See Mandich, *supra* note 79, at 173–75; Jacob S. Sherkow, *Negating Invention*, 2011 BYU L. REV. 1091, 1097 (discussing various scholarly views of the Venetian “ingenuity” requirement); Sichelman & O’Connor, *supra* note 3, at 1279–80.

82. See Mandich, *supra* note 79, at 173.

83. *Id.* at 187–88.

84. See sources cited *supra* notes 72–88.

85. Kitch, *Function of the Patent System*, *supra* note 2, at 267–71.

86. *Id.* at 268 (“[T]he invention as claimed in the patent claims and the physical embodiment of the invention are two quite different things.”).

87. Duffy, *supra* note 12, at 23 (“The policy set forth in the Venetian statute was quite plainly copied throughout Europe.”).

88. Duffy, *supra* note 12, at 18; see also Sichelman & O’Connor, *supra* note 3, at 1279–80 (“[I]t is not surprising that the Venetian guilds appeared to actively oppose patent applications for putative inventions not only known to them but also those that they would have invented in the ordinary course.”).

89. Sichelman & O’Connor, *supra* note 3, at 1280.

90. *Id.* (“In England, however, patents operated without the omnipresent background of monopolist artisan guilds . . .”).

91. *Id.* at 1270.

effort, setting the inventiveness bar very low does not harm the local industry, while providing a greater assortment of commercial products to the general public.<sup>92</sup>

## 2. Early American Practice and the Adoption of an “Ingenuity” Requirement

At the outset, American patent law did not adopt the ingenuity requirement of the Venetian system.<sup>93</sup> Instead, Thomas Jefferson and the other original patent “examiners” applied various rules of thumb to screen those applications that were considered patentably distinct advances over the prior art.<sup>94</sup> These heuristics were predicated on the Patent Act of 1790’s provision that required an application to be rejected if the invention was “so unimportant and obvious that it ought not to be the subject of an exclusive right.”<sup>95</sup>

Jefferson suggested inserting language into the Patent Act to refuse a patent on the grounds of “unimportance and obviousness,” as part of the process to amend the Act and institute a registration system. Yet, Jefferson’s proposed language was rejected in favor of simply implementing the most important rule-of-thumb.<sup>96</sup> Specifically, the Patent Act of 1793 stated that “simply changing the form or the proportions of any machine, or composition of matter, in any degree, shall not be deemed a discovery.”<sup>97</sup>

Thus, once the Venetian Republic fell at the hands of Napoleon Bonaparte in 1797, it appears no patent system in the world contained a generalized “ingenuity” requirement akin to the nonobviousness standard applied today.<sup>98</sup>

Nonetheless, the language of the Patent Act of 1793 facilitated the development of the modern nonobviousness doctrine.<sup>99</sup> A trial court first interpreted the provision in *Evans v. Eaton* in 1816, finding that a patentable improvement must include a change in the “principle of the machine” not “a

92. *Id.*

93. Duffy, *supra* note 12, at 18–19 (“American law, most likely inspired by an unusual exception in French law, began to move away from a novelty-only standard in the early 1800s. American law invented a concept of invention or nonobviousness that is based upon the capabilities of a person having ordinary skill in a field . . .”).

94. See Thomas Jefferson, A Bill to Promote the Progress of the Useful Arts, in 22 THE PAPERS OF THOMAS JEFFERSON (Dec. 1, 1791), available at <http://founders.archives.gov/documents/Jefferson/01-22-02-0322> [<https://perma.cc/J77T-2ULV>].

95. *Id.*

96. *Id.* (“[A]ny person making or selling the thing so invented without permission as aforesaid shall be liable to an action at law . . . unless he can shew on like grounds that he did not know that there existed an exclusive right to the said invention, or can prove [] that the same is so unimportant and obvious that it ought not to be the subject of an exclusive right . . .”).

97. Act of Feb. 21, 1793, ch. 11 § 2, 1 Stat. 318, 321 (repealed 1836).

98. See Duffy, *supra* note 12, at 21; see also Nard & Morriss, *supra* note 73, at 223.

99. Duffy, *supra* note 12, at 31.

mere change in the form or proportions.”<sup>100</sup> Chief Justice Marshall affirmed the trial court’s interpretation of this requirement holding that the change in “principle” was a key component of patentability.<sup>101</sup>

The 1836 Act, in returning to an examination system, eliminated the language concerning simple changes in form and restored the “unimportant and obvious” concept to that found in the 1790 Act.<sup>102</sup> The Commissioner of Patents was authorized to issue a patent for any invention or discovery “if [he] shall deem it to be sufficiently useful and important.”<sup>103</sup> In practice however, the courts relied on the general concept of “invention” similar to the 1793 Act of changes in “form” or “proportions.”<sup>104</sup>

Despite this specific language, in 1846, the trial court in *Hovey v. Stevens* in passing announced a slightly broader principle.<sup>105</sup> Although, the court recited the usual language that a patentable invention must be “new in form” and “new in principle,” the court further stated that the change must not be “a very obvious change to any mechanic.”<sup>106</sup> However, it was not until the Supreme Court’s decision in 1851 in *Hotchkiss v. Greenwood* that an independent, general principle akin to today’s nonobviousness standard appeared.<sup>107</sup>

In *Hotchkiss*, the Court was essentially confronted with the issue of whether a change in the material of a doorknob constituted an advancement significant enough for patentability.<sup>108</sup>

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100. *Evans v. Eaton*, 8 F. Cas. 846, 852 (C.C.D. Pa. 1816) (No. 4,559), *rev’d on other grounds*, 16 U.S. 454, 519 (1818) (“As to what constitutes an improvement it is declared that it must be in the principle of the machine, and that a mere change in the form or proportions of any machine, shall not be deemed a discovery.”).

101. *Davis v. Palmer*, 7 F. Cas. 154, 159 (C.C.D. Va. 1827) (No. 3,645) (Marshall, C.J., sitting as Circuit Justice) (“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. In every case, therefore, the question must be submitted to the jury, whether the change of form and proportion, has produced a different effect.”).

102. Patent Act of July 4, 1836, ch. 357, § 6, 5 Stat. 117, 119 (1836) (“That any person or persons having discovered or invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used by others before his or their discovery or invention thereof . . .”).

103. *Id.* § 7.

104. ROBERT P. MERGES & JOHN DUFFY, PATENT LAW AND POLICY: CASES AND MATERIALS 611 (6th ed. 2013); Duffy, *supra* note 12, at 37.

105. *Hovey v. Stevens*, 12 F. Cas. 609, 612 (C.C.D. Mass. 1846) (No. 6,745).

106. *Id.*

107. *Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248, 259–60 (1850); Duffy, *supra* note 12, at 39–41.

108. *Hotchkiss*, 52 U.S. at 257 (“The court now is called upon to decide whether this patent, or whether any patent, can be sustained merely for applying a common, well-known material to a use to which it had not before been applied, without any new mode of using the material, or any new mode of manufacturing the article sought to be covered by the patent.”).



Rather than merely reciting the usual heuristic concern as a change “in form,” the Court announced a much broader rule, stating in critical part:

Unless more ingenuity and skill . . . were required . . . 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 a skillful mechanic, not that of the inventor.<sup>109</sup>

Interestingly, the Court used the same term “ingenuity” as used in the Venetian patent system, by then well-defunct, rather than employ the more modern terms “nonobvious” or “inventive.”<sup>110</sup> Unfortunately, there appears to be no evidence linking the Court’s invocation of this term to the Venetian statute.<sup>111</sup> Specifically, the “ingenuity” phrase first appeared in the *Hotchkiss* trial court’s jury instructions, rather than originating with the Supreme Court.<sup>112</sup> How the trial court constructed the more general test that now forms the basis of obviousness remains unexplained.<sup>113</sup>

Regardless of the origin of the *Hotchkiss* test, similarities between that and the Venetian standard certainly exist.<sup>114</sup> Duffy notes in contrast that the Venetian standard was a subjective one, but it does not appear to be more subjective than the *Hotchkiss* test.<sup>115</sup> Thus, to the extent that the *Hotchkiss* test and the Venetian ingenuity requirement share many common features, statements by academics and commentators that “the so-called patentability requirement was invented by the Americans, in particular the Justices of the U.S. Supreme Court in the case *Hotchkiss v. Greenwood* in 1850s” are in our view incorrect.<sup>116</sup> Rather, the *Hotchkiss* test should be viewed as a variant of the original Venetian requirement, though the lineage between the two tests remains unknown.<sup>117</sup>

109. *Id.* at 267.

110. *Id.*

111. See generally Duffy, *supra* note 12 (describing the evolution of the nonobviousness requirement from the Venetian Republic through *Hotchkiss v. Greenwood*).

112. *Hotchkiss*, 52 U.S. at 248 (“The test was, that, if no more ingenuity and skill was necessary to construct the new knob than was possessed by an ordinary mechanic acquainted with the business, the patent was void; and this was a proper question for the jury.”).

113. See *Hotchkiss v. Greenwood*, 12 F. Cas. 551, 553 (C.C.D. Ohio 1848) (No. 6718), *aff’d* by 52 U.S. (11 How.) 248 (1850).

114. See *Hotchkiss*, 52 U.S. at 267.

115. Compare *id.* at 248, with Duffy, *supra* note 12, at 39–41.

116. Friedrich-Karl Beier, *The Inventive Step in Its Historical Development*, 17 INT’L REV. INDUS. PROP. & COPYRIGHT L. (IIC) 301, 304–05 (1986).

117. See *id.*

B. *THE SECOND CYCLE: FROM “INGENUITY” TO THE “FLASH OF GENIUS”*

Following the Supreme Court’s decision in *Hotchkiss*, courts varied in how rigorously they applied the “ingenuity and skill” test, particularly given the brevity of the Court’s explication of the test. In *Reckendorfer v. Faber*,<sup>118</sup> the Court merely described the relevant standard as one “between mechanic skill . . . and inventive genius.”<sup>119</sup> Indeed, even at the Supreme Court itself, standards varied significantly. The vagueness in the Court’s decision made it possible for lower courts to interpret the standard too narrowly or too stringently.<sup>120</sup> For example, in *Smith v. Goodyear Dental Vulcanite Co.*, the Supreme Court held that where an inventor’s efforts resulted in “a machine [having] acquired new functions and useful properties,” then patentability could be presumed.<sup>121</sup> Perhaps Judge Learned Hand’s 1950 remark in *Air Kind Products* best sums up the difficulties courts faced in formulating the appropriate test: The “issue is as fugitive, impalpable, wayward, and vague a phantom as exists in the whole paraphernalia of legal concepts. . . . If there be an issue more troublesome, or more apt for litigation than this, we are not aware of it.”<sup>122</sup>

C. *THE THIRD CYCLE: THE 1952 ACT TO KSR V. TELEFLEX*

The new language of the 1952 Patent Act, particularly the Supreme Court’s interpretation of that language, substantially repositioned the nonobviousness test.<sup>123</sup> In turn, the Federal Circuit applied its own gloss to Supreme Court precedent in adopting its teaching-suggestion-motivation test. Finally, subsequent criticism of the Federal Circuit’s TSM test ultimately led to another refashioning of the nonobviousness doctrine in the Supreme Court’s 2007 decision in *KSR v. Teleflex*.<sup>124</sup>

1. Reconceptualizing the Invention Standard as a Nonobviousness Standard

The Patent Act of 1952 was a landmark revision to patent law. In many areas, the 1952 Act was a response to the jurisprudence that emanated from the Supreme Court and appellate courts just before the 1952 Act.<sup>125</sup> The standard of “inventiveness” was at the heart of this response, particularly given

118. *Reckendorfer v. Faber*, 92 U.S. 347, 357 (1875).

119. *Id.* at 357.

120. Duffy, *supra* note 12, at 41 (“[T]he standard of invention already seemed to be moving quite high . . . . But the Court was not consistent. At times the Court interpreted the *Hotchkiss* standard in a manner seemingly more lax than modern law . . .”).

121. *Smith v. Goodyear Dental Vulcanite Co.*, 93 U.S. 486, 496 (1876).

122. *Harries v. Air King Prods. Co.*, 183 F.2d 158, 162 (2d Cir. 1950).

123. Patent Act of July 19, 1952, ch. 950, § 103, 66 Stat. 792, 798 (1952).

124. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 402–04 (2007).

125. Jonas Anderson, *Congress as a Catalyst of Patent Reform at the Federal Circuit*, 63 AM. U. L. REV. 961, 973 (2014).

widespread criticism of the “flash of genius” threshold, but also in view of concerns that the standard needed to rest on surer footing.<sup>126</sup>

In many respects, the 1952 Act was “intended to codify the judicial nonobviousness standard, as the standard existed before Justice Douglas’ use of the ‘flash of creative genius’ concept.”<sup>127</sup> However, the 1952 Act went beyond merely codifying pre-*Cuno* law in that it replaced the so-called invention concept prevalent in the pre-1952 case law with the nonobviousness concept.<sup>128</sup> Specifically, the Act adopted relatively original language to implement the concept: “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.”<sup>129</sup>

Because the term and concept of “invention” recurred throughout the Act and associated doctrine, substituting it with the term and concept of “nonobviousness” was intended to allow the doctrine to develop more independently than previously.<sup>130</sup> In some ways, this independence led to immediate splits of authority among the appellate courts as to what constitutes “obvious[ness] . . . to a person having ordinary skill in the art.”<sup>131</sup>

To resolve these splits, the Supreme Court addressed the nonobviousness standard for the first time since the 1952 Act through a series of cases in the mid-1960s. In the most important of these cases, *Graham v. John Deere*, the Court set forth the test that forms the basis of all nonobviousness doctrine today.<sup>132</sup> Specifically, under the *Graham* test, one examines (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; (3) the level of ordinary skill in the field of the invention; and (4) objective considerations such as commercial success, long felt need, and the failure of others.<sup>133</sup>

Despite the *Graham* test’s added clarity, important issues were unresolved. For instance, exactly how does one compare the prior art to the claimed

126. George M. Sirilla, 35 U.S.C. § 103: *From Hotchkiss to Hand to Rich, the Obvious Patent Law Hall-of-Famers*, 32 J. MARSHALL L. REV. 437, 462 (1999); see also *Hearings before the Subcomm. on Patents, Trademarks, and Copyrights of the Comm. on the Judiciary House of Representatives on H.R. 5988, H.R. 4061 and H.R. 5248*, 80th Cong., 2nd Sess. 46 (1948) (“The general feeling of the patent bar, and I suppose among inventors and businessmen is that the Supreme Court has shoved up this hurdle, pushed up the standard of invention so high that it is getting harder and harder for the people that would ordinarily be considered inventors to get over it.” (statement of Giles Rich)).

127. Barton, *supra* note 29, at 486 (“The second sentence of this section providing that patentability shall not be negated by the manner in which the invention was made eliminates the ‘flash of genius’ concept that has been considered as an essential element of patentability since the *Cuno* case.”); Duffy, *supra* note 12, at 43–44; Sirilla, *supra* note 126, at 462.

128. Duffy, *supra* note 12, at 42–43.

129. 35 U.S.C. § 103(a) (1952).

130. See Holbrook, *supra* note 10, at 1028–49; Petherbridge & Wagner, *supra* note 24, at 2061.

131. 35 U.S.C. § 103(a); see also Duffy, *supra* note 12, at 19.

132. Duffy, *supra* note 12, at 60–62.

133. *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 17–18 (1966).

invention? In a 1976 case, *Sakraida v. Ag Pro, Inc.*, the Supreme Court indicated that at least for inventions that were the combination of known elements—which accounts for a great majority of all inventions—it was necessary to show some “synergy” between those known elements.<sup>134</sup> In that case, the Court denied patentability because the invention “simply arrange[d] old elements with each performing the same function it had been known to perform.”<sup>135</sup> These elements did not meet the standard for a combination patent, which should be “properly . . . characterized as synergistic, that is, ‘result(ing) in an effect greater than the sum of the several effects taken separately.’”<sup>136</sup>

## 2. The Federal Circuit’s Creation of the TSM Test

Created in the early 1980s, the Court of Appeals for the Federal Circuit was the genesis of congressional inquiry centered around the uniformity and stability of patent doctrine. In a sharp break with historical practice, Congress replaced the regional courts of appeal with one circuit court as the ultimate destination for essentially all appeals in patent cases from federal district courts.<sup>137</sup> The Federal Circuit actively created new patent law doctrine in many areas due to its mandate to bring stability to the system and the judicial philosophies of the particular judges nominated to the court.<sup>138</sup> In hindsight, many of these doctrines were in tension with previous Supreme Court case law.<sup>139</sup>

One of these areas was the appropriate test for obviousness. Seemingly disregarding the Supreme Court’s decision in *Sakraida*, the Federal Circuit held that “synergy” is not a requirement for combination patents in the patent statute, 35 U.S.C.<sup>140</sup> In *Stratoflex, Inc. v. Aeroquip Corp.*, Chief Judge Markey explained that “[a] requirement for ‘synergism’ or a ‘synergistic effect’ is nowhere found in the statute . . . virtually *all* patents are ‘combination

134. *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 281–82 (1976) (“[A]lthough the (respondent’s) flush system does not embrace a complicated technical improvement, it does achieve a synergistic result through a novel combination.” (second alteration in original) (quoting *Ag Pro, Inc. v. Sakraida*, 474 F.2d 167, 173 (5th Cir. 1973))).

135. *Id.* at 282.

136. *Id.* (alteration in original) (quoting *Anderson’s-Black Rock, Inc. v. Pavement Salvage Co.*, 396 U.S. 57, 61 (1969)).

137. Ryan T. Holte & Christopher B. Seaman, *Patent Injunctions on Appeal: An Empirical Study of the Federal Circuit’s Application of eBay*, 92 WASH. L. REV. 145, 165–66 (2017) (“The adoption of a single tribunal for patent appeals was intended to yield a ‘more predictable patent law doctrine, reduce or eliminate forum shopping, and at least rationalize—if not strengthen—the patent grant.’ . . . [T]he Federal Circuit has served as ‘the manager and developer of [] patent law.’” (alteration in original) (footnotes omitted) (quoting R. Polk Wagner & Lee Petherbridge, *Is the Federal Circuit Succeeding? An Empirical Assessment of Judicial Performance*, 152 U. PA. L. REV. 1105, 1115–16 (2004))).

138. *Id.* at 166.

139. *Id.* at 164–65.

140. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1540 (Fed. Cir. 1983).

patents,' if by that label one intends to describe patents having claims to inventions formed of a combination of elements."<sup>141</sup> Pushing in the opposite direction, the Federal Circuit adopted its TSM test to ensure that the combination of prior art elements could not be haphazardly stitched together with hindsight and render an invention unpatentable.<sup>142</sup>

Under the TSM test, the Federal Circuit required "some 'suggestion, teaching, or motivation' that would have led a person of ordinary skill in the art to combine the relevant prior art teachings in the manner claimed."<sup>143</sup> Although the reason, suggestion, or motivation could technically emanate from the "nature of [the] problem to be solved" or the mere "knowledge of one having ordinary skill in the art," in practice, the Federal Circuit (as well as the U.S. Patent & Trademark Office ("USPTO")) frequently required it to be shown in the prior art itself.<sup>144</sup>

In other words, without some express or implied suggestion in the prior art that certain references be combined, it was often quite difficult to show obviousness in court or at the Patent Office.<sup>145</sup> As Chris Cotropia has aptly remarked, "A finding of obviousness [could not] be made unless there [was] some impetus—that is a suggestion, teaching, or motivation—to make the leap from what is found in the individual pieces of prior art to the invention for which patent protection is sought."<sup>146</sup>

### 3. Criticism of the TSM Test

Given the difficulty of showing nonobviousness under the TSM test—as well as the dramatic rise in litigation by so-called non-practicing entities ("NPEs"), often derided as "patent trolls"—academics, large corporations, startups and policymakers lodged significant criticism of the TSM test.<sup>147</sup> For instance, the Federal Trade Commission (FTC) issued an influential report asserting that the Federal Circuit was applying a very demanding standard of

141. *Id.* ("Reference to 'combination' patents is . . . meaningless.").

142. *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573 (Fed. Cir. 1996) (citing *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 n.24 (Fed. Cir. 1985)).

143. *Teleflex, Inc. v. KSR Int'l Co.*, 119 F. App'x 282, 285 (2005).

144. *See, e.g., Pro-Mold & Tool Co.*, 75 F.3d at 1673; *Ashland Oil, Inc.*, 776 F.2d at 292–94; *ACS Hosp. Sys., Inc.*, 732 F.2d at 1578.

145. Rebecca S. Eisenberg, Commentary, *The Supreme Court and the Federal Circuit: Visitation and Custody of Patent Law*, 106 MICH. L. REV. FIRST IMPRESSIONS 28, 33 (2007); Harold C. Wegner, Commentary, *Making Sense of KSR and Other Recent Patent Cases*, 106 MICH. L. REV. FIRST IMPRESSIONS 39, 41 (2007).

146. Cotropia, *supra* note 41, at 917–18.

147. *See* FTC, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY, Ch. 4, at 11 (2003), [www.ftc.gov/os/2003/10/innovationrpt.pdf](http://www.ftc.gov/os/2003/10/innovationrpt.pdf) [<https://perma.cc/GT7H-T9M8>] (noting that participants "disagreed with the Federal Circuit's recent applications of the test, which seem to require 'specific and definitive [prior] art references with clear motivation of how to combine those references'" (alteration in original) (quoting Q. Todd Dickinson's Feb. 6, 2002 contribution to FTC/DOJ Hearing)).

proof in obviousness cases.<sup>148</sup> The report quoted the USPTO's Deputy Commissioner for examination policy, who had remarked that "the Federal Circuit [was] insisting that the [US]PTO . . . 'connect the dots . . . very, very clearly'" for the agency to reject a patent application on obviousness grounds.<sup>149</sup> As such, the FTC recommended that the non-obviousness standard be reformed so "that in assessing obviousness, the analysis should ascribe to the person having ordinary skill in the art an ability to combine or modify prior art reference that is consistent with the creativity and problem-solving skills that in fact are characteristic of those having ordinary skill in the art."<sup>150</sup>

Similar criticisms and recommendations emanated from the National Research Council of the National Academics of Science (NRC), the American Intellectual Property Law Association (AIPLA), and a variety of academics.<sup>151</sup> For instance, the NRC flatly contended that the TSM test "is a serious and growing problem that is degrading the innovative output of society."<sup>152</sup>

#### 4. *KSR v. Teleflex*: A Return to Pre-Federal Circuit Standards?

It was against this backdrop of criticism of the TSM test that the Supreme Court granted certiorari in *KSR v. Teleflex*,<sup>153</sup> a case involving the obviousness of an electronic accelerator pedal assembly used in automobiles.<sup>154</sup> In reversing, the Supreme Court found that the Federal Circuit's application of the TSM test in its opinion led to analysis of nonobviousness "in a narrow, rigid manner . . . inconsistent with § 103 and this Court's precedents."<sup>155</sup> In other words, constraining the test merely to teachings, suggestions, and motivations solely in the prior art set too high a bar to show obviousness. On the other hand, the Court left open the door for continued use of the TSM test by finding that the TSM test can nonetheless provide "helpful insight" if applied in an appropriate manner.<sup>156</sup>

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148. *Id.*

149. *Id.* (second alteration in original) (quoting Stephen G. Kunin's July 10, 2002 contribution to FTC/DOJ Hearing).

150. *Id.* ch. 4, at 15.

151. NAT'L RESEARCH COUNCIL, A PATENT SYSTEM FOR THE 21ST CENTURY 59 (Stephen A. Merrill, Richard C. Levin & Mark B. Myers eds., 2004), <http://www.nap.edu/html/patentsystem/030908g107.pdf> [<https://perma.cc/ZD48-T5DG>]; AM. INTELLECTUAL PROP. LAW ASS'N, REPORT OF AIPLA SPECIAL COMMITTEE TO STUDY THE NATIONAL RESEARCH COUNCIL'S REPORT ON REAPING THE BENEFITS OF GENOMIC AND PROTEOMIC RESEARCH 18 (2006), [https://www.aipla.org/docs/default-source/advocacy/documents/reapbenegenprotes.pdf?sfvrsn=9ecdb215\\_3](https://www.aipla.org/docs/default-source/advocacy/documents/reapbenegenprotes.pdf?sfvrsn=9ecdb215_3) [<https://perma.cc/T39W-WEW3>] ("The non-obviousness requirement should be applied with vigor.").

152. Petherbridge & Wagner, *supra* note 24, at 2068.

153. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 427-28 (2007).

154. *Id.* at 407.

155. *Id.* at 400.

156. *Id.* at 418.

Yet, the Court went well beyond its mere admonition to apply the TSM test more flexibly. The Court stated that the Federal Circuit’s “rigid approach” to obviousness is “inconsistent” with Supreme Court cases “set[ting] forth an expansive and flexible approach” to determining obviousness.<sup>157</sup>

Departing in part from TSM, the Court developed “different factors” to provide helpful insight on finding obviousness including common sense, ordinary creativity, and market forces.<sup>158</sup>

*D. THE FOURTH CYCLE: THE FEDERAL CIRCUIT’S “NEW AND IMPROVED”  
TSM TEST?*

Since the Supreme Court decision in *KSR*, the Federal Circuit’s precise approach to questions of obviousness remains somewhat inconsistent. Although *KSR* stated that a “reason to combine” prior art references must be present, the extent to which the reason may originate from outside the prior art itself remains contested.<sup>159</sup> For instance, some Federal Circuit judges—apparently in order to protect against hindsight bias—disfavor reasons external to the prior art and tend to rely less on those *KSR* “factors” such as common sense, ordinary creativity, and market forces to find obviousness.<sup>160</sup> Other judges take a tack seemingly more consistent with policy motivations behind the Court’s decision to massively expand the rationales available to show obviousness.<sup>161</sup>

More specifically, in the few years following *KSR*, some Federal Circuit opinions emphasized those aspects of the *KSR* opinion that represented a clear departure from Federal Circuit doctrine. For instance, in *Leapfrog Enterprise*, decided very soon after *KSR*, the Federal Circuit noted that an obviousness determination is “not the result of a rigid formula disassociated from the consideration of the facts of a case.”<sup>162</sup> Instead, “the common sense of those skilled in the art demonstrates why some combinations would have

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157. *Id.* at 415.

158. *Id.*; Fromer, *supra* note 16, at 87 (“highlighting that ‘[t]he diversity of inventive pursuits and of modern technology counsels against limiting the analysis’ of obviousness in inflexible ways.” (alteration in original) (quoting *KSR*, 550 U.S. at 419)).

159. See, e.g., Tony V. Pezzano & Michael P. Dougherty, *Federal Circuit Judges Disagree on Proper Standard for Evaluating Patent Validity Under 35 U.S.C. § 103*, DLA PIPER (Dec. 13, 2018), <https://www.dlapiper.com/en/us/insights/publications/2018/12/federal-circuit-judges-disagree> [https://perma.cc/WG4B-BALB].

160. See *Merck Sharp & Dohme Corp. v. Hospira, Inc.*, 874 F.3d 724, 732 (Fed. Cir. 2017) (Newman, J., dissenting) (“However, some Federal Circuit decisions appear to have sought a shortcut, and converted three of the four Graham factors into a self-standing ‘prima facie’ case, whereby the objective considerations must achieve rebuttal weight. This path of analysis was followed by the district court herein, finding that Hospira ‘made a *prima facie* showing’ based solely on the prior art.”).

161. *Intercontinental Great Brands LLC v. Kellogg N. Am. Co.*, 869 F.3d 1336, 1336 n.1 (Fed. Cir. 2017); *S-Tek Sys., LLC v. Engineered Corrosion Sols., LLC*, No. 2017-2297, 2018 WL 4520013, at \*5 (Fed. Cir. Sept. 20, 2018).

162. *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1161 (Fed. Cir. 2007).

been obvious where others would not.”<sup>163</sup> In affirming the district court’s obviousness determination, the Federal Circuit found that adapting older mechanical devices and applying them to modern electronics is “commonplace in recent years.”<sup>164</sup>

*In re Kubin*<sup>165</sup> dealt with patents related to a biotechnology invention for isolating and sequencing human genes. Quoting from *KSR*, the Federal Circuit held that “where a skilled artisan merely pursues ‘known options’ from a ‘finite number of identified, predictable solutions,’ obviousness under § 103 arises.”<sup>166</sup> Effectively contrary to numerous pre-*KSR* Federal Circuit cases, the “obvious to try” doctrine became fully viable. Relatedly, to show nonobviousness, the court found an “improvement [must be] more than the predictable use of prior art elements according to their established functions.”<sup>167</sup>

Other cases seemed to pay less attention to *KSR*’s departures from Federal Circuit doctrine, and instead emphasized the Supreme Court’s remark that the TSM test is a “helpful insight,” at least if flexibly applied. For instance, in *In re Translogic Tech*, the Federal Circuit reaffirmed the continued viability of the TSM test, stating “as the Supreme Court suggests, a flexible approach to the TSM test prevents hindsight and focuses on evidence before the time of invention.”<sup>168</sup>

### III. PRIOR EMPIRICAL STUDIES OF THE NONOBVIOUSNESS DOCTRINE

Since *KSR* was decided, a number of scholars have conducted empirical studies of obviousness cases. Most of these studies were limited to narrow time periods, and all but one only addressed Federal Circuit cases. The single study reviewing district courts examined only four of the 94 federal district courts. Finally, none of these studies comprehensively coded for the reasoning used by the courts in reaching their various decisions. As a result, all of these studies are subject to significant limitations in our understanding of how the obviousness doctrine operates following *KSR*. Nonetheless, we report their major findings, because they are still of significant interest and they provide an important backdrop for our findings. We begin this review by discussing some pre-*KSR* studies as well.

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163. *Id.* (citing *KSR*, 550 U.S. at 416).

164. *Leapfrog Enters., Inc.*, 485 F.3d at 1161.

165. *In re Kubin*, 561 F.3d 1351, 1359 (Fed. Cir. 2009).

166. *Id.* (citing *KSR*, 550 U.S. at 421).

167. *Id.* (quoting *KSR*, 550 U.S. at 417).

168. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1260 (Fed. Cir. 2007); *see also* Black & Decker, Inc. v. Robert Bosch Tool Corp., 260 F. App’x 284, 290 (Fed. Cir. 2008) (“This court has already said that the teaching, suggestion, motivation test remains good law for obviousness, only a rigid application of that test is problematic.”); *Cordis Corp. v. Medtronic Ave, Inc.*, 511 F.3d 1157, 1172 (Fed. Cir. 2008); *Ortho-McNeil Pharm., Inc. v. Mylan Labs., Inc.*, 520 F.3d 1358, 1364–65 (Fed. Cir. 2008).



In a 2007 article, Lee Petherbridge and R. Polk Wagner discovered that much of the then-current commentary (pre-*KSR*) may have overstated the concerns with the Federal Circuit's approach to obviousness.<sup>169</sup> First, the authors discovered that the Federal Circuit found patents obvious a majority of the time (58%), with a trend that had been increasing since 1990 and did not seem to be associated with broad technological areas.<sup>170</sup> Second, within the Federal Circuit opinions, Petherbridge and Wagner found that the Federal Circuit's TSM analysis did not appear to dominate the law of obviousness, with only 45% of cases using it to reach a finding.<sup>171</sup> According to the authors, whether the TSM analysis is used appeared to have no observable effect on whether the reviewed analysis is affirmed and only a modest impact (about 5%) on whether the patent is declared obvious.<sup>172</sup> Third, the TSM analysis seemed to be a flexible tool biased in favor of patentability.<sup>173</sup> Although Petherbridge and Wagner found that the rate at which the TSM analysis had been applied increased substantially since 1990, the rate at which TSM analyses result in determinations of obviousness had also increased significantly. Fourth, they found the Federal Circuit affirmed determinations of obviousness a majority of the time (more than 65%), and the rate at which the Federal Circuit reversed or vacated obviousness decisions by the USPTO had been falling steadily since 1990.<sup>174</sup> Fifth, the authors found the Federal Circuit's jurisprudence in this area was relatively stable.<sup>175</sup>

Another 2007 pre-*KSR* article by Christopher Cotropia approached the rulings of obviousness and nonobviousness by the Federal Circuit on two levels.<sup>176</sup> First, the study engaged in a "macro-level" analysis, focusing on the outcome of each case.<sup>177</sup> Second, the study took a "micro-level" look at the actual reasoning behind the court's findings.<sup>178</sup> Cotropia concluded that then-recent criticism of the Federal Circuit was not supported, at least weakly on the macro-level.<sup>179</sup> In appeals from patent infringement cases, the macro-level study found a distribution that only slightly favored findings of nonobviousness.<sup>180</sup> In terms of the court's reasoning, use of the TSM test led to a finding of nonobviousness, or a vacating of a finding of obviousness in only 33% of the patents appealed from patent infringement cases and in 11%

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169. See Petherbridge & Wagner, *supra* note 24, at 2055–56.

170. *Id.* at 2055.

171. *Id.*

172. *Id.*

173. *Id.*

174. *Id.*

175. *Id.*

176. Cotropia, *supra* note 41, at 914.

177. *Id.*

178. *Id.*

179. *Id.*

180. *Id.* at 914–15.

of cases appealed from the USPTO.<sup>181</sup> These low percentages stand in sharp contrast to claims that the suggestion test had caused the nonobviousness requirement to become substantially lower than prior to the creation of the Federal Circuit.<sup>182</sup>

In 2009, in an early qualitative study of Federal Circuit cases following *KSR*, Emer Simic claimed that the Federal Circuit's case law post-*KSR* largely remained unchanged.<sup>183</sup> In particular, Simic concluded that this not-so-radical change happened following the Supreme Court's decision because: (1) the Supreme Court failed to replace the TSM test with a new, clearly articulated test for obviousness; and (2) as a result, the Federal Circuit had opted to construe the decision narrowly.<sup>184</sup> Nonetheless, Simic believed that the Supreme Court may have been wrong about the impact of the TSM test on the "rise of junk patents and may have caused more harm than good by altering the obviousness inquiry without creating a safeguard against hindsight bias."<sup>185</sup>

A 2010 article, written by then-student Ali Mojibi, presented an empirical study suggesting that after *KSR*, both the Federal Circuit and the four district courts he analyzed are more likely to render patents invalid as obvious.<sup>186</sup> Mojibi contended that this showing contradicted a commonly held belief that *KSR* did not in fact change the law of obviousness significantly.<sup>187</sup> Further, the study found that the effect of *KSR* is not necessarily connected to the text of the Supreme Court's opinion.<sup>188</sup> Instead, the Federal Circuit reacted to the particularity of the Supreme Court's granting of certiorari to *KSR* by invalidating a relatively high percentage of patents—both for obviousness and anticipation—during the period in which *KSR* was pending before the Supreme Court.<sup>189</sup> Lastly, the study found that, "statistically speaking, the Federal Circuit in particular, and judges in general, may be surprisingly

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181. *Id.*

182. *Id.*

183. *See* Simic, *supra* note 23, at 229–30.

184. *Id.*

185. *Id.* In 2006, Gregory Mandel reported on an original experimental study that provides the first empirical demonstration of hindsight bias in patent law. Gregory N. Mandel, *Patently Non-Obvious: Empirical Demonstration that the Hindsight Bias Renders Patent Decisions Irrational*, 67 OHIO ST. L.J. 1391, 1393 (2006) ("Judges, jurors, and patent examiners seemingly lack the cognitive ability to make decisions in the manner that patent law currently requires."). Mandel also analyzed pre-*KSR* district court decisions regarding obviousness from July 2004 through December 2005, finding that these cases infrequently relied on secondary considerations in order to make a determination of nonobviousness. *See id.* at 1422–24.

186. Mojibi, *supra* note 41, at 559. Mojibi was a law clerk when he published the article, but a student when he wrote the bulk of it. Personal Communication from Professor Lee Petherbridge to Professor Ted Sichelman, 2011.

187. Mojibi, *supra* note 41, at 559.

188. *Id.*

189. *Id.* at 559–61.

sensitive to criticism coming from the practicing bar and academia.”<sup>190</sup> Although the Mojibi study in our view made valuable findings and was the only one to examine any district court cases, it was limited to a four-and-a-half year period ending in 2009. Additionally, it only examined four out of the 94 federal districts in which patent litigation may be brought.<sup>191</sup>

A 2011 article by Jennifer Nock and Sreekar Gadde reports the results of an empirical study of all Federal Circuit obviousness decisions in the two-and-a-half years following *KSR*.<sup>192</sup> Like previous studies, Nock and Gadde found a shift in the Federal Circuit’s willingness to uphold findings of obviousness from lower courts.<sup>193</sup> The authors discovered that the Federal Circuit is now much less willing to reverse a lower-tribunal finding that a patent is obvious versus a finding that a patent is nonobvious.<sup>194</sup> During the authors’ study period post-*KSR* (mid-2007 through 2009), the Federal Circuit did not reverse a single lower court determination that a patent claim was obvious.<sup>195</sup> Further, according to the authors, obviousness findings below were affirmed in 81% of all decisions.<sup>196</sup> Nonobviousness findings below, by contrast, were affirmed just 53% of the time.<sup>197</sup> Further, nonobviousness holdings below were appealed to the Federal Circuit far more frequently than obviousness holdings, with nonobviousness holdings accounting for 67% of appeals from district courts.<sup>198</sup> In sum, appeals to the Federal Circuit during the study resulted in claims being held obvious in 66% of all final determinations on the issue of obviousness.<sup>199</sup> The authors compare this number to the 58% of decisions holding claims obvious from 1990 to 2005.<sup>200</sup>

Jason Rantanen’s 2013 study of the Federal Circuit’s obviousness jurisprudence is the most comprehensive examination to date. Rantanen focused on two contradicting theories of the impact of *KSR*.<sup>201</sup> First, according to Rebecca Eisenberg, “*KSR* [would change] what the Federal Circuit said about obviousness but not what it did.”<sup>202</sup> The contrasting theory, according to Harold Wegner, was that *KSR* would change case outcomes: Inventions that

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190. *Id.* at 561.

191. *Id.*

192. Nock & Gadde, *supra* note 41, at 369.

193. *Id.*

194. *Id.*

195. *Id.* at 405.

196. *Id.* at 373.

197. *Id.*

198. *Id.* at 372.

199. *Id.* at 393.

200. *Id.* at 407.

201. Rantanen, *supra* note 41, at 709.

202. Eisenberg, *supra* note 145, at 33.

were nonobvious the day before *KSR* would suddenly become obvious after the Court's opinion.<sup>203</sup>

Rantanen made several major findings generally in favor of Wegner's prediction. First, Rantanen discovered that following *KSR* the Federal Circuit has become less favorable to patentees on the issue of obviousness, and that the rate at which the Federal Circuit has affirmed lower tribunals suggests that the court has applied a substantively changed law of obviousness.<sup>204</sup>

Second, the study found that "the Federal Circuit's ubiquitous pre-*KSR* requirement that patent challengers identify a "teaching, suggestions, or motivation (TSM) to combine or modify the prior art has largely disappeared, at least in formal terms."<sup>205</sup> Rather, he concluded that "although the concept underlying TSM has endured in the form of a "reason to combine" requirement, the post-*KSR* nature of that requirement differs substantially from its pre-*KSR* incarnation."<sup>206</sup> Indeed, Rantanen found that no post-*KSR* opinions he examined explicitly stated that they were restricting "reason to combine" to only the prior art.<sup>207</sup>

Third, Rantanen found significant use of *KSR*-specific reasoning by the Federal Circuit.<sup>208</sup> For instance, he determined that in 25% of post-*KSR* opinions, the reason to combine stemmed from predictable uses of the prior art elements, and that in at least 14 opinions, the Federal Circuit relied on "common sense" to find a reason to combine.<sup>209</sup> At the same time, Rantanen found that the Federal Circuit often relies on secondary factors of nonobviousness, such as licensing, whether there was a reasonable expectation of success, prolific licensing, and the market's reaction to whether the invention was a success.<sup>210</sup> Thus, Rantanen concluded there is "a new obviousness jurisprudence that offers substantial flexibility to district courts ruling on the issue."<sup>211</sup>

Despite the comprehensiveness of Rantanen's study, it leaves some important gaps.<sup>212</sup> Specifically, as Rantanen notes himself, he did not measure how often "obviousness to try" or "predictable uses of prior art elements" appeared in the Federal Circuit's reasoning.<sup>213</sup> Similarly, he did not measure the role of "market forces" in the Federal Circuit's determinations of

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203. Wegner, *supra* note 145, at 41.

204. Rantanen, *supra* note 41, at 713.

205. *Id.*

206. *Id.*

207. *Id.* at 754-55.

208. *See id.*

209. *Id.* at 759-60.

210. *See id.*

211. *Id.* at 713.

212. *See infra* Part III.

213. Rantanen, *supra* note 41, at 760.

nonobviousness.<sup>214</sup> By measuring the frequency of these types of reasons, one can determine with greater certainty whether the Federal Circuit has applied a more traditional, “formal” TSM test, or whether it is more along the lines of the flexible test espoused by the Supreme Court in *KSR*.<sup>215</sup> Furthermore, Rantanen did not examine any district court decisions. Most patent litigation begins and ends in district courts, which also frame legal and factual issues for appeal. Thus, understanding how the district courts apply *KSR* is critical not only for practitioners, but also to understand the theoretical and doctrinal nuances of how courts in general (not merely the Federal Circuit) have reacted to the *KSR* decision.<sup>216</sup>

Last, a 2017 study by Brendan Seth O’Brien O’Shea further examined Federal Circuit opinions (from 2012 to 2015) solely arising from the USPTO, but not appeals from district courts or district court opinions themselves.<sup>217</sup> Interestingly, the study found that the rate of obviousness findings by the Federal Circuit in ex parte appeals (those involving in just the patentee) from the USPTO was about 80%, but only about 56% from inter partes appeals from the USPTO (those involving the patentee and a challenger).<sup>218</sup> Although these findings are a useful extension of prior work, this study suffers from a limited dataset, and like earlier studies, wholly omitted decisions at district courts.

In sum, the post-*KSR* studies have consistently found a substantial shift at the Federal Circuit toward findings of obviousness. Additionally, other than the Simic study, which was quite limited in its review, the studies found a notable change in the Federal Circuit’s doctrine—in particular, the court discarded its “rigid” form of the TSM test used in at least some of its previous decisions in favor of a more flexible standard that could support an increased rate of obviousness findings. However, these studies had very little to say about district court approaches to obviousness post-*KSR*, with just one of them examining only four district courts. Furthermore, none of the studies extensively coded the reasoning used pre- and post-*KSR* in order to more precisely quantify the shift in doctrine.

#### IV. A TALE OF TWO COURTS?: THE FEDERAL CIRCUIT’S AND DISTRICT COURTS’ DIFFERING APPROACHES TO NONOBVIOUSNESS

In this Part, we first describe our study methodology and dataset, explaining how we exhaustively identified and coded what we believe are all Federal Circuit and district court cases addressing obviousness during the time period of our study (2003 to 2013). Next, we present two major findings.

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214. *Id.* at 760–61.

215. *See infra* Part IV.

216. *See infra* Part IV.

217. O’Shea, *supra* note 41, at 541–44. This study also excluded Rule 36 (summary affirmance) opinions. *Id.* at 542.

218. *See id.* at 543.

First, we show that there has been a substantial increase in obviousness findings in both the district courts and the Federal Circuit, though somewhat less of an increase in the Federal Circuit. Second, we find that although doctrine also shifted substantially in both the district courts and the Federal Circuit, like outcomes, the shift was less robust in the Federal Circuit.

#### A. STUDY METHODOLOGY AND DATA SOURCES

Using a variety of search techniques,<sup>219</sup> and by collecting raw data from authors of several previous studies on nonobviousness, we are fairly confident that we identified and collected all district court and Federal Circuit obviousness decisions—including so-called Rule 36 summary affirmances with no opinion—issued between January 1, 2003 and December 31, 2013.<sup>220</sup> The Supreme Court issued the *KSR* decision on April 30, 2007—essentially the middle of the analysis period.

We began with over 700 district court and Federal Circuit decisions that plausibly raised obviousness issues.<sup>221</sup> Reviewing each opinion, we narrowed the set to 319 district court opinions and 192 Federal Circuit opinions that had actual obviousness determinations.<sup>222</sup> Because we coded each set of patents and claims separately,<sup>223</sup> we were able to determine when opinions

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219. In this regard, we relied heavily on the various search techniques used in the Rantanen study. See Rantanen, *supra* note 41, at 726–27 & nn.87–89 (describing search methodology).

220. Rule 36 decisions are decisions in which the Federal Circuit affirms the district court's decision without a written opinion, effectively adopting the district court's decision and opinion as-is. Of the 154 CAFC decisions, 16 were Rule 36 decisions. In order to be faithful to the rule, we coded the reasoning of the CAFC's Rule 36 as that of the district court, though we think it is unlikely that if the CAFC actually wrote opinions in these cases, the reasoning would be the same as the district court decisions. See generally Martha J. Dragich, *Will the Federal Courts of Appeals Perish If They Publish? Or Does the Declining Use of Opinions to Explain and Justify Judicial Decisions Pose a Greater Threat?*, 44 AM. U. L. REV. 757, 763 n.20 (1995) (describing the Federal Circuit's Rule 36 and similar rules in other courts of appeal).

221. The selection of decisions was mainly gathered from PatStats.org, a resource published by the University of Houston Law Center, <http://www.patstats.org> [<https://perma.cc/EZW4-K9PB>], as well as a patent litigation intelligence platform called Docket Navigator, <http://docketnavigator.com> [<https://perma.cc/4FBG-gYQH>]. Coverage of all cases during the time period was verified with searching on Lexis and Westlaw. The Federal Circuit data set was further verified using the Finnegan Federal Circuit decision website, *Federal Circuit IP Decisions*, FINNEGAN, <https://www.finnegan.com/en/tools/index.html> [<https://perma.cc/R4PR-EEW5>]. To further ensure we captured every appeal during our time frame, we keycited each district court case in our dataset and matched the district court decision to any appellate decision at the Federal Circuit.

222. We excluded district court jury verdicts, as the focus of our project is determining changes in judicial decision-making before and after *KSR*. See, e.g., Mark A. Lemley, Su Li & Jennifer N. Urban, *Does Familiarity Breed Contempt Among Judges Deciding Patent Cases?*, 66 STAN. L. REV. 1121, 1131–32 (2014) (“Because we were concerned with the behavior of district court judges, we excluded jury verdicts . . .”).

223. To code specific claims, each decision was broken into several obviousness “blocks” per case. A few cases contained patent numbers but no patent claims because the opinion did not identify specific claims. Those instances were counted as one claim. See Ryan Holte & Ted

used differing reasoning or reached different outcomes with respect to different patents—even different claims within the same patent—within a single opinion.<sup>224</sup>

We managed a team of approximately 15 research assistants who analyzed the obviousness portion of each opinion by a rigorous and very time-consuming manual review of more than 700 opinions to create our final dataset (a few thousand hours of work in total). We provided an intensive training instruction period including multiple training sessions reviewing the coding process, which was thoroughly documented in “codebooks” associated with each level of court, Federal Circuit and district courts.<sup>225</sup> Additionally, as a team, we and our most experienced research assistants, conducted on-going review of the case coding in order to ensure the accuracy of our data.<sup>226</sup> We also performed multiple rounds of quality checking during this process. For example, we coded a majority of cases twice to confirm the junior coders coding quality and to identify discrepancies that we personally reviewed.<sup>227</sup>

Over 100 types of coding fields were used to record data for each decision, and multiple coding blocks were used in a single decision if the court conducted separate analyses of different patents or claims.<sup>228</sup> In total, if a given case used all patent coding blocks, 284 coding fields for district court decisions and 461 coding fields for Federal Circuit decisions may have been filled with data.<sup>229</sup> Field types captured a variety of data from each case, including basic case data such as (1) date of decision; (2) court name; (3) procedural posture; (4) judge(s); (5) authoring judge; (6) party names; (7) patent numbers and claims; and other related fields.<sup>230</sup> More important

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Sichelman, Codebook for *Cycles of Obviousness* Project—Case Coding Instructions (2019) [hereinafter, Project Codebook] (on file with authors) (specifying our coding procedure in detail).

224. See *id.* The Federal Circuit appeals included all district court appeals during the time period, but not appeals from the International Trade Commission or USPTO. Although we coded concurrences and dissents in Federal Circuit opinions, because this Article focuses on the reasoning of courts, rather than judges, we do not report on those separate opinions here.

225. See *id.*

226. See, e.g., Robert M. Lawless, Angela K. Littwin, Katherine M. Porter, John A.E. Pottow, Deborah K. Thorne & Elizabeth Warren, *Did Bankruptcy Reform Fail? An Empirical Study of Consumer Debtors*, 82 AM. BANKR. L.J. 349, 394 (2008) (“Each coder who input these questionnaire data received extensive training, including instruction on the coding protocols, coding of practice questionnaires, and individual review of each coder’s first set of questionnaires. A written instruction manual established consistent protocols . . .”).

227. See *id.* (reviewing and testing for inter-coder reliability).

228. See Project Codebook, *supra* note 223.

229. See *id.*

230. Some standardized fields were coded by computer algorithm (“machine-coded”) and others were hand-coded by research assistants (“hand-coded”). Machine-coded examples include the “Case\_Name” field which is the full case title, as exported from Westlaw or Lexis. “Filing\_Date” is the date the opinion was filed in the court. Hand-coded fields requiring human analysis included “Procedural\_Posture\_CAFC\_2,” which contains information on the procedural posture of the obviousness issue at the CAFC, and explains whether the CAFC appeal is from a jury verdict, bench verdict, JMOL, or other district court outcome. See *id.*

to this study is the coding of the outcomes and reasoning used in each decision.<sup>231</sup> For instance, research assistants coded a field called, “TSM\_Use,” which states whether the TSM test was used in the analysis of the opinion (or not).<sup>232</sup> A research assistant was required to distinguish whether the TSM test was merely discussed in passing or if the test was actually employed by the court in reaching its holding.<sup>233</sup> Other reasoning fields included, for example, whether the opinion relied on such factors as “obvious to try,” “design incentives and other market forces,” and the “common sense” of a PHOSITA.<sup>234</sup> We also coded whether the court used any secondary “objective” factors of nonobviousness, such as the “commercial success” of the claimed invention, whether there was a “long felt need” for the invention, and evidence of “copying” of the invention.<sup>235</sup> In our results below, we describe the complete set of “reasoning” and “outcome” fields, including the use of secondary factors.<sup>236</sup>

After the coding was complete, National Bureau of Economic Research (NBER) classification numbers for each patent were used to assign one of six technology types to each patent: chemistry, computers and communications, drugs and medical, electrical and electronic, mechanical, and other.<sup>237</sup> Although these classifications are not perfect, they are regularly used in empirical patent law scholarship, and are a useful way to distinguish outcomes and reasoning by technology type.<sup>238</sup>

*B. MAJOR RESULT #1: A SUBSTANTIAL INCREASE IN OBVIOUSNESS FINDINGS IN THE DISTRICT COURTS AND FEDERAL CIRCUIT*

We first provide insight into the total number of district court and Federal Circuit decisions on obviousness pre- and post-*KSR*. An immediate question after the Supreme Court lowered the bar in *KSR* for accused infringers to show obviousness, is whether the number of cases addressing this issue substantially increased. Next, we analyze these decisions for outcome (obviousness vs. nonobviousness), affirmances vs. reversals, procedural posture, technology type, and finally, the basis for the court’s decisions. We begin by presenting descriptive statistics and follow with a regression analysis.

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231. See *infra* Section IV.C.

232. See Project Codebook, *supra* note 223.

233. See *id.*

234. See *infra* Section IV.C.

235. See *infra* Section IV.C.

236. See *infra* Section IV.C.

237. Jean Roth, *The NBER U.S. Patent Citations Data File: Lessons, Insights, and Methodological Tools*, NAT’L BUREAU OF ECON. RESEARCH, <http://www.nber.org/patents> [<https://perma.cc/5Y7P-2TFY>] (last updated May 16, 2012).

238. See, e.g., Michael Risch, *A Generation of Patent Litigation*, 52 SAN DIEGO L. REV. 67, 84 (2015) (relying on NBER technology classifications); Christopher A. Cotropia, Jay P. Kesan & David L. Schwartz, *Unpacking Patent Assertion Entities (PAEs)*, 99 MINN. L. REV. 649, 680 (2014) (same).



### 1. Total Cases Raising an Obviousness Defense

Following the Supreme Court's April 2007 decision in *KSR*, accused infringers had much greater incentives to raise a defense of obviousness. Because no prior study has comprehensively analyzed district court opinions, this important issue essentially remains unexplored. Although we only coded determinations of obviousness—as opposed to answers to complaints, summary judgment briefs, and trial transcripts—the number of obviousness determinations, adjusted for total cases filed, are arguably a decent proxy for how frequently the defense was raised pre- and post-*KSR* in the district courts.<sup>239</sup>

Overall, we identified 319 district court opinions with obviousness determinations from 2003 to 2013. Of those, 119 were decided before *KSR* and 200 after *KSR*. On an annual basis, this amounts to 27.5 decisions per year prior to *KSR* and 30.0 decisions per year after *KSR*.<sup>240</sup> If we further adjust for the number of patent cases filed during each period—lagging the number by two years to take account from the time of complaint to time of decision<sup>241</sup>—we find the number of obviousness decisions per filed case per year to be nearly the same: 10.2 per 1000 filed cases pre-*KSR* and 9.7 per 1000 filed cases post-*KSR*.<sup>242</sup>

Although these findings are not conclusive, it is a plausible indication that the rate at which the obviousness defense is raised has essentially not changed since the *KSR* decision. This may seem surprising at first blush, but based on the authors' prior and on-going patent litigation experience, the obviousness defense was raised in the vast majority of patent cases prior to *KSR*. Importantly, given the nature of prior art and patent claims, it is much more likely to win an invalidity argument via obviousness than anticipation. For anticipation, a single reference must disclose all of the claim elements, whereas for obviousness, an accused infringer can—subject to limiting

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239. Indeed, for a full determination of incentives post-*KSR*, one would need to determine how many cases that might have been filed pre-*KSR* were not filed post-*KSR*. Even more so than answers to complaints, there is no simple method to make this determination other than looking at aggregate case filings. Given the large number of other changes to patent doctrine at the time and shortly thereafter—from substantial changes in the award of injunctive relief, the rise NPEs, and the America Invents Act of 2011—such a determination would be extremely difficult, if not impossible, even using the most sophisticated empirical techniques. As such, our comparison of pre- and post-*KSR* decisions above showed by viewed as a rough proxy for the change in incentives effectuated by *KSR*.

240. Here, we ignore obviousness determinations by juries. Based on our appeal data, there was an insignificant difference in the number of jury verdicts on obviousness per year before and after *KSR*.

241. On average, the time from the filing of a complaint to termination in patent cases is approximately one to two years. Christopher A. Cotropia, Jay P. Kesana & David L. Schwartz, *Heterogeneity Among Patent Plaintiffs: An Empirical Analysis of Patent Case Progression, Settlement, and Adjudication*, 15 J. EMPIRICAL LEGAL STUD. 80, 103, 106 (2018).

242. We calculated these rates using data generated by one of the authors (Sichelman) for the USPTO examining patent litigation filings from 1999–2016 (available from author upon request).

doctrines—effectively “combine” multiple references to disclose the claim elements. Thus, even though *KSR* effectively lowered the bar for an obviousness finding, because accused infringers were routinely raising this defense before *KSR*, it appears there was essentially no effect on the rate at which the defense has been raised following *KSR*.

Besides being an interesting finding by itself, it is also important to rule out so-called “selection effects” that may bias overall findings of obviousness and nonobviousness by district courts and the Federal Circuit. For instance, to the extent accused infringers substantially increased the rate at which they pleaded an obviousness defense, one might expect that the quality of the defense post-*KSR* might be weaker, compensating for the lower threshold such that the overall rate of obviousness findings remained unchanged. Yet, because the defense is essentially raised as a matter of course, and the rates appear unchanged pre- and post-*KSR*, one might then expect that findings of obviousness would increase post-*KSR* (which we indeed find in the next section).

Relatedly, one can examine the appeal rate of obviousness determinations pre- and post-*KSR*. We identified 192 Federal Circuit cases between 2003 and 2013 with an obviousness determination (again, including Rule 36 opinions), 69 of which were decided before *KSR* and 123 after *KSR*. Unlike an assertion of an obviousness defense in the district court, whose marginal cost is relatively small once a case has been filed, appealing a case instead of settling can result in substantial costs, especially for risk-averse parties. Thus, if post-*KSR*, parties expected a finding of obviousness more likely to be affirmed by the Federal Circuit than prior to *KSR*, the rate of appeals to the Federal Circuit from obviousness determinations may have fallen (and, in turn, the rate of appeals from nonobviousness opinions may have risen). Moreover, given the asymmetries in incentives to settle between patentees and accused infringers, it might seem likely that a shift in substantive doctrine could change appeals rates. Yet, examining the number of obviousness appeals per filed case, the overall rates were approximately 5.7 appeals per 1000 cases filed before *KSR* and 5.3 appeals per 1000 cases filed after *KSR*, which is a fairly minor shift.

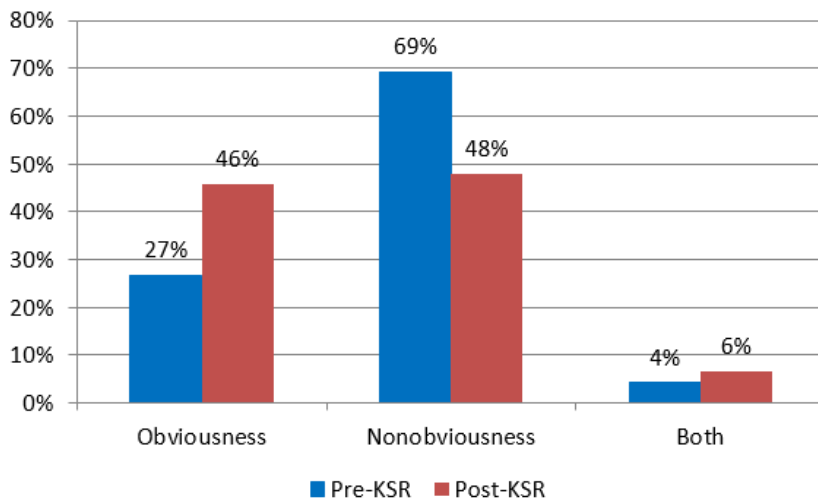
## 2. Findings of Obviousness and Nonobviousness Pre- and Post-*KSR*

As noted earlier, because we coded each set of claims separately, a single opinion fell into one of three categories: (1) obviousness only; (2) nonobviousness only; and (3) both obviousness and nonobviousness. Below we show the shift in overall findings of obviousness and nonobviousness (and the small percentage of opinions with both findings) pre- and post-*KSR* at the district court and Federal Circuit level.

*i. District Court Rates of Obviousness Findings*

Figure 1 shows district court cases organized by judicial findings of obviousness only, nonobviousness only, and both obviousness and nonobviousness—each split by decisions before and after *KSR*.

Figure 1. Obviousness and Nonobviousness Determinations in District Court Cases Before and After *KSR*



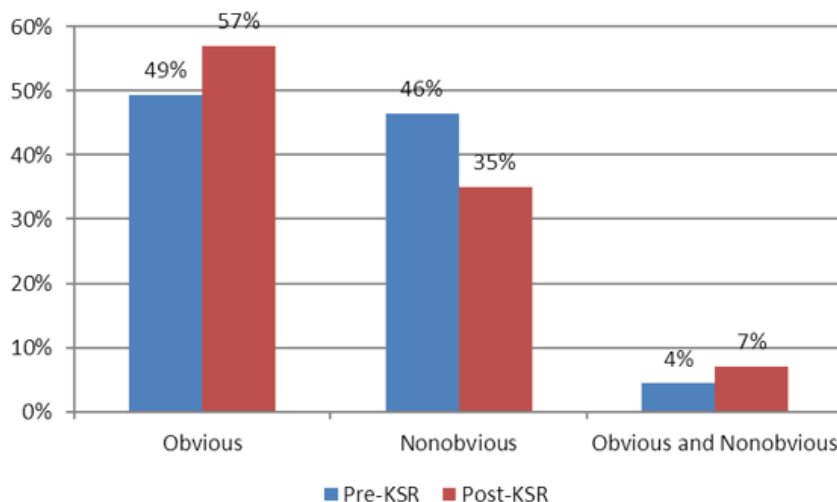
As shown in Figure 1, there was a substantial and significant rise at the district courts in findings of obviousness following *KSR*, from 27% to 46%. As expected, there was a corresponding 21% absolute decrease in nonobviousness determinations, from 69% to 48%. As we discussed earlier, because the overall rate of decisions involving obviousness appeared to remain stable before and after *KSR*, and because the defense is brought as a matter of course, these rates very likely reflect a notable change in the underlying substantive doctrine used to determine whether a patent claim is obvious. In particular, all other factors equal, it became about 70% more likely in relative terms that an accused infringer could show a patent was obvious. Controlling for all other factors, such as technology type, procedural posture, and court, as we describe below, our regression models show that after *KSR*, with statistical significance, obviousness determinations became about 20% more likely in the district courts.<sup>243</sup> These findings provide strong support for a fairly immediate, direct, and sizeable impact of the Supreme Court's decision on district court judges.

<sup>243</sup> See *infra* Section IV.B.6.

ii. *Federal Circuit Rates of Nonobviousness Findings*

Figure 2 details Federal Circuit decisions of obviousness and nonobviousness as well as decisions with both determinations.

Figure 2. Obvious and Nonobvious Decisions in the Federal Circuit Cases Before and After *KSR*



As with the district courts, there was an increase in findings of obviousness at the Federal Circuit after *KSR*, about 8% in absolute terms, and a corresponding decrease of about 11% in nonobviousness findings (the asymmetry arising from decisions holding some claims obvious and others nonobvious). Thus, in contrast to the district courts, the increase in obviousness findings at the Federal Circuit was relatively moderate. Specifically, our regression models show that, with statistical significance, the Federal Circuit became about 10% more likely to find for obviousness after *KSR* compared to 20% for the district courts.<sup>244</sup>

The immediate follow-up question is: Why did the *KSR* opinion seemingly have less impact at the Federal Circuit than the district court? One potential answer is that the Federal Circuit took the opinion with less precedential significance than the district courts. Another potential answer is that the more moderate increase reflects the differential appeal rate (noted earlier) or, relatedly, differing types of patents on appeal than what is considered at the district court, or underlying trends prior to *KSR*. We consider these various explanations in the following discussion.

<sup>244</sup> See *infra* Section IV.B.6.

### 3. Trends in Prior to *KSR*

The results in Figures 1 and 2 are overall decision counts before and after the *KSR* decision. It is possible that the district courts and the Federal Circuit were already trending in the direction of greater findings of obviousness prior to *KSR*, and that the Supreme Court's decision was not a causal factor in the increase in obviousness findings.

To investigate this possibility further, we determine trailing averages of obviousness findings over the prior 30 cases in the district courts and the prior 20 cases at the Federal Circuit for a given date in time.

Figure 3. Obviousness Findings at the District Court: 30-Case Trailing Average



As Figure 3 illustrates, almost immediately after the issuance of the Supreme Court's *KSR* decision, the rate of obviousness findings increased sharply, from slightly less than 40% to about 70% at its peak. After which, there is a sharp unexplained drop in obviousness findings starting in late 2009 through late 2010, followed by another steep increase. Of course, this decline could reflect selection effects in the assertion of patent suits—once attorneys and clients learned of the very high invalidation rates in the district courts, they selected much stronger patents to assert. (We discuss selection effects in more detail later in the Article.)

Prior to *KSR*, there was a noticeable increase in obviousness findings from about mid-2005 through the time of the *KSR* decision in April 2007, but the graph shows that the increase following *KSR* was much steeper, and thus pre-*KSR* trends cannot wholly explain why the rates of obviousness findings was so high following *KSR* at the district courts.

Figure 4 shows a similar sharp increase in obviousness findings at the Federal Circuit.

Figure 4. Obviousness Findings at the Federal Circuit: 20-Case Trailing Average



Yet, unlike the district courts, there was a noticeable downward trend in obviousness findings beginning in late 2004 that continued (hovering over 20%) until a very sharp increase beginning in mid-2006, which hit a peak in mid-2007 (at roughly 78%) and basically remained there until early 2010, with a slow slide through late 2013 (ending between 50–60%).

Notably, the Supreme Court granted certiorari in the *KSR* case on June 27, 2006, at which point most observers believed the Supreme Court would reverse the Federal Circuit and modify or replace its TSM test.<sup>245</sup> As Rantanen has documented, during the period between certiorari and the Supreme Court’s issuance of, “the Federal Circuit issued several opinions addressing the issue of obviousness that were widely viewed as an attempt to defend itself from criticism by the Supreme Court and others.”<sup>246</sup> As such, it is not surprising that the Federal Circuit found a very large percentage of patent claims obvious during this period.<sup>247</sup> In essence, the Federal Circuit properly predicted the Supreme Court’s rejection of its TSM test as soon as certiorari was granted and shifted its course in view of this prediction. In this sense, one can view the steep increase at the Federal Circuit in obviousness determinations prior to the actual issuance of *KSR* as still driven by *KSR*—here, the case as a whole—rather than reflecting pre-decision trends. On the other hand, the long-term trend shows that the Federal Circuit in most recent years in our dataset has retreated somewhat from its marked shift towards findings of obviousness, with its obviousness rate trending towards its

245. See, e.g., Rantanen, *supra* note 41, at 720–21.

246. *Id.* at 725 n.29; see also *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) (citing intervening Federal Circuit cases and noting that “the Court of Appeals has since elaborated a broader conception of the TSM test than was applied in the instant matter”).

247. Mojibi, *supra* note 41, at 584–90.

pre-*KSR* rate, at least that in 2003 to 2004, the beginning of the time frame we analyzed.

#### 4. Affirmance and Reversal Rates for the Federal Circuit

One way to test whether the Federal Circuit shifted its outcomes less after *KSR* than the district courts is to examine how the Federal Circuit treats appeals by the outcome of the case below. Specifically, given a finding of obviousness or nonobviousness below, is the Federal Circuit more likely to affirm post-*KSR* than pre-*KSR*?

To begin, we determine the percentage of obviousness versus nonobviousness district court findings for appealed cases pre- and post-*KSR*.<sup>248</sup> For instance, if it is simply the case that more findings of obviousness were appealed post-*KSR* than pre-*KSR*, and the Federal Circuit was very likely to affirm obviousness on appeal, this could explain the higher rate of obviousness findings at the Federal Circuit, rather than differing viewpoints between the Federal Circuit and the district courts about *KSR* itself.

Reviewing substantive Federal Circuit obviousness decisions, prior to *KSR*, we find that about 48% were from findings of obviousness below, while about 52% were from findings of nonobviousness (again, we exclude the small number of mixed findings). This is notable, because recall that only about 27% of pre-*KSR* district court cases resulted in findings of obviousness while 69% resulted in findings of nonobviousness. Thus, in many cases, nonobviousness determinations were not appealed to the Federal Circuit pre-*KSR*. This seemingly low appeals rate may appear odd; however, since we find that 90% of all nonobviousness determinations were affirmed by the Federal Circuit prior to *KSR*, this result becomes less surprising.

After *KSR*, the mix of appeals was fairly similar, with about 52% of cases appealed from findings of obviousness and about 48% from findings of nonobviousness (again we limited the analysis to those appeals that resulted in a substantive decision). In absolute terms, this appeals rate does not appear much different from the rate prior to *KSR*, except recall that post-*KSR*, district courts found obviousness and nonobviousness about the same percentage of the time. Thus, in stark contrast to pre-*KSR* appeals, and consistent with the findings of the Nock and Gadde study, a much higher absolute percentage of litigants began to appeal nonobviousness findings post-*KSR*.<sup>249</sup> And, in fact, again consistent with the findings of Nock and Gadde, we find a much lower affirmance rate of nonobviousness findings at the Federal Circuit post-*KSR*,

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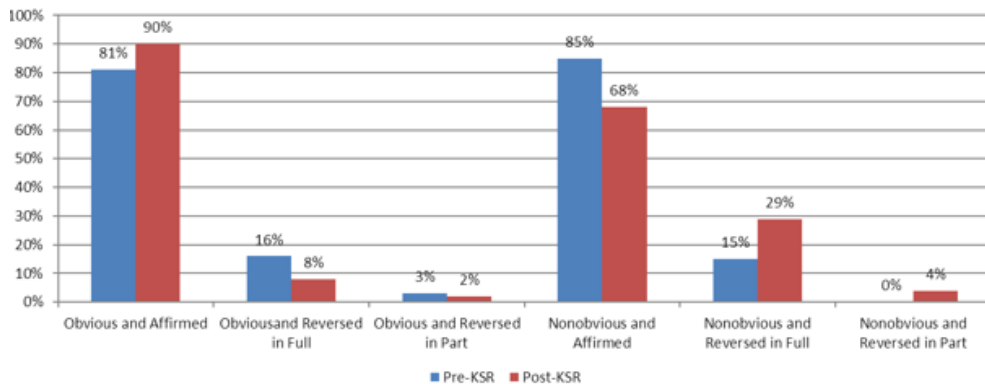
248. Because we do not have the dates of appeal for all of cases, we assume that all Federal Circuit cases decided six months after *KSR* were appealed prior to *KSR*. See generally Holte & Seaman, *supra* note 137, at 184 (examining time to disposition in the Federal Circuit).

249. See Nock & Gadde, *supra* note 41, at 372.

providing a substantially greater incentive to bring appeals of these findings.<sup>250</sup>

Figure 5 below demonstrates how the Federal Circuit reacted pre- and post-*KSR* to district court findings of obviousness and nonobviousness.<sup>251</sup>

Figure 5. Affirmance and Reversal Rates for Federal Circuit Cases Before and After *KSR*



Based on the district decision below, Figure 5 shows how the Federal Circuit decided the case on appeal.<sup>252</sup> Interestingly, the affirmance and reversal rates for findings of obviousness below did not change too much on appeal—only about 8%–9% in absolute terms. However, recall that prior to *KSR*, district courts found obviousness only about 30% of the time, but roughly 50% of all appeals pre-*KSR* were from obviousness determinations, which the Federal Circuit reversed about 16% of the time.

In contrast, following *KSR*, as we described earlier, many findings at the district court of obviousness would likely have been findings of nonobviousness prior to *KSR*. Thus, the fact that the Federal Circuit affirmed in about 90% of the cases—while not much more in absolute numbers than its pre-*KSR* 81% affirmance rate—in actuality means the Federal Circuit effectively found obviousness in substantially more cases than it would have prior to *KSR*. Indeed, examining the cases where the district courts found

<sup>250</sup>. See *id.* at 373.

<sup>251</sup>. We include a relatively small number of appeals from jury decisions that included determinations on nonobviousness in the results in Figure 5, but excluding this data would not materially alter our results. Figure 5 excludes a small number of cases in which the district court decision included both findings of obviousness and nonobviousness.

<sup>252</sup>. For simplicity, we exclude a small number of cases with either mixed decisions below, above, or both, as well as a relatively low percentage of appeals that resulted in decisions vacating and remanding the lower court decision. None of these exclusions substantially affects our comparative results, particularly because these percentages remained fairly constant pre- and post-*KSR*. See Rantanen, *supra* note 41, at 741 tbl.3 (finding that the vacated and remanded rate pre-*KSR* certiorari was 15% and post-*KSR* was 9% from appeals from the district courts and ITC).



nonobviousness, the Federal Circuit affirmed at a substantially lower rate than prior to *KSR*, with a drop from 85% to 68%. Thus, even cases that arguably would have been some of the strongest findings of nonobviousness prior to *KSR* were reversed at relatively high rates at the Federal Circuit following *KSR*.

Taken together, these findings indicate that the seemingly smaller differential between obviousness findings pre- and post-*KSR* than the differential in the district courts is somewhat misleading. Specifically, because of selection effects in the suits chosen for appeal, the Federal Circuit in fact had a much larger shift than can be gleaned merely from overall descriptive findings. Indeed, our regression analysis (presented below) shows that controlling for a variety of factors, the Federal Circuit's increased likelihood of finding obviousness post-*KSR* was about 10%, compared to 20% for the district courts.<sup>253</sup>

### 5. Decision Timing and Procedural Posture

Of course, it is possible that procedural posture of the district court decision may have shifted pre- and post-*KSR*. As a result, there were more appeals at the Federal Circuit from, for example, summary judgment following *KSR*. Indeed, Justice Kennedy suggested in *KSR* that summary judgment was a more appropriate forum for obviousness determinations than previously believed by the lower courts.<sup>254</sup> If more appeals arose from summary judgment, then it may have been easier for the Federal Circuit to reverse district courts, since these decisions do not turn on material disputes of fact, but rather disputes of law and application of law to fact.

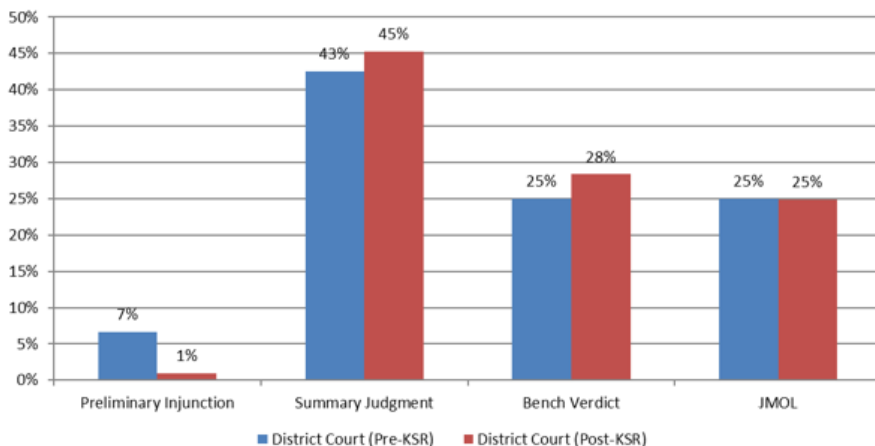
Thus, another factor we considered was the decision timing at the district court and the procedural posture of the Federal Circuit. Timing is divided into five categories: preliminary injunction; summary judgment; bench verdict; jury verdict; and judgment as a matter of law (JMOL). Figure 6 illustrates the percentage of decision timing at the district court (excluding jury verdicts, as we did not collect them), whereas Figure 7 displays the procedural posture only of appeals decided by the Federal Circuit.

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253. See *infra* Section IV.B.6 (presenting regression results).

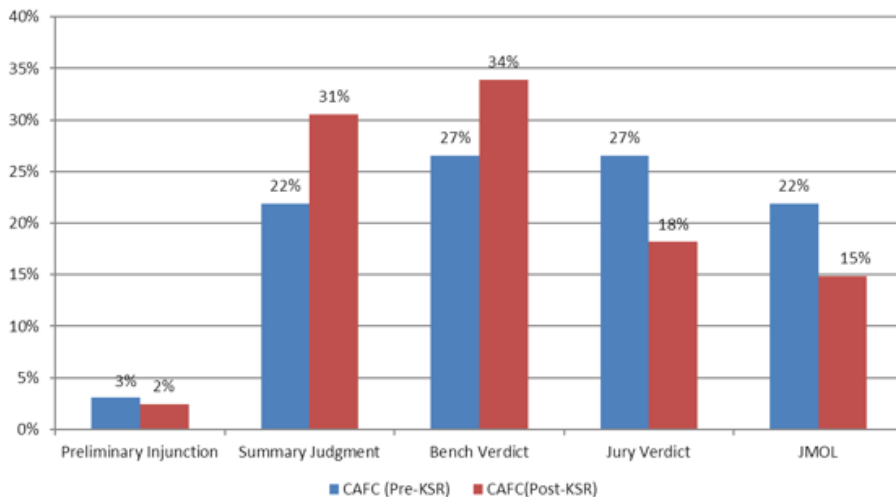
254. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 427 (2007).

Figure 6. Decision Timing for District Court Decisions Before and After *KSR*



The decision timing of the district court changed slightly overall after *KSR*, though there was a substantial decrease in preliminary injunctions finding obviousness.

Figure 7. Procedural Posture for Federal Circuit Appeals Before and After *KSR*



The procedural posture of cases appealed to the Federal Circuit changed somewhat after *KSR*. As in the district courts, there was a decrease in preliminary injunctions. Interestingly, unlike the district courts, there was a substantial increase in Federal Circuit decisions reviewing summary judgment determinations below, indicating that the appeal rates of summary judgment

orders increased following *KSR*. Yet, given that the changes in procedural posture do not appear substantial, it seems unlikely that the changes in obviousness determinations at the Federal Circuit post-*KSR* was related to the procedural posture of appealed cases. Indeed, our regression models below confirm that procedural posture did not play any substantial role in the changes in outcome at the Federal Circuit or district courts after *KSR*.<sup>255</sup>

#### 6. Importance of Technology Type in Obviousness Decisions

Like the change in appeals rates following *KSR*, it is possible that the differential rates at the district courts and the Federal Circuit were being driven by changes in the types of technologies at-issue. To investigate these trends, technologies were assigned to each patent using the NBER data previously mentioned.<sup>256</sup> Table 1 shows the total number of decisions by technology type at the district courts and Federal Circuit before and after *KSR*.

Table 1. Frequency of District Court and Federal Circuit (“CAFC”) Obviousness Determinations Pre- and Post-*KSR*

| NBER Technology Class   | Dist. Ct. Pre- <i>KSR</i> | Dist. Ct. Post- <i>KSR</i> | CAFC Pre- <i>KSR</i> | CAFC Post- <i>KSR</i> |
|-------------------------|---------------------------|----------------------------|----------------------|-----------------------|
| Chemical                | 22                        | 15                         | 7                    | 6                     |
| Computers & Comms       | 27                        | 49                         | 8                    | 30                    |
| Drugs & Medical         | 44                        | 79                         | 22                   | 44                    |
| Electrical & Electronic | 17                        | 17                         | 8                    | 8                     |
| Mechanical              | 16                        | 24                         | 8                    | 13                    |
| Other                   | 34                        | 41                         | 16                   | 21                    |

As Table 1 indicates, there was a modest decline in decisions regarding chemical patents, a sharp rise in computers and communications patents, a sharp rise in drugs & medical patents, and a moderate rise in mechanical patents. Thus, it could very well be that the shift in the district courts and Federal Circuit toward findings of obviousness was merely driven by the changing nature of the technologies under consideration.

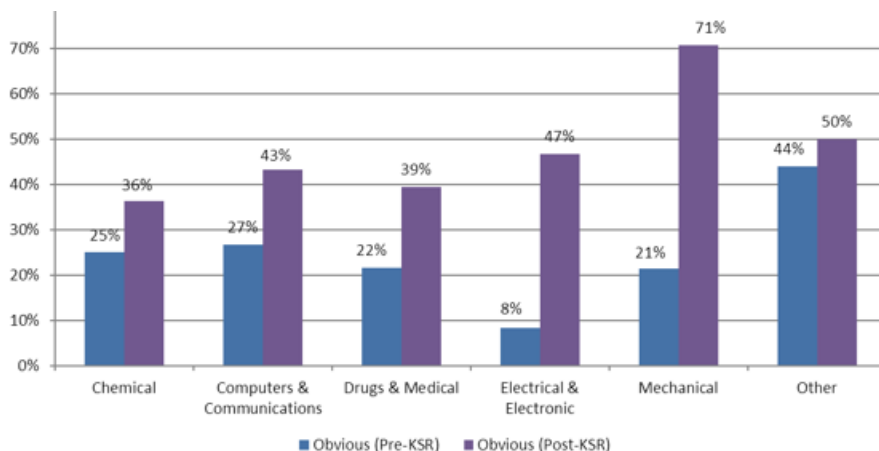
In order to investigate this possibility, we examined findings of obviousness and nonobviousness by technology type before and after *KSR*. Figure 8 shows the decisions by district court cases and Figure 9 for Federal

255. See *infra* Section IV.B.6.

256. See *supra* note 237–38 and accompanying text.

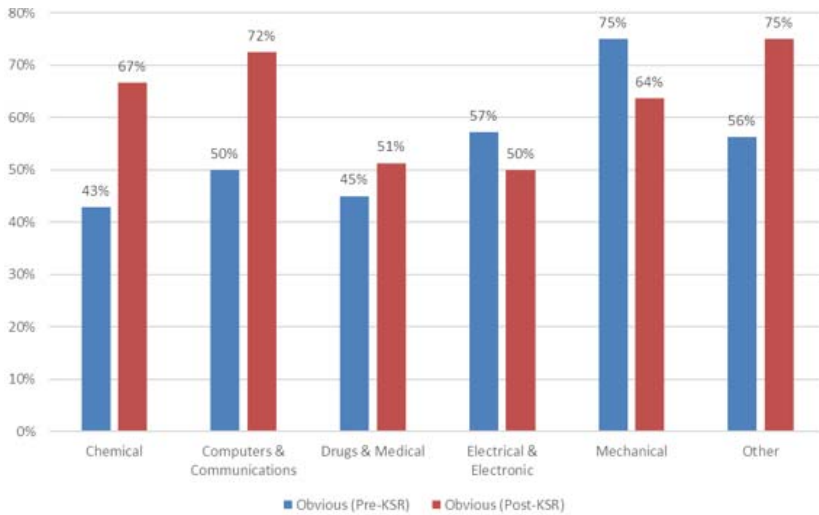
Circuit cases (we have removed the small number of mixed decisions and only show obviousness percentages for simplicity).

Figure 8. District Court Decisions Grouped by Technology Type



As Figure 8 shows, the general trend of an increase in obviousness determinations after *KSR* holds true for all technology types. Findings of obviousness for electrical & electronic patents and mechanical patents increased the most. The rate of obviousness determinations for computers & communications patents and drugs & medical patents also significantly increased, although to a lesser extent. Chemical patents were moderately affected and other patents were slightly affected. Given that the increases affected all technology classes, this indicates that the changes at the district courts in obviousness determinations were not driven by changes in the types of technologies at issue. In fact, the technologies with the largest increases in number of substantive decisions (obviousness or nonobviousness) at the district courts, computers & communications and drugs & medical, were fairly similar in the amount of increase to other technology types.

Figure 9. CAFC Court Decisions Grouped by Technology Type



Like the district courts, other than for mechanical and electrical & electronic patents, findings of obviousness increased at the Federal Circuit for all technology types after *KSR*.<sup>257</sup> Chemical and computers & communications patents obviousness determinations increased the most. Other patents also increased substantially, although to a slightly lesser extent. Electrical & electronic patents remained the same. For reasons similar to those discussed for this district courts, given the changes in determinations by technology type indicated in Table 1, these results show that the shift towards obviousness determinations at the Federal Circuit following *KSR* was not primarily driven by changes in the types of technologies being considered by the Federal Circuit, and we confirm as much in our regression models.

## 7. Regression Models

The previous results are only descriptive, and it is possible that the interaction of several variables, including additional control variables, could explain the increases in obviousness determinations. As such, we present several regression models in order to address this possibility.<sup>258</sup> Based on these regressions, we find that the results of our descriptive statistics continue to hold, including the difference between the extent of the shift at the district courts and the Federal Circuit.

<sup>257</sup>. Again, we have excluded a small number of mixed decisions in the calculations.

<sup>258</sup>. Probit regression models are particularly well-suited to regressions involving dependent variables that are binary, such as a judicial decision. See JAMES H. STOCK & MARK W. WATSON, INTRODUCTION TO ECONOMETRICS 389–94 (Pearson 2008) (explaining that probit regression models are nonlinear regression models that estimate the probability a binary dependent variable occurs).

Table 2. Probit Estimation of the Likelihood a District Court Finds Obviousness

|                        | 8                    | 9                   | 10                   | 11                  |
|------------------------|----------------------|---------------------|----------------------|---------------------|
| Post-KSR               | 0.202***<br>(0.057)  | 0.202***<br>(0.059) | 0.210***<br>(0.060)  | 0.204***<br>(0.061) |
| Necessary for Decision |                      | -0.003<br>(0.093)   | -0.013<br>(0.095)    | -0.009<br>(0.095)   |
| Procedural Posture     |                      |                     |                      |                     |
| Bench                  |                      | -0.188<br>(0.147)   |                      | -0.087<br>(0.172)   |
| JMOL                   |                      | -0.092<br>(0.156)   |                      | 0.008<br>(0.175)    |
| SJ                     |                      | 0.032<br>(0.155)    |                      | 0.107<br>(0.167)    |
| Technology             |                      |                     |                      |                     |
| Chemical               |                      |                     | -0.143<br>(0.120)    | -0.110<br>(0.125)   |
| Computer & Comm.       |                      |                     | -0.097<br>(0.096)    | -0.092<br>(0.097)   |
| Drugs & Medical        |                      |                     | -0.131<br>(0.088)    | -0.076<br>(0.095)   |
| Electrical             |                      |                     | -0.274**<br>(0.092)  | -0.254**<br>(0.097) |
| Mechanical             |                      |                     | 0.002<br>(0.111)     | 0.002<br>(0.111)    |
| District is:           |                      |                     |                      |                     |
| D. Del.                | -0.240***<br>(0.065) | -0.141*<br>(0.081)  | -0.214***<br>(0.074) | -0.159*<br>(0.084)  |
| D. N.J.                | -0.166*<br>(0.088)   | -0.111<br>(0.100)   | -0.129<br>(0.104)    | -0.109<br>(0.108)   |
| E.D. Tex.              | -0.277**<br>(0.095)  | -0.241*<br>(0.113)  | -0.279**<br>(0.102)  | -0.248*<br>(0.115)  |
| N.D. Cal.              | 0.314**<br>(0.117)   | 0.335**<br>(0.123)  | 0.435***<br>(0.110)  | 0.420***<br>(0.116) |
| N.D. Ill.              | -0.123<br>(0.116)    | -0.129<br>(0.120)   | -0.118<br>(0.122)    | -0.127<br>(0.124)   |
| S.D. N.Y.              | -0.077<br>(0.112)    | -0.038<br>(0.123)   | -0.010<br>(0.131)    | 0.009<br>(0.132)    |
| Log-likelihood         | -196                 | -186                | -181                 | -178                |
| Observations           | 318                  | 308                 | 301                  | 301                 |

Note: Population of 319 district court obviousness decisions. Marginal effects reported with discrete change of dummy variables from 0 to 1. Robust standard errors included in parenthesis. \*  $p < .10$ ; \*\*  $p < .05$ ; and \*\*\*  $p < .01$ .

In total we ran 11 different regression district court models (four of which are shown here, with the remainder in the Appendix).<sup>259</sup> In all of the regression models, there was a substantial and statistically significant increase in obviousness findings following *KSR*. The effect in fact strengthened when we controlled by procedural posture, technology type, and district. Interestingly, across our entire study period, controlling for technology type and procedural posture, the District of Delaware and the Eastern District of Texas were significantly more likely to find patents nonobvious than other districts. In contrast, the Northern District of California was significantly less likely to find patents nonobvious, which maps onto the collective wisdom about how these districts generally view patents as a whole.<sup>260</sup>

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259. See *infra* Appendix Table 1. For all independent variables, we report marginal effects, which capture the impact of a one unit change in the value of the variable on the probability a court would find obviousness with all other independent variables measured at their means. Thus, for example, the coefficient of 0.153 on “Post-*KSR*” in Specification 1 of Table 1 is interpreted as indicating that decisions post-*KSR* are 15.3% more likely to find obviousness than decisions made before *KSR*. Similarly, the coefficient of -0.240 for “D. Del.” in Table 2, Specification 8, indicates that the District of Delaware is 24% less likely to find obviousness than other courts in our data set.

260. See Colleen V. Chien & Michael Risch, *Recalibrating Patent Venue*, 77 MD. L. REV. 47, 107 n.97 (2017) (reporting invalidation rates in different districts).

Table 3. Probit Estimation of the Likelihood the Federal Circuit Finds Obviousness

|                       | 1                | 2                  | 3                  | 4                  |
|-----------------------|------------------|--------------------|--------------------|--------------------|
| Post-KSR              | 0.104<br>(0.074) | 0.077<br>(0.077)   | 0.095<br>(0.077)   | 0.065<br>(0.080)   |
| Procedural Posture    |                  |                    |                    |                    |
| Bench                 |                  | 0.171<br>(0.214)   |                    | 0.229<br>(0.213)   |
| Jury                  |                  | 0.045<br>(0.220)   |                    | 0.104<br>(0.219)   |
| JMOL                  |                  | 0.108<br>(0.209)   |                    | 0.143<br>(0.205)   |
| SJ                    |                  | 0.435**<br>(0.150) |                    | 0.468**<br>(0.144) |
| Prelim.<br>Injunction |                  | -0.017<br>(0.366)  |                    | 0.053<br>(0.358)   |
| Technology            |                  |                    |                    |                    |
| Chemical              |                  |                    | -0.153<br>(0.164)  | -0.254<br>(0.164)  |
| Computer &<br>Comm.   |                  |                    | -0.079<br>(0.120)  | -0.095<br>(0.129)  |
| Drugs &<br>Medical    |                  |                    | -0.179*<br>(0.105) | -0.162<br>(0.112)  |
| Electrical            |                  |                    | -0.195<br>(0.149)  | -0.138<br>(0.162)  |
| Mechanical            |                  |                    | -0.087<br>(0.141)  | -0.099<br>(0.147)  |
| Log-likelihood        | -129             | -117               | -126               | -115               |
| Observations          | 192              | 192                | 191                | 191                |

Note: Population of 154 Federal Circuit obviousness decisions. Marginal effects reported with discrete change of dummy variables from 0 to 1. Robust standard errors included in parenthesis. \*  $p < .10$ ; \*\*  $p < .05$ ; and \*\*\*  $p < .01$ .

Table 3 presents all four of our regression models that we ran for the Federal Circuit. Like the district courts, we find an increase in obviousness findings after *KSR* controlling for procedural posture and technology type, but one that is noticeably weaker and not statistically significant at conventional levels. However, when one compares decisions at the Federal Circuit before and after the grant of certiorari in *KSR*, we do find statistically significant differences, just slightly less than those in the district courts.<sup>261</sup> These results generally align with our discussion above that although the

261. See Appendix Table 2.



Federal Circuit shifted its outcomes substantially, its shift was not as dramatic as at the district courts, particularly once the Supreme Court's *KSR* decision actually issued.<sup>262</sup>

C. MAJOR RESULT #2: *KSR'S EFFECT ON THE DISTRICT COURT'S AND FEDERAL CIRCUIT'S REASONING AND DOCTRINE DIFFERED*

Our results in the previous section showed a very substantial shift in the district courts and a smaller, though substantial shift (especially controlling for appeals rates) at the Federal Circuit towards obviousness determinations following the Supreme Court's decision in *KSR*. In order to gain a richer understanding of how *KSR* drove these changes in outcome, we carefully examined the reasoning in each obviousness decision at the district courts and Federal Circuit.

As noted before, *KSR* rejected the "rigid" application of the TSM test. Instead, it offered a variety of much more flexible factors to make determinations of obviousness, such as whether the invention was "obvious to try," as well as less technical factors, such as "common sense," "market forces," and "design incentives." Because the Supreme Court did not wholly reject the TSM test per se, it left open the possibility that courts would resort to some modified form of that test, essentially ignoring the more flexible factors now available under *KSR*. By coding the reasoning in each case, our study can definitively answer which approaches district courts and the Federal Circuit have used after *KSR*.

In particular, we coded up to 16 major reasons, as well as up to nine secondary factors of obviousness, that were central in each opinion in reaching the ultimate decision. First, we briefly describe what our study found to be the 17 most important reasons and secondary factors that courts relied upon in their reasoning. We then turn to our results of how the use of those reasons varied pre- and post-*KSR*.<sup>263</sup>

The first group of reasons examines whether the TSM test, or some variant of it was used, and if so how. Specifically, we report on five key factors, labeled as follows (with the fourth and fifth factors' explanations combined):

- (1) **TSM**: Did the court use the TSM test or some variant of it, such as "reason, suggestion, motivation," "reason to combine," and the like, in order to teach its holding?

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<sup>262</sup>. See *supra* Sections IV.B.2, IV.B.3.

<sup>263</sup>. In coding the Federal Circuit's reasoning, we excluded Rule 36 cases. Although technically the Federal Circuit adopts the district court's reasoning in such summary affirmances, because we wanted to compare the reasoning of the district courts to the Federal Circuit, we decided not to count the reasoning in the district court opinions that led to Rule 36 appellate decisions as that of the Federal Circuit. Ultimately, the number of these cases was small, and did not materially affect the results we present here.

(2) TSM Formal: Did the court use the “formal” TSM test, which specifically requires a “teaching, suggestion, or motivation” to combine prior art references?

(3) “Reason to Combine” Must be in Prior Art: If the court used the TSM test or some variant of it, did the court require that the “reason to combine” must be present in the prior art itself? (Such a formulation would be closest to the “rigid” formulation rejected by the Supreme Court in *KSR*.)

(4)–(5) “Reason to Combine” May Come from a PHOSITA (or the Nature of the Problem to be Solved): If the court used the TSM test or a variant, did it state that the reason could be from one of skill in the art (or from the nature of the problem to be solved) in addition to the prior art? (This is more indicative of the flexible approach set forth by the Supreme Court in *KSR*.)

The second group of factors revolve around specific factors that the Supreme Court stated should be used in obviousness determinations and that differ in various respects from the “rigid” TSM approach rejected by the Court. Specifically, we report on six key factors, labeled as follows:

(6) “Predictable Uses” of Prior Art Elements: *KSR* introduced essentially a new factor that turns on whether the use of a known technique that has improved other devices will improve similar devices in the same way.

(7) “Obvious to Try”: *KSR* resurrected this older doctrine, which had been rejected by earlier Federal Circuit cases, now allowing a showing of obviousness based upon whether a PHOSITA would have tried a finite number of identified, predictable solutions to achieve the claimed result.

(8) “Common Sense”: *KSR* sanctioned the use of the “common sense” of the PHOSITA in combining references and making inferences in order to show obviousness.

(9) “Design Incentives or Other Market Forces”: After *KSR*, courts may consider non-technical incentives, such as those dictated by product design or other market forces that drive the innovation process.

(10) “Mere Substitution”: *KSR* mentioned that the “mere substitution” of one component for another in the prior art would point toward a finding of obviousness.

The third group of major reasons includes eight of the nine secondary factors developed by the courts after the Supreme Court's opinion in *Graham v. John Deere*.<sup>264</sup> Specifically, we report on the following secondary factors:

(11) “Teaching Away”: The *KSR* opinion placed great emphasis on the secondary factor that prior art “teaches away” from the claimed invention, which supports a showing of nonobviousness.<sup>265</sup>

(12) “Commercial Success”: If the commercial success of the product was due to the merits of the claimed invention, then such a showing points in favor of nonobviousness.

(13) “Long Felt Need”: A long felt need in the market for the invention helps to support a finding of nonobviousness.

(14) “Unsuccessful Attempts by Others”: The fact that others had tried to make the invention but failed makes a finding of nonobviousness more likely.

(15) “Copying of the Claimed Invention”: Copying of the claimed invention by others, in general, points towards a finding a nonobviousness.

(16) Invention “Received Praise”: Inventions that win awards or receive praise from those of skill in the art are more likely to be nonobvious.

(17) “Unexpected Results”: The fact that an invention is treated with “skepticism” by the relevant scientific community, or has “unexpected results,” helps to support a finding of nonobviousness.

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<sup>264</sup>. See *supra* notes 132–33 and accompanying text.

<sup>265</sup>. The “teaching away” factor had historically been treated as a secondary factor, and we continue that designation here. See, e.g., *Ecolchem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361, 1379–80 (Fed. Cir. 2000) (discussing teaching away under secondary considerations); *Miles Labs., Inc. v. Shandon Inc.*, 997 F.2d 870, 878 (Fed. Cir. 1993) (categorizing teaching away under “objective indicia”). However, following the *KSR* opinion’s emphasis on “teaching away,” this aspect of the has become a central component of the nonobviousness determination, essentially becoming part of the prima facie test. *Merck & Cie v. Gnosis S.P.A.*, 808 F.3d 829, 836–37 (Fed. Cir. 2015) (discussing “teaching away” separately from objective indicia); *Leo Pharm. Prods., Ltd. v. Rea*, 726 F.3d 1346, 1357 (Fed. Cir. 2013) (similar).

Table 4. Reasons for Courts' Decisions Before and After *KSR*<sup>266</sup>

| Factor Category   | Factor in Court's Reasoning?                                | Dist. Court (Pre-KSR) | Dist. Court (Post-KSR) | CAFC (Pre-KSR) | CAFC (Post-KSR) |
|-------------------|---|-----------------------|------------------------|----------------|-----------------|
| General Test      | TSM   | 56%                   | 48%                    | 73%            | 49%             |
| General Test      | TSM Formal  | 34%                   | 25%                    | 33%            | 9%              |
| General Test      | "Reason to Combine" Must be in Prior Art                    | 30%                   | 9%                     | 27%            | 8%              |
| General Test      | "Reason to Combine" May Come from a PHOSITA                 | 55%                   | 41%                    | 45%            | 37%             |
| General Test      | "Reason to Combine" May Come from the Nature of the Problem | 34%                   | 27%                    | 27%            | 18%             |
| <i>KSR</i> Factor | "Predictable Uses" of Prior Art                             | 1%                    | 26%                    | 3%             | 26%             |
| <i>KSR</i> Factor | "Obvious to Try"  | 2%                    | 33%                    | 9%             | 20%             |
| <i>KSR</i> Factor | "Common Sense"  | 3%                    | 20%                    | 3%             | 21%             |
| <i>KSR</i> Factor | "Design Incentives or Other Market Forces"                  | 12%                   | 22%                    | 3%             | 13%             |
| <i>KSR</i> Factor | "Mere Substitution"   | 4%                    | 13%                    | 9%             | 11%             |
| Secondary Factor  | "Teaching Away"   | 19%                   | 35%                    | 30%            | 28%             |
| Secondary Factor  | "Commercial Success"  | 38%                   | 41%                    | 27%            | 29%             |
| Secondary Factor  | "Long Felt Need"  | 33%                   | 32%                    | 15%            | 20%             |
| Secondary Factor  | "Unsuccessful Attempts by Others"                           | 13%                   | 18%                    | 18%            | 8%              |
| Secondary Factor  | "Copying of the Claimed Invention"                          | 16%                   | 15%                    | 9%             | 13%             |
| Secondary Factor  | Invention "Received Praise"                                 | 7%                    | 11%                    | 3%             | 9%              |
| Secondary Factor  | "Unexpected Results"  | 19%                   | 34%                    | 24%            | 28%             |

266. The p-value of the difference between the district courts in the "obvious to try" factor is 0.11, and in the "design incentives or other market forces" factor is 0.14. Although these results are not quite statistically significant, they are close to the 0.10 level, and we treat them as meaningful in a doctrinal sense, especially given the relatively small size of the dataset and that it represents the entire population of cases. To calculate these percentages, we excluded a relatively small number of non-Rule 36 opinions in which the court did not state its reasoning, as well as a small number of opinions we identified after we performed the reasoning coding.

Previous studies had found on mere qualitative grounds that the Federal Circuit still relied on the TSM test post-*KSR*, albeit in a much modified form.<sup>267</sup> Here, we quantitatively test this observation, and—in an important qualification to previous studies—find that reference to the TSM test in the reasoning portion of Federal Circuit decisions substantially declined after *KSR*, from 73% of the decisions pre-*KSR* to 49% of the decisions post-*KSR*. Interestingly, this drop was notably greater than the drop at the district courts, which referenced TSM in the reasoning of 56% of opinions before *KSR* and 48% of opinions after *KSR*.

Relatedly, our results show a substantial drop in the Federal Circuit's use of the "formal" TSM test, from 33% before *KSR* to 9% after *KSR*. We find that although the Federal Circuit has continued to reference the TSM test following *KSR*, in general, it has been less frequent and, like Rantanen's finding, it has not been the "rigid" form of the test that the Supreme Court rejected.<sup>268</sup> In this regard, while 27% of the Federal Circuit's cases before *KSR* stated that the reason to combine "must" be found in the prior art itself, only 8% of its cases stated as much after *KSR*. Similarly, 30% of district court opinions relied on this "rigid" formulation of TSM pre-*KSR*, but only 9% of cases did post-*KSR*. At the same time, a relatively large percentage of opinions continued to state that the reason to combine could come from the nature of the problem to be solved or from a PHOSITA herself. These findings largely indicate that both district courts and the Federal Circuit have rejected a rigid formulation of the TSM test following *KSR*.

The key question then becomes whether the Federal Circuit's and district courts' reasoning merely paid lip service to the Supreme Court's opinion, as some commentators predicted, or whether these courts took the Court's opinion to heart. In general, it appears the latter is the case. Across all of the so-called *KSR* factors, there were substantial increases at the Federal Circuit and district courts. The increase includes "predictable uses" of the prior art, "obvious to try," "common sense," "design incentives or other market forces," and "teaching away." On the other hand, the Federal Circuit was somewhat less likely to use these "*KSR* factors" as the district courts, especially "obvious to try" and "design incentives and other market forces."<sup>269</sup>

In other words, although the Federal Circuit has used many of the factors set forth in the *KSR* opinion to substantially increase its findings of obviousness, the Federal Circuit has not embraced the reasoning of *KSR* to the extent of the district courts. These findings are generally consistent with

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267. See *supra* Part III (describing earlier studies).

268. Rantanen, *supra* note 41, at 755-56.

269. Additionally, on the whole, both the district courts and the Federal Circuit have increased their usage of the pre-*KSR* secondary factors. Although there is some variation in reliance on secondary factors between the district courts and Federal Circuit, overall, it does not appear the Federal Circuit's somewhat less robust shift to findings of obviousness can be explained by heavier usage of secondary factors.

our earlier reflection that although the shift from obviousness to nonobviousness findings at the Federal Circuit was substantial, it was not as substantial as in the district courts.

#### V. SOME IMPLICATIONS OF (AND CAVEATS TO) OUR RESULTS

No empirical study is perfect. Data is incomplete and never fully accurate, methodologies can never fully control for every potential external factor that could explain results. As such, the results of any empirical study must be taken with the proverbial grain of salt. Here, we describe some of the limitations of our study that should be taken into account when drawing conclusions from it, especially ones that might be pertinent to policymaking.

With that said, empirical studies are typically more reliable than anecdote, and our study is the first to comprehensively address district court determinations of obviousness. In so doing, we take into account how the variation in appeals rates of those determinations resulted in selection effects at the Federal Circuit that slightly masked the substantial shift to obviousness findings at that court. Additionally, ours is the first study to show that the somewhat lesser shift at the Federal Circuit can be at least partly explained by reasoning in that court's decisions that adheres more closely to its prior precedent than decisions in the district courts, which utilize more of the "flexible" factors introduced by the Supreme Court in *KSR* to make findings of obviousness easier for the courts and juries.

These findings appear to be quite robust, and allow us to make some preliminary reflections to their doctrinal, economic, and normative implications. First, in agreement with other major studies, we reject the contention that the Federal Circuit has continued to adhere to the form of its TSM test rejected by the Supreme Court; additionally, we show the same, even more so, at the district courts. Second, we opine that the differences between the district courts and the Federal Circuit regarding the role of obviousness likely reflect the historically varying views of the economic role of patents. Last, we contend normatively that it is imperative for appellate courts, particularly the Supreme Court, to take greater cognizance of not only future consequences but also historical trends when radically altering doctrine in the field of patent law (and, likely, in other fields, too).

##### A. POTENTIAL LIMITATIONS OF OUR STUDY

Although we believe we have conducted the most comprehensive analysis of obviousness determinations since the *KSR* decision our study may be limited in several important ways. First, it is possible we missed some district court or Federal Circuit cases addressing obviousness. Yet, because we performed a comprehensive review of several data sources, including prior studies, we do not believe this number is large enough to affect our overall findings.

Second, because we relied heavily on research assistants, some of our coding may be incomplete or inaccurate. As noted earlier, we utilized cross-coder comparison as well as on-going management by one of us and a quality correction (QC) processes to reduce errors and ensure completeness. We did not personally review each and every case. Nonetheless, as long as coder errors or omission show systematic bias—and we have no reason to believe that this would be the case—any coding error would merely introduce random measurement error which would simply reduce the significance of our results overall. Thus, it is unlikely that any coder errors in our data would be substantial enough to affect our results.

Third, we have not analyzed every aspect of our data relevant to the shift in obviousness determinations pre- and post-*KSR*. For example, we do not report on Federal Circuit cases appealed from the International Trade Commission (ITC) or the U.S. Patent & Trademark Office (USPTO). Although we provide regression models, we do not control for every relevant variable, such as proxies for patent quality like forward citations. Yet, given our large dataset and our focus on comparing our results pre- and post-*KSR*, the failure to include ITC or USPTO appeals is likely to be immaterial. Thus, we do not believe that these limitations likely bias our results in any significant way.

Fourth, although we attempted to compensate for selection effects, there are many factors that are difficult to impossible to examine in this regard. For instance, it does not appear that changes in technology type account for the increase in obviousness decisions. However, it could be that changes in litigation budgets, attorney quality, and other unobservable factors that changed in patent-holders' reaction to *KSR* may account for the shifts, rather than judicial decisionmaking. Yet, nearly all empirical studies examining the effects of shifting legal doctrine are subject to such limitations. As we noted earlier, incomplete empirical study is often, if not nearly always, better than resorting to anecdotal cases, such as opinions with large stakes, or a few en banc opinions that can be extrapolated to the population of decisions on a legal issue.

In sum, although our results should certainly be interpreted cautiously, at the same time, we do not believe these limitations prevent at least preliminary doctrinal, economic, and normative reflections, a topic we turn to next.

#### B. DOCTRINAL, ECONOMIC, AND NORMATIVE IMPLICATIONS OF OUR FINDINGS

Here, we make three observations from our data. One doctrinal, one economic, and one normative. First, we observed a substantial doctrinal shift in both the district courts and Federal Circuit regarding the appropriate test for determining whether a patent is obvious. Consistent with observations from Rantanen and others—and in contrast with some predictions just after *KSR*—we find that the Federal Circuit largely has avoided the “rigid” form of

the TSM test that the Supreme Court rejected in *KSR*.<sup>270</sup> For the first time, we also find the district courts have similarly rejected this test.

At the same time, although both the Federal Circuit and district courts heavily rely upon “*KSR*” factors that can be used in determining obviousness, there appears to be a somewhat greater embrace of these factors in the district courts than the Federal Circuit. Given that the Federal Circuit arguably had more “invested” in its prior TSM test, and given its differing judicial philosophy regarding the nature and function of patents, a greater embrace of *KSR* by the district courts is perhaps not surprising. On the other hand, it is surprising that the Federal Circuit has more readily discarded its previous TSM test than many guessed at the time, and some still believe today.

This reflection leads to our second observation, namely that the changing role of obviousness in legal doctrine—the “cycles of obviousness”—likely reflects the different underlying views of judges regarding the economic role

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270. At least one scholar has claimed that while the “Federal Circuit seemed to abide by the Supreme Court’s instructions” immediately following *KSR*, “the Federal Circuit has [more recently] issued several decisions that appear to conflict with *KSR*.” Paul Gugliuzza, *Elite Patent Law*, 104 IOWA L. REV. 2481, 2504 (2019). In support of the claim, Gugliuzza cites several recent Federal Circuit opinions, including *Arendi S.A.R.L. vs. Apple, Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016) and *Apple, Inc. vs. Samsung Elecs. Co.*, 839 F.3d 1034, 1052 (Fed. Cir. 2016) (en banc). See *id.* at nn. 74–76. Although we agree that these Federal Circuit opinions contain some language that is in tension with *KSR*, even in our dataset, a small number of Federal Circuit decisions contained language in tension with *KSR*. See *supra* Table 4 (showing, for example, that some post-*KSR* Federal Circuit cases still recited a narrow TSM test). Moreover, both *Arendi v. Apple* and *Apple vs. Samsung* contain other language that is entirely consistent with *KSR*, and in our view these cases as a whole do not directly conflict with *KSR*. See *Arendi*, 832 F.3d at 1361–64 (recognizing that *KSR* adopted “common sense” as an important component of the obviousness analysis, but ensuring that “reasoned analysis and evidentiary support” continue to play a role, especially where common sense is alleged to supply a missing claim limitation); *Apple*, 839 F.3d at 1047–52 (describing the *Graham-KSR* framework and holding that obviousness is a question of law that turns on subsidiary questions of fact, including the motivation to combine).

To determine if the Federal Circuit has widely implemented different doctrines and reasoning after our dataset ended, we (the authors) reviewed over 100 Federal Circuit decisions on obviousness issued between 2014 and 2019. In addition to *Arendi v. Apple* and *Apple vs. Samsung*, a very small number of recent opinions contain some language seemingly in tension with *KSR*. Yet, again, these cases also contain language drawn from *KSR* that in our view eliminates any direct conflict with *KSR*. See, e.g., *Forest Labs., LLC v. Sigmapharm Labs., LLC*, 918 F.3d 928, 934 (2019) (reciting the pre-*KSR* TSM test, but immediately qualifying it with specific language from *KSR*). Although certainly not determinative, our qualitative review indicates that the Federal Circuit’s overall doctrinal approach to obviousness has been quite similar in the period immediately following *KSR* (2007 to 2013) and more recent years (2014 to 2019).

Despite the apparent uniformity in reasoning at the Federal Circuit, it is important to note our earlier result showing a continued decline in ultimate obviousness findings at the Federal Circuit since 2009, and we would not be surprised if the recent rate of obviousness determinations at the Federal Circuit is essentially the same as the pre-*KSR* rate (at least the 2003–2004 levels). See *supra* Figure 4 (showing running averages of obviousness determinations at the Federal Circuit from 2003 to 2013). So, while the nominal doctrines of the Federal Circuit may appear similar from soon after *KSR* to now, the court’s application of its doctrine to the facts appears to have notably shifted since *KSR*. Of course, more detailed review of the recent obviousness opinions is necessary to confirm (or deny) these suspicions.



of patents. Specifically, as we explained earlier, the Federal Circuit adopted its TSM test to protect against hindsight bias by judges and juries—especially lay judges and juries who might have difficulty determining how straightforward it would be for a PHOSITA to combine prior art references—in making determinations of obviousness.<sup>271</sup> Such a test was arguably in its view particularly important given the high invalidation of rates of patents in some circuit courts of appeal prior to the creation of the Federal Circuit in the early 1980s. Thus, the Federal Circuit viewed itself as safeguarding the patent right against somewhat perfunctory analyses that did not fully reflect the difficulty faced by PHOSITAs in forming inventive combinations of the prior art. At the same time, many believed the Federal Circuit’s test became too difficult a hurdle to pass—which led to widespread criticism in scholarly and public policy circles—ultimately culminating in the Supreme Court’s decision in *KSR*, and drastic loosening of the standard for showing obviousness.

Yet, in our view, these differences in approaching obviousness do not merely turn on doctrine, but rather on quite different policy views regarding the appropriate role of patents in the inventive process. Such a position is supported by at least three bodies of evidence: (1) our findings regarding the variation between the district courts and Federal Circuit in the reasoning used to reach their results; (2) specific language from post-*KSR* cases evidencing competing, sometimes conflicting, views regarding the appropriate role of the obviousness doctrine; and (3) our regression results showing wide variation in obviousness findings after controlling for a host of key factors.

First, as we noted earlier, the prevalence of specific doctrines and factors used by district courts and the Federal Circuit to make obviousness determinations was fairly similar post-*KSR*. For instance, the frequency that the district courts and Federal Circuits relied on the TSM test, “predictable uses” of prior art, “common sense,” “mere substitution,” “copying of the claimed invention,” invention “received praise,” and unexpected results have been quite similar following *KSR*.<sup>272</sup> On the other hand, the Federal Circuit has been notably less likely to rely on the *KSR* factor of “design incentives or other market forces” to find obviousness of the claimed invention.<sup>273</sup> Specifically, according to the Supreme Court in *KSR*, “[w]hen a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one.”<sup>274</sup> Such a pronouncement—particularly the reliance on “market forces”—is in our view in deep tension with the Federal Circuit’s TSM test, which focuses not on the market, but on *technological* limitations and incentives. Moreover, the

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271. See *supra* notes 27, 60, 185 and accompanying text.

272. See *supra* Table 4.

273. See *supra* Table 4.

274. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007).

reliance on market forces to show obviousness is in tension with the secondary factor of commercial success, which is typically used to show nonobviousness. Thus, given at least some Federal Circuit judges' continued penchant for the TSM test—a test the Federal Circuit itself fashioned, mainly to prevent hindsight bias—it is not surprising that Federal Circuit has been somewhat less willing to rely on “market forces” than the district courts.

Second, even a cursory sampling of opinions reflects the often deep divide among judges regarding the proper role of obviousness in the patent system. For instance, in affirming a finding of nonobviousness below, in *WBIP, LLC v. Kohler Co.*,<sup>275</sup> the Federal Circuit relied heavily on secondary factors, contending that “[t]he objective indicia of non-obviousness play an important role as a guard against the statutorily proscribed hindsight reasoning in the obviousness analysis.”<sup>276</sup> The Federal Circuit rejected the accused infringer’s reliance on the *KSR* factor of “design incentives and other market forces” essentially without any analysis, instead upholding “the jury’s presumed factual findings of commercial success underlying its verdict on obviousness.”<sup>277</sup> Similarly, in *Arendi S.A.R.L. v. Apple Inc.*, the Federal Circuit took a relatively narrow view of *KSR*’s “common sense” factor, stating that “common sense is typically invoked to provide a known motion to combine, not to supply a missing claim limitation.”<sup>278</sup> In yet other instances, the Federal Circuit demanded relatively specific evidence showing a motivation to combine to support a finding of obviousness.<sup>279</sup>

The Federal Circuit’s preference for more traditional factors over the more flexible *KSR* factors is consistent with our findings that the Federal Circuit is somewhat less willing than the district courts to rely on the expansive reasoning in *KSR*. Thus, while the Federal Circuit has clearly shifted its course substantially in favor of obviousness findings, these counter-tendencies point in favor of protecting patentability relative to the district courts.

Although the Federal Circuit has not expounded on the theoretical motivations behind its tendencies, reference to the well-known patent law theorist Edmund Kitch may help illustrate the divide between the Federal Circuit, on the one hand, and the Supreme Court and district courts, on the other. Specifically, early in his career, when Kitch adhered to a more traditional view of the role of patent law in the innovation process—one more focused on invention, rather than commercialization—he argued that commercial success was a tenuous factor in favor of nonobviousness.<sup>280</sup> In line

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275. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1328 (Fed. Cir. 2016).

276. *Id.*

277. *Id.* at 1326–27.

278. *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016).

279. *See, e.g., Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1052 (Fed. Cir. 2016) (en banc) (upholding jury verdict of nonobviousness as supported by “implied fact finding” of no motivation to combine), *cert. denied*, 138 S. Ct. 420 (2017).

280. Kitch, *supra* note 2, at 301.

with the Supreme Court's view in *KSR*, Kitch argued that “[i]f a product would be commercially successful, there may be less need for a patent to induce its creation.”<sup>281</sup> In other words, to rephrase Kitch's early position, commercial success may very well indicate strong market forces driving the invention, which in turn indicates less of a need for patenting, and hence counsels favor of a high bar for nonobviousness. Yet, later in his career, espousing the “prospect theory” of patent law, which placed much more emphasis on the commercialization phase of the innovation process, Kitch claimed: “[t]he fact that a product or process within the terms of the patent claim is commercially successful tells the court that the patent serves as the foundation for a series of now valuable contract rights.”<sup>282</sup> As such, the Federal Circuit's eschewal of the “market forces” approach of *KSR* may be consistent with more of a commercialization or prospect theory based approach to patent law.

The distinction between the Federal Circuit's approach and that of the Supreme Court is underscored by Justice Kennedy's assertion within the *KSR* opinion itself: “[i]n many fields it may be that there is little discussion of obvious techniques or combinations, and it often may be the case that market demand, rather than scientific literature, will drive design trends.”<sup>283</sup> Unlike at least some of the Federal Circuit's post-*KSR* pronouncements, the Supreme Court's view arguably downplays the importance of protecting hindsight bias in favor of market-based factors, tilting the scale against patentability.<sup>284</sup>

Importantly, our contention is not merely based on anecdotes. The results from our regressions and our detailed analysis of the reasons provided to reach the ultimate holding in each case demonstrates at least indirect empirical support for our view. As noted, the Federal Circuit was significantly less likely to rely on the “obvious to try” and “market forces” *KSR* factors—two factors that have proven highly controversial among commentators. Moreover, controlling for a variety of factors, other than the period between the grant of certiorari in *KSR* and the Supreme Court's ultimate decision in the case, there was no statistically significant difference between the Federal Circuit's pre- and post-*KSR* rates of finding obviousness. Even putting statistical significance aside, in absolute terms, the Federal Circuit was about ten percent less likely to make a finding of obviousness than the district courts after *KSR*.

Perhaps more telling is the variation across districts. Specifically, judges in the more patentee-friendly Eastern District of Texas were roughly 25 percent less likely than those in the average district to find obviousness and

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281. *Id.* at 333–34.

282. *Id.* at 283.

283. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 419 (2007).

284. See generally N. Scott Pierce, *Common Sense: Treating Statutory Non-Obviousness as a Novelty Issue*, 25 SANTA CLARA COMPUTER & HIGH TECH. L.J. 539, 641 (2009) (comparing in detail the use of secondary factors by the Federal Circuit to favor patentability against the use of alternative *KSR* factors to disfavor patentability).

judges in the accused infringer-friendly Northern District of California were roughly 40 percent more likely to find obviousness. Because these results account for technology type, procedural status, and other potentially explanatory factors, it seems likely that judicial ideology plays a critical role in explaining these gaps.

Thus, rather than reflecting mere textual ambiguities latent in the *KSR* opinion, the differences in outcome that our study has shown more likely indicates the differing views at the Federal Circuit and in the district courts regarding the role patents should play (or not) in spurring innovation. In our opinion, it is wrong to label the Federal Circuit as a “renegade” court, at least in this context, because following *KSR*, the Federal Circuit substantially shifted its outcomes and doctrine.<sup>285</sup> Nonetheless, at the margins, differences matter, and certainly differences are present between the Federal Circuit and the district courts.

These economic reflections lead to our third, normative reflection on an important question: To what extent should the Federal Circuit diverge from the district courts in interpreting *KSR*? There is no straightforward answer to this question. Yet, we can make a cautious normative claim based on our finding that the doctrine of obviousness matters: Even resistant courts can respond quite dramatically to precedential opinions that bind their decisionmaking, and that given this elasticity of the courts, it is incumbent on appellate courts—particularly the Supreme Court—to take care when radically altering doctrine. Like several other opinions over the last decade, such as the Court’s restriction in the ability to garner injunctive relief in patent cases as well as the ability to gain patent protection over software and medical diagnostic tests, the Court has seemingly shifted doctrine without detailing or explaining the full consequences of its actions. Given the historical cycles in obviousness and the rich set of jurisprudence and scholarly commentary considering the ramifications of this doctrine for innovation, it was in our view unfortunate that the Court perhaps listened to a chorus driven mainly by anecdotal evidence not even a decade old. Given the major shift in decisions on obviousness in the Federal Circuit and district courts that we have documented here, we hope that further empirical study of these effects on innovation will more generally be undertaken, particularly in view of historical trends, in order to provide a more rigorous set of data for the Supreme Court (or Congress) to engage in future doctrinal change.

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285. See Eisenberg, *supra* note 145, at 31–32; *cf.* Transcript of Oral Argument at 11, *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006) (No. 05-130), [https://www.supremecourt.gov/oral\\_arguments/argument\\_transcripts/2005/05-130.pdf](https://www.supremecourt.gov/oral_arguments/argument_transcripts/2005/05-130.pdf) [<https://perma.cc/LMD7-JGCA>] (noting that Justice Scalia labeled the Eastern District of Texas as a “renegade jurisdiction” in patent cases).

## VI. CONCLUSION

Although the Supreme Court sets precedent, the lower courts must interpret and implement it. On thorny doctrinal issues that turn on competing policy visions, the interpretation and implementation of precedent can often be patchy, differing substantially among courts and judges. Patent law's obviousness doctrine is one such thorny issue. Undergoing shifts and cycles from its origins in the Venetian Republic, judges and commentators alike have failed to agree upon just how to determine it. As such, it is not surprising that our study—the first to comprehensively analyze both Federal Circuit and district court opinions following the Supreme Court's landmark decision in *KSR*—finds that while both “lower” levels of the judiciary substantially altered course in outcome and doctrine, the Federal Circuit shifted somewhat less than the district courts. Indeed, divergent implementations of the same Supreme Court opinion recur in all areas of law, illustrating that the “supreme” law of the land may be in actuality multiple variations on a theme.

## APPENDIX

Appendix Table 1. Probit Estimation of the Likelihood a District Court Finds Obviousness

|                        | 1                   | 2                   | 3                   | 4                   | 5                   | 6                   | 7                   |
|------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Post-KSR               | 0.191***<br>(0.055) | 0.196***<br>(0.055) | 0.202***<br>(0.056) | 0.209***<br>(0.056) | 0.204***<br>(0.057) | 0.214***<br>(0.057) | 0.209***<br>(0.058) |
| Necessary for Decision |                     | 0.001<br>(0.089)    |                     |                     | 0.008<br>(0.090)    | 0.011<br>(0.090)    | 0.015<br>(0.091)    |
| Procedural Posture     |                     |                     |                     |                     |                     |                     |                     |
| Bench                  |                     |                     | -0.249*<br>(0.134)  |                     | -0.238<br>(0.136)   |                     | -0.120<br>(0.164)   |
| JMOL                   |                     |                     | -0.161<br>(0.143)   |                     | -0.145<br>(0.146)   |                     | -0.064<br>(0.164)   |
| SJ                     |                     |                     | 0.062<br>(0.152)    |                     | 0.057<br>(0.153)    |                     | 0.134<br>(0.163)    |
| Technology             |                     |                     |                     |                     |                     |                     |                     |
| Chemical               |                     |                     |                     | -0.172<br>(0.105)   |                     | -0.153<br>(0.112)   | -0.093<br>(0.122)   |
| Computer & Comm.       |                     |                     |                     | -0.113<br>(0.086)   |                     | -0.099<br>(0.089)   | -0.082<br>(0.092)   |
| Drugs & Medical        |                     |                     |                     | -0.178**<br>(0.076) |                     | -0.196**<br>(0.077) | -0.114<br>(0.088)   |
| Electrical             |                     |                     |                     | -0.125<br>(0.105)   |                     | -0.134<br>(0.105)   | -0.118<br>(0.108)   |
| Mechanical             |                     |                     |                     | 0.081<br>(0.107)    |                     | 0.061<br>(0.109)    | 0.057<br>(0.110)    |
| District is:           |                     |                     |                     |                     |                     |                     |                     |
| D. Del.                |                     |                     |                     |                     |                     |                     |                     |
| D. N.J.                |                     |                     |                     |                     |                     |                     |                     |
| E.D. Tex.              |                     |                     |                     |                     |                     |                     |                     |
| N.D. Cal.              |                     |                     |                     |                     |                     |                     |                     |
| N.D. Ill.              |                     |                     |                     |                     |                     |                     |                     |
| S.D.N.Y.               |                     |                     |                     |                     |                     |                     |                     |
| Log-likelihood         | -211                | -204                | -198                | -200                | -193                | -194                | -187                |
| Observations           | 319                 | 309                 | 319                 | 312                 | 309                 | 302                 | 302                 |

Note: Population of 319 district court obviousness decisions. Marginal effects reported with discrete change of dummy variables from 0 to 1. Robust standard errors included in parenthesis. \*  $p < .10$ ; \*\*  $p < .05$ ; and \*\*\*  $p < .01$ .

Appendix Table 2. Probit Estimation of the Likelihood the Federal Circuit Finds Obviousness Post-KSR Grant of Cert

|                    | 1                   | 2                  | 3                  | 4                  |
|--------------------|---------------------|--------------------|--------------------|--------------------|
| Post-KSR           | 0.214***<br>(0.080) | 0.189**<br>(0.084) | 0.211**<br>(0.082) | 0.180**<br>(0.087) |
| Procedural Posture |                     |                    |                    |                    |
| Bench              |                     | 0.112<br>(0.223)   |                    | 0.172<br>(0.224)   |
| Jury               |                     | -0.018<br>(0.228)  |                    | 0.041<br>(0.230)   |
| JMOL               |                     | 0.068<br>(0.217)   |                    | 0.102<br>(0.215)   |
| SJ                 |                     | 0.393*<br>(0.163)  |                    | 0.427**<br>(0.158) |
| Prelim. Injunction |                     | -0.080<br>(0.368)  |                    | -0.001<br>(0.369)  |
| Technology         |                     |                    |                    |                    |
| Chemical           |                     |                    | -0.151<br>(0.165)  | -0.240<br>(0.166)  |
| Computer & Comm.   |                     |                    | -0.082<br>(0.120)  | -0.100<br>(0.128)  |
| Drugs & Medical    |                     |                    | -0.191*<br>(0.105) | -0.170<br>(0.113)  |
| Electrical         |                     |                    | -0.193<br>(0.151)  | -0.138<br>(0.164)  |
| Mechanical         |                     |                    | -0.100<br>(0.142)  | -0.138<br>(0.164)  |
| Log-likelihood     | -127                | -115               | -124               | -113               |
| Observations       | 192                 | 192                | 191                | 191                |

Note: Population of 192 Federal Circuit obviousness decisions. Marginal effects reported with discrete change of dummy variables from 0 to 1. Robust standard errors included in parenthesis. \*  $p < .10$ ; \*\*  $p < .05$ ; and \*\*\*  $p < .01$ .