PATENT ELIGIBILITY AND INVESTMENT

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Have the Supreme Court's recent patent eligibility cases changed the behavior of venture capital and private equity investment firms, and if so how? This Article provides empirical data about investors' answers to those important questions. Analyzing responses to a survey of 475 investors at firms investing in various industries and at various stages of funding, this Article explores how the Court's recent cases have influenced these firms' decisions to invest in companies developing technology. The survey results reveal investors' overwhelming belief that patent eligibility is an important consideration in investment decisionmaking, and that reduced patent eligibility makes it less likely their firms will invest in companies developing technology. According to investors, however, the impact differs between industries. For example, investors predominantly indicated no impact or only slightly decreased investments in the biotechnology, medical device, and pharmaceutical industries. The data and these findings (as well as others described in the Article) provide critical insight, enabling evidence-based evaluation of competing arguments in the ongoing debate about the need for congressional intervention in the law of patent eligibility. And, in particular, they indicate reform is most crucial to ensure continued robust investment in the development of life science technologies.

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INTRODUCTION

In a series of recent cases the Supreme Court significantly altered the landscape of patent law.[1] Indeed, the Court has "embarked upon a drastic and far-reaching experiment in patent eligibility standards."[2] Numerous inventors, scientists, lawyers, lawyer groups, companies, industry groups, professors, and judges have decried this sea change in patent law.[3] They have highlighted not only critical flaws in the Supreme Court's analyses, but also the perverse impact of the Court's new eligibility standard.[4] The new standard, for example, has required lower courts to make determinations of ineligibility that judges themselves recognize as

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1 *See generally* Alice Corp. v. CLS Bank Int'l, 573 U.S. 208 (2014); Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576 (2013); Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66 (2012); Bilski v. Kappos, 561 U.S. 593 (2010).

2 Jeffrey A. Lefstin et al., *Final Report of the Berkeley Center for Law & Technology Section 101 Workshop: Addressing Patent Eligibility Challenges*, 33 BERKELEY TECH. L.J. 551, 554 (2018).

3 For summaries of criticisms, see generally JOHN R. THOMAS, CONG. RESEARCH SERV., 7-5700, PATENTABLE SUBJECT MATTER REFORM (2017); U.S. PATENT & TRADEMARK OFFICE, PATENT ELIGIBLE SUBJECT MATTER: REPORT ON VIEWS AND RECOMMENDATIONS FROM THE PUBLIC (2017).

4 *See, e.g.*, AM. INTELLECTUAL PROP. LAW ASS'N, AIPLA LEGISLATIVE PROPOSAL AND REPORT ON PATENT ELIGIBLE SUBJECT MATTER (2017); Letter from Donna P. Suchy, Section Chair, Am. Bar Ass'n, Section of Intellectual Prop. Law, to the Honorable Michelle K. Lee, Under Sec'y of Commerce for Intellectual Prop. & Dir. of the U.S. Patent & Trademark Office (Mar. 28, 2017); INTELLECTUAL PROP. OWNERS ASS'N, PROPOSED AMENDMENTS TO PATENT ELIGIBLE SUBJECT MATTER UNDER 35 U.S.C. § 101 (2017).

incorrect, particularly in cases of biotechnology.[5] Moreover, the standard has created confusion and lacks administrability.[6]

The most significant concern with the Supreme Court's new eligibility standard is that it has negatively impacted investment in the development of technology, in the sense that it has reduced investment in inventive activities in critically important industries, like biotechnology.[7] The change in the law represents a "drastic and far-reaching experiment," in particular, because of the lack of certainty regarding the full extent of that impact. And to some degree the lack of certainty cannot be eliminated. For example, if investors have reduced investments in certain industries, no one can say for sure what inventions were delayed, or, worse, what inventions simply were not and will not be invented. No one knows, for example, whether the Court's decisions have delayed or altogether prevented the development of medicines and medical procedures.[8]

There have been signals, however, of the likelihood of these devastating consequences. The case of *Ariosa Diagnostics, Inc. v. Sequenom, Inc.* represents perhaps the best example of how the Supreme Court's new standard denies eligibility for inventions in critically important fields.[9] In 1996, long before the Supreme Court's recent cases, two researchers discovered that a pregnant woman's bloodstream

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[5] *See, e.g.*, Ariosa Diagnostics, Inc. v. Sequenom, Inc., 809 F.3d 1282, 1287 (Fed. Cir. 2015) (Lourie, J., concurring in the denial of en banc rehearing) ("In sum, it is unsound to have a rule that takes inventions of this nature out of the realm of patent-eligibility on grounds that they only claim a natural phenomenon plus conventional steps, or that they claim abstract concepts. But I agree that the panel did not err in its conclusion that under Supreme Court precedent it had no option other than to affirm the district court.").

[6] *See* David O. Taylor, *Confusing Patent Eligibility*, 84 TENN. L. REV. 157, 227 (2016) ("Beyond confusing relevant policies and doctrines, the current approach to determining patent eligibility lacks administrability.").

[7] *See, e.g.*, Hallie Wimberly, *The Changing Landscape of Patent Subject Matter Eligibility and Its Impact on Biotechnological Innovation*, 54 HOUS. L. REV. 995 (2017) ("This roadblock to intellectual property protection for biotechnological inventions, due both to the recent restrictions and to the uncertain legal standard, may slow growth of the industry that relies heavily on investment.").

[8] There have been attempts in the past to identify the proportion of inventions that would not be invented absent patent protection. *See, e.g.*, Edwin Mansfield, *Patents and Innovation: An Empirical Study*, 32 MGMT. SCI. 173 (1986). To my knowledge, no one has conducted such a study with respect to the Supreme Court's eligibility cases.

[9] Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d 1371 (Fed. Cir. 2015).

includes genetic material from her unborn baby.[10] In light of this discovery, the researchers used known laboratory techniques to create a method to detect this genetic material.[11] This genetic material, in turn, could be used to identify fetal characteristics such as gender as well as fetal abnormalities such as Down's syndrome.[12] This invention avoided risks associated with prior techniques to identify fetal characteristics, namely taking samples from the fetus or placenta.[13] The inventors sought and obtained a patent for their invention.[14] In 2015, however, the U.S. Court of Appeals for the Federal Circuit invalidated the patent using the Supreme Court's recently-developed, heightened standard for patent eligibility.[15]

The Federal Circuit, which hears all appeals in patent cases, first concluded that the existence of fetal genetic material in maternal blood is a natural phenomenon, and that the claimed method described in the patent was directed to this natural phenomenon.[16] Then, the court concluded that the claimed method did not include any "inventive concept" transforming this natural phenomenon into a patent-eligible invention.[17] In particular, the court highlighted that the claimed invention involved merely routine, well-understood, conventional techniques to detect the natural phenomenon.[18] As a result, the court invalidated the patent for failing to disclose patent-eligible subject matter.[19]

Judge Linn concurred, but his opinion condemned the Supreme Court's standard that required the court's finding of ineligibility.[20] He joined the court's opinion only because he felt bound by the Supreme Court's standard.[21] He lamented that that standard required him to deprive "a meritorious invention from the patent protection it deserves

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10 *Id.* at 1373.

11 *Id.*

12 *Id.* at 1373, 1381 (Linn, J., concurring).

13 *Id.* at 1373.

14 *Id.*

15 *Id.*

16 *Id.* at 1376.

17 *Id.* at 1376–77.

18 *Id.* at 1377.

19 *Id.* at 1378.

20 *Id.* at 1380–81 (Linn, J., concurring).

21 *Id.* at 1380.

and should have been entitled to retain."[22] In particular, Judge Linn criticized the second part of the standard, the requirement of an "inventive concept," which discounts "seemingly without qualification" any conventional or obvious steps in a process.[23] Judge Linn pointed out how this aspect of the standard conflicts with prior Supreme Court precedent, in particular *Diamond v. Diehr*, which held that "a new combination of steps in a process may be patentable even though all the constituents of the combination were well-known and in common use before the combination was made."[24]

Judge Linn also highlighted how meritorious the invention was. It eliminated the need for invasive prenatal methods to detect genetic material, which presented health risks to the mother and unborn baby, were time consuming, and required expensive equipment.[25] It represented a paradigm shift to non-invasive prenatal diagnoses that presented fewer risks and a more dependable rate of abnormality detection.[26] He made clear his belief that Sequenom's patent "claims a new method that should be patent eligible."[27] In particular, he explained, "[t]he new use of the previously discarded maternal plasma to achieve such an advantageous result is deserving of patent protection."[28] Notably, Judge Linn also highlighted how use of a traditional standard would have resulted in a finding of patent eligibility for the invention, because the invention "effectuate[d] a practical result and benefit not previously attained."[29] But for the Supreme Court's standard, he saw "no reason, in policy or statute, why this breakthrough invention should be deemed patent ineligible."[30]

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22 *Id.*

23 *Id.*

24 *Id.* (quoting Diamond v. Diehr, 450 U.S. 175, 188 (1981)).

25 *Id.* at 1381.

26 *Id.*

27 *Id.*

28 *Id.*

29 *Id.* (alteration in original).

30 *Id.* Other judges similarly condemned the Supreme Court's standard when the Federal Circuit denied a petition for en banc rehearing in the same case. *See* Ariosa Diagnostics, Inc. v. Sequenom, Inc., 809 F.3d 1282 (Fed. Cir. 2015) (per curiam order denying en banc rehearing). Judges Lourie and Moore, for example, similarly expressed their view that "neither of the traditional preclusions of laws of nature or of abstract ideas ought to prohibit patenting of the subject matter in this case." *Id.* at 1284 (Lourie, J., concurring). They explained that "methods that utilize laws of

Building upon judges' views that they are bound by the Supreme Court's standard and their concerns that that standard is having devastating consequences, various groups believe the situation is so untenable that they have proposed ways Congress might overturn that standard.[31] Others, however—particularly large, established, software- and Internet-focused companies and their representatives—disagree.[32] They effectively ask: To what extent have the Court's cases shifting eligibility law actually impacted decisions to invest in the development of technology? Moreover, exactly how have these cases actually impacted investment decisions? And to the extent these cases have had a significant impact on investment decisions, has that impact proven to be positive or negative in the sense of increased or decreased investment?

Existing literature provides surprisingly little data even to begin to answer these questions.[33] Indeed, I have been unable to identify any survey asking investors to identify how changes to patent eligibility law have impacted their investment decisions. And, make no mistake, these questions are fundamental, and the accuracy of their answers is important. Answers to these questions, for example, will either support congressional intervention in the law of patent eligibility or counsel against it. Thus, the questions ought to be asked and—more

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nature do not set forth or claim laws of nature." *Id.* at 1285. Likewise, "steps that involve machines, which are tangible, steps that involve transformation of tangible subject matter, or tangible implementations of ideas or abstractions should not be considered to be abstract ideas." *Id.* They recognized that others have said "that a crisis of patent law and medical innovation may be upon us, and there seems to be some truth in that concern." *Id.* "In sum, it is unsound to have a rule that takes inventions of this nature out of the realm of patent-eligibility on grounds that they only claim a natural phenomenon plus conventional steps . . . ." *Id.* at 1287. Judge Dyk also concurred, expressing that he shared the concerns expressed by others. *Id.* at 1288–90 (Dyk, J., concurring). Judge Newman dissented, agreeing with her colleagues that the case was wrongly decided but disagreeing that the incorrect decision was required by Supreme Court precedent. *Id.* at 1293–94 (Newman, J., dissenting).

31 *See supra* note 4. I served as a member and the Reporter of the Patentable Subject Matter Task Force of the American Intellectual Property Law Association.

32 *See, e.g.*, WILLIAM G. JENKS, COMMENTS OF THE INTERNET ASSOCIATION AND THE COMPUTER & COMMUNICATIONS INDUSTRY ASSOCIATION REGARDING THE LEGAL CONTOURS OF SUBJECT MATTER ELIGIBILITY (PART 2) (2017), https://www.uspto.gov/sites/default/files/documents/RT2%20Comments%20the%20Internet%20Association%20and%20the%20Computer%20%26%20Communications%20Industry%20Association.pdf [https://perma.cc/GJ6C-NLKC].

33 *See infra* Section V.A.

importantly—answered by reference to hard data rather than gut feeling or prognostication.[34] Quite literally, future innovation—lifesaving innovation—hangs in the balance.

And so that is exactly what I have done: gathered data to help begin the process of identifying accurate answers to these questions about the Supreme Court's impact on decisions to invest in the development of technology. In particular, I have conducted a survey of 475 venture capital and private equity investors to study the impact of the Court's eligibility cases on their firms' decisions to invest in companies developing technology. This survey is the first of its kind, and the data it has provided is sorely needed.

The results of the survey provide critical insights into the impact of the Supreme Court's eligibility cases. In this Article, I present detailed results of the survey and identify and consider four principal findings. The first relates to the absolute and relative importance of patent eligibility with respect to investor decisionmaking. The second correlates reduced eligibility with particular investment behaviors in particular industries. The third provides more specific insight into the potential causal connection between the Supreme Court's eligibility cases and particular changes in investment behavior. And the fourth identifies a correlation between investors' knowledge regarding the Court's eligibility cases (what I refer to as eligibility knowledge) and changes in investment behavior.

Regarding the first principal finding,[35] the investors who responded to the survey overwhelmingly believe patent eligibility is an important consideration when their firms decide whether to invest in companies developing technology. Indeed, overall, 74% of the investors agreed that patent eligibility is an important consideration in firm decisions whether to invest in companies developing technology; only 14% disagreed. Likewise, investors reported that reduced patent eligibility for a technology makes it less likely that their firm will invest in companies developing that technology. For example, overall 62% of the investors agreed that their firms were less likely to invest in a company developing technology if patent eligibility makes patents unavailable, while only 20%

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[34] *Cf.* Mark A. Lemley, *Faith-Based Intellectual Property*, 62 UCLA L. REV. 1328, 1336 (2015) (lamenting that "[p]articipants on both sides of the IP debates are increasingly staking out positions that simply do not depend on evidence at all").

[35] *See infra* Section IV.A.

disagreed. These results, while perhaps not surprising, nonetheless confirm one of the central premises upon which the patent system rests: that patents help to spur investment in development of technology. The availability of patents, however, was not the most important consideration to the investors. The quality of a target company's people ranked as most important, followed by the quality of the company's technology and the size of the potential market for the technology. By one metric, investors deemed the availability of U.S. patent protection to be only slightly less important than first-mover advantage; by another metric, it was deemed slightly more important. Thus, the first principal finding is that patent eligibility is an important factor—albeit certainly not the most important factor—in investment decisions.

The second principal finding[36] is that reduced patent eligibility correlates with particular investment behaviors in particular industries. Investors overwhelmingly indicated, for example, that the elimination of patents would either not impact their firms' decisions whether to invest in companies or only slightly decrease investments in companies developing technology in the construction (89%), software and Internet (80%), transportation (84%), energy (79%), and computer and electronic hardware (72%) industries. But investors, by contrast, overwhelmingly indicated that the elimination of patents would either somewhat decrease or strongly decrease their firms' investments in the biotechnology (77%), medical device (79%), and pharmaceutical industries (73%). Thus, according to these investors, on average each industry would see reduced investment, but the impact on particular industries would be different. And the life sciences industries are the ones most negatively affected.

The third principal finding[37] is that the Supreme Court's eligibility cases have impacted many firms' investments and, more significantly going forward, the firms' investment behaviors. Almost 40% of the investors who knew about at least one of the Court's eligibility cases indicated that the Court's decisions had somewhat negative or very negative effects on their firms' existing investments, while only about 15% of these investors reported somewhat positive or very positive effects. On a going-forward basis, moreover, almost 33% of the investors who knew about at least one of the Court's eligibility cases indicated that these cases affected their firms' decisions whether to invest in companies developing

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36 *See infra* Section IV.B.

37 *See infra* Section IV.C.

technology. These investors reported primarily decreased investments, but also shifting of investments between industries. In particular they identified shifting of investments out of the biotechnology, medical device, pharmaceutical, and software and Internet industries.

The fourth principal finding[38] is that investors familiar with the Supreme Court's eligibility cases indicated different changes in firm investment behavior as compared to investors without this familiarity. As discussed above, about 33% of investors with this familiarity reported that these cases impacted their firms' investment behavior, with these investors reporting shifting of investments away from the software and Internet industry along with the biotechnology, medical device, and pharmaceutical industries. Investors without familiarity with these cases, by contrast, overwhelmingly reported that the decreased availability of patents since 2009 (prior to the Supreme Court's eligibility cases) has not impacted their firms' changes in investment behavior. Indeed, a full 95% indicated no impact on any change in their firms' investments. Moreover, investors without familiarity with these cases indicated more often, as compared to investors with familiarity, that their firms have shifted investments into the software and Internet industry as compared to all other industries. In short, eligibility knowledgeable investors report the Supreme Court's cases have resulted in reduced investment in software and the Internet, while unknowledgeable investors report increased investment in software and the Internet over the same time period. As investors transition from unknowledgeable to knowledgeable (once they learn about the Court's cases and their impact on patent eligibility), investment in software and the Internet will seemingly decrease.

The results of the survey provide critical data for an evidence-based evaluation of competing arguments in the ongoing debate about the need for congressional intervention in the law of patent eligibility.[39] Proponents of reform may tout the results of the survey as representing a clarion call for reform.[40] The best that can be said by those that prefer the

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38 *See infra* Section IV.D.

39 *See* John M. Golden et al., *The Path of IP Studies: Growth, Diversification, and Hope*, 92 TEX. L. REV. 1757, 1759 (2014) ("IP legal studies have entered a new period of very substantial empirical scholarship, a period that might enable more precise and accurate policy prescriptions than ever before.").

40 *See infra* Section V.B.

status quo is that most investors do not report changing their investment decisionmaking based upon the Supreme Court's eligibility decisions.[41] A significant part of this group of investors, however, represents those uninformed about the Court's cases. The reality is that the results of the survey highlight the importance of patent eligibility and the negative impact of the Supreme Court's eligibility cases generally on investment, but particularly in the most important areas of technological development in terms of its impact on public health: the biotechnology, medical device, and pharmaceutical industries, which collectively I refer to as the life sciences industries. That said, it is important to highlight that the results show the Court's decisions have negatively impacted each and every area of technological development studied. And, as a consequence, the results do support the idea that the time has come for Congress to at least consider overturning the Supreme Court's new eligibility standard to prevent additional lost investment in technological development in the United States.[42] Indeed, given the results of the survey, it seems likely that the Supreme Court's eligibility decisions have resulted in lost investment in the life sciences that has delayed or altogether prevented the development of medicines and medical procedures.

I have organized the Article into five main Parts. In Part I, I explain the need for a survey of this type by highlighting the recent development of the law governing patent eligibility, the criticisms of its current state, and the absence of data answering basic questions about the impact of the Supreme Court's decisions in the area of patent eligibility. In Part II, I describe my hypothesis and the survey methodology used to test that hypothesis. In Part III, I explore the demographics of the respondents to the survey and compare the respondents to the non-respondents to assess the extent to which they are representative or reflect selection bias. In Part IV, I study the results of the survey, identifying and exploring the ramifications of the four principal findings I have already summarized. In Part V, I identify where the results of this survey fit within the existing literature and recognize limitations on the survey's results and findings, before briefly concluding.

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41 *See infra* Section V.C.

42 *See generally* David O. Taylor, *Amending Patent Eligibility*, 50 U.C. DAVIS L. REV. 2149 (2017) (evaluating various approaches to amending the patent statute).

I. THE LAW OF PATENT ELIGIBILITY

To understand the need for a survey of the type I conducted, one must understand recent judicial developments in the law governing patent eligibility, primarily its recent changes and its present state. Then one must understand the significant criticism engendered by the present state of the law, along with gaps in the evidence underlying some of the criticism.

A. *Recent Judicial Developments*

While the patent statute by its terms extends eligibility to "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof,"[43] the Supreme Court has long held that eligibility does not encompass laws of nature, natural phenomena, and abstract ideas.[44]

These judicially recognized exceptions to the statutory text have been the subject of numerous Supreme Court decisions over the last several decades, including eight since 1972.[45] The distribution of these eight cases, however, has been almost perfectly bimodal. Between 1972 and 1981 the Supreme Court decided the first four of these eight cases, and between 2010 and 2014 the Court decided the last four. In between

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43 35 U.S.C. § 101 (2018).

44 *See* Parker v. Flook, 437 U.S. 584, 598 (1978) (Stewart, J., dissenting) ("It is a commonplace that laws of nature, physical phenomena, and abstract ideas are not patentable subject matter."); Mackay Radio & Tel. Co. v. Radio Corp. of Am., 306 U.S. 86, 94 (1939) ("[A] scientific truth, or the mathematical expression of it, is not patentable invention . . . ."); Rubber-Tip Pencil Co. v. Howard, 87 U.S. (20 Wall.) 498, 507 (1874) ("An idea of itself is not patentable . . . ."); Le Roy v. Tatham, 55 U.S. (14 How.) 156, 175 (1853) ("[A] principle is not patentable. . . . Nor can an exclusive right exist to a new power, should one be discovered in addition to those already known. Through the agency of machinery a new steam power may be said to have been generated. But no one can appropriate this power exclusively to himself, under the patent laws. The same may be said of electricity, and of any other power in nature, which is alike open to all, and may be applied to useful purposes by the use of machinery.").

45 Alice Corp. v. CLS Bank Int'l, 573 U.S. 208 (2014); Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576 (2013); Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66 (2012); Bilski v. Kappos, 561 U.S. 593 (2010); Diamond v. Diehr, 450 U.S. 175 (1981); Diamond v. Chakrabarty, 447 U.S. 303 (1980); Parker v. Flook, 437 U.S. 584 (1978); Gottschalk v. Benson, 409 U.S. 63 (1972).

those two time periods—indeed in 1982, just one year after the fourth of the eight decisions—Congress established a new court, the U.S. Court of Appeals for the Federal Circuit, and vested it with nearly exclusive jurisdiction over appeals in patent cases.[46] Then, between 1982 and 2010 the Supreme Court effectively deferred to the Federal Circuit's understanding and application of the judicially recognized exceptions to eligibility; the Court did not decide one case on the topic of patent eligibility during this twenty-eight-year period.

The Federal Circuit, however, repeatedly interpreted and applied the law governing patent eligibility during that period. Moreover, largely consistent with most of the Supreme Court's pronouncements in this area of the law prior to 1982, the Federal Circuit enforced a rather permissive standard that ensured broad eligibility. Between 1994 and 2008, for example, that standard permitted a claimed invention to be eligible for patenting so long as it fell within one of the statutory categories (a "process, machine, manufacture, or composition of matter," or an "improvement thereof") and did not fall within one of the judicially created exceptions ("laws of nature, natural phenomena, and abstract ideas"), where the latter did not occur if the claimed invention was a "practical application of an abstract idea" such that it produced a "useful, concrete, and tangible result."[47] In 2006, however, some members of the Supreme Court viewed this standard as too lax; in a dissent from a dismissal of a case in which the Court granted certiorari to the Federal Circuit, they expressed the view that "this Court has never made such a statement [that an abstract idea is one that does not produce a useful, concrete, and tangible result] and, if taken literally, the statement would cover instances where this Court has held the contrary."[48] No doubt as a result, in 2008 the Federal Circuit changed its interpretation of the judicially created exceptions, adopting instead a "machine-or-

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[46] Federal Courts Improvement Act of 1982, Pub. L. No. 97-164, 96 Stat. 25.

[47] *In re* Alappat, 33 F.3d 1526, 1544 (Fed. Cir. 1994); State St. Bank & Tr. Co. v. Signature Fin. Grp., 149 F.3d 1368, 1373 (Fed. Cir. 1998), *abrogated by* Bilski v. Kappos, 561 U.S. 593 (2010); AT&T Corp. v. Excel Commc'ns, Inc., 172 F.3d 1352, 1356 (Fed. Cir. 1999).

[48] Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc., 548 U.S. 124, 136 (2006) (Breyer, J., dissenting from dismissal of the writ of certiorari as improvidently granted).

transformation test"[49] that asked whether the claimed invention "is tied to a particular machine or apparatus" or "transforms a particular article into a different state or thing."[50] This test, however, also ultimately proved to be too lax for the Supreme Court.

The Supreme Court reentered the scene in 2010 to review the Federal Circuit's decision adopting the machine-or-transformation test and, ultimately, rejected that test as the exclusive basis to determine patent eligibility.[51] But the Court did so without identifying any standard whatsoever for determining when a claimed invention falls within a judicial exception.[52] In two subsequent cases, the Court finally did identify a new governing standard; it created a two-part test for determining patent eligibility.[53] That test significantly increased the likelihood that a claimed invention would be found ineligible. It requires, first, determining whether a claim is directed to one of the patent-ineligible concepts (laws of nature, natural phenomena, and abstract ideas).[54] If so, one must ask whether elements in the claim transform the nature of the claim into a patent-eligible application of the otherwise ineligible concept, a question the Court describes as a search for an "inventive concept—i.e., an element or combination of elements that is sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the ineligible concept itself."[55]

This standard represents a sea change in patent law because it requires an inventive application of a newly discovered law of nature, natural phenomenon, or abstract idea—directly contrary to the Court's historical standard requiring a mere practical application of any such discovery.[56] As a result, for the Court it is apparently not enough to obtain a patent for a scientist to make a new discovery (e.g., the cure to cancer)

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[49] *In re* Bilski, 545 F.3d 943, 959–60 (Fed. Cir. 2008) (en banc) (concluding "that the 'useful, concrete and tangible result' inquiry is inadequate" and adopting a "machine-or-transformation test").

[50] *Id.* at 954.

[51] *See generally* Bilski v. Kappos, 561 U.S. 593 (2010).

[52] *Id.*

[53] *See generally* Alice Corp. v. CLS Bank Int'l, 573 U.S. 208 (2014); Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66 (2012).

[54] *Alice*, 573 U.S. at 217–18.

[55] *Id.* (internal quotation marks and brackets omitted) (quoting *Mayo*, 566 U.S. at 72–73).

[56] *See generally* Jeffrey A. Lefstin, *Inventive Application: A History*, 67 FLA. L. REV. 565 (2015).

and disclose how to apply that discovery to advance the state of the world (e.g., treat patients using the cure). There must be a disclosure of how to apply the new discovery in a new way. This is a double novelty requirement. In short, the Supreme Court has shifted the law of patent eligibility significantly since 2010, making it much more difficult to prove eligibility. The Federal Circuit's invalidation of the patent in *Ariosa Diagnostics, Inc.* is just one example.[57]

B. *Criticisms of the Supreme Court's Approach*

Many, including myself, have criticized the Supreme Court's patent eligibility decisions and, in particular, this new two-part test and the search for an "inventive concept."[58] I, for example, have argued that this test "reflects a lack of understanding of the relevant statutory provisions, precedent, and policies already undergirding the patent statute."[59] I have also argued that the two-part test lacks administrability because "[i]t is exceedingly difficult to understand whether a[] patent examiner or a court should find subject matter eligible for patenting given the overarching test for eligibility articulated by the Supreme Court."[60] But other criticisms have been even more devastating. Indeed, in *Ariosa Diagnostics, Inc.*, multiple Federal Circuit judges went so far as to say that the Supreme Court's test results in incorrect findings of ineligibility.[61] Various groups, moreover, are convinced that the Court's test is so problematic and its impact so negative in terms of reducing investment

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57 Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d 1371 (Fed. Cir. 2015).

58 *See generally* Lefstin, *supra* note 2 (discussing widespread agreement over such criticism).

59 Taylor, *supra* note 6, at 244–45.

60 *Id.* at 227.

61 *See, e.g.*, Ariosa Diagnostics, Inc. v. Sequenom, Inc., 809 F.3d 1282, 1287 (Fed. Cir. 2015) (Lourie, J., concurring in the denial of en banc rehearing) ("In sum, it is unsound to have a rule that takes inventions of this nature out of the realm of patent-eligibility on grounds that they only claim a natural phenomenon plus conventional steps, or that they claim abstract concepts. But I agree that the panel did not err in its conclusion that under Supreme Court precedent it had no option other than to affirm the district court."); *Ariosa Diagnostics*, 788 F.3d at 1381 (Linn, J., concurring) (finding claims ineligible but stating that "[b]ut for the sweeping language in the Supreme Court's *Mayo* opinion, I see no reason, in policy or statute, why this breakthrough invention should be deemed patent ineligible").

in technological development that they are considering ways Congress might amend the patent statute to overturn that test.[62]

These groups have proposed specific statutory language their members believe set forth workable and appropriate standards for courts to use to determine patent eligibility. But to convince Congress to amend the patent statute to include one of these standards, these groups probably need more than simple arguments related to confusion, arguments of lack of administrability, and examples of incorrect findings of ineligibility.[63] What they need is evidence—data—showing how the Supreme Court's decisions, and in particular the two-part test for determining eligibility, have negatively impacted investment in the development of technology. Indeed, in my recent article addressing patent eligibility, given the lack of relevant data,[64] I was forced to argue that the "*risk* of underinvestment in research and development" gave reason to consider encouraging Congress to amend the patent statute.[65]

Data is needed to answer the following types of questions: Has the Supreme Court's change in the law of patent eligibility changed investment in the development of technology? If so, how? Is there now less overall investment in the development of technology? Is there less investment in the development of technology in certain industries, but more in others? How has the Court's eligibility decisions impacted venture capital investment? Have the Court's decisions increased companies' investments in the development of technologies protected by trade secrets as opposed to patents? Have investment dollars dried up in certain areas of science and technology? Or have the Court's decisions had no discernable impact on investment decisions? As I have mentioned, existing literature provides surprisingly little data even to begin to answer these questions.[66]

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62 *See* sources cited *supra* note 4.

63 Of course, these groups have plenty of ammunition in this regard. *See* sources cited *supra* note 4.

64 *See infra* Section I.C.

65 Taylor, *supra* note 6, at 163 (emphasis added).

66 *See infra* Section I.C.

C. *Previous Studies and Surveys*

Previous studies and surveys more broadly addressed the role of patents with respect to investment in research and development. Maureen Ohlhausen, at the time a Commissioner of the Federal Trade Commission, recently analyzed and summarized much of this literature—both theoretical and empirical literature addressing the relationship between patents and innovation.[67] Notably, the present survey supports conclusions consistent with the majority of this literature, while focusing attention on the particular doctrine of patent eligibility.

Commissioner Ohlhausen first summarized the principal findings of various econometric studies. For example, she described how "[s]urveys reveal that patents contribute to incentives to invest, most acutely in the bio-pharmaceutical and medical device fields but elsewhere to varying degrees as well."[68] As support for this finding, she described, among other things, "[a] host of . . . empirical work . . . find[ing] a statistically significant relationship between patent strength and R&D [(Research & Development)] investment."[69] "[E]mpirical evidence that patents drive innovation in pharmaceuticals," she reported, "is especially strong."[70] And, "[m]ore generally, there is evidentiary support for the core proposition underlying the economic case for patents: investment in R&D will be suboptimal if the investing firm has limited ability to internalize the ensuing value."[71] That said, she recognized that "the econometric work to date is not unanimous in linking strong IP rights and innovation."[72] As already described, consistent with the majority of the econometric work, the present survey reveals that patents contribute to incentives to invest in technological development generally, and in the biomedical, medical device, and pharmaceutical industries in particular.[73]

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[67] *See generally* Maureen K. Ohlhausen, *Patent Rights in a Climate of Intellectual Property Rights Skepticism*, 30 HARV. J.L. & TECH. 103 (2016).

[68] *Id.* at 125.

[69] *Id.* at 128.

[70] *Id.* at 130.

[71] *Id.*

[72] *Id.* at 131.

[73] *See generally infra* Part IV.

Some prior studies focused on particular industries. For example, a study of venture-backed software firms explored the relationship between patenting and investment in the software industry.[74] The data indicated that "an increase of one in the total number of patents is related with an increase of $2.7M in total investment, so that firms with patents received about $10.7M more in total investment that those without."[75] The data suggested to the study's authors that "patents are valuable for the firms that elect to obtain them, but this data does not exclude the possibility (frequently discussed in the existing literature) that the transaction costs those patents impose on third parties exceed the value they provide to the firms that obtain them."[76] Their work, moreover, "provides substantial evidence that patenting, at least in [the software] industry, is an important part of a well-organized operation, rather than a random or happenstance occurrence."[77] The present survey similarly highlights that reduced patent eligibility has caused investors to report reduced incentive to invest in the software industry.[78]

Commissioner Ohlhausen also summarized the principal findings of various surveys. After conceding the limited usefulness of surveys—in part because "what people say they will do often differs from what they will actually do"—she recognized that "there is reason to survey innovators in an effort to determine which factors drive them to invest in R&D."[79] She highlighted two such surveys. In her view, these surveys' "most important takeaway is that patents are the principal means of protecting innovations in certain industries, especially in pharmaceuticals but elsewhere too, and are of ancillary effectiveness compared to other appropriation mechanisms in other industries."[80]

One survey recorded the responses of 650 high-level R&D executives to questions seeking to determine "those industries and technologies in which patents are effective in preventing competitive imitation of a new

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74 Ronald J. Mann & Thomas W. Sager, *Patents, Venture Capital, and Software Start-ups*, 36 RES. POL'Y 193 (2007).

75 *Id.* at 201.

76 *Id.* at 205.

77 *Id.* at 207.

78 *See generally infra* Sections IV.B., C.

79 Ohlhausen, *supra* note 67, at 134.

80 *Id.* at 134–35.

process or product."[81] The respondents revealed their view that patents were generally the least effective of various mechanisms (specifically: patents to prevent duplication, patents to secure royalty income, secrecy, lead time, moving quickly down the learning curve, and sales or service efforts) for protecting new methods, but had greater effect on protecting new products.[82] One exception was the drug industry, where a majority of respondents rated patents as more effective than other means of appropriation.[83] The present survey did not separately address methods and products. And it did reveal, contrary to this prior survey, that patents are more important than trade secrecy in spurring investment in technological development, and that patents are only slightly less important or slightly more important than first-mover advantage.[84] The present survey, though, points in the same direction as the prior survey in the sense that both highlight that in the pharmaceutical or drug industry patents are more important than other factors in spurring investment and preventing competitive imitation respectively.[85]

Another survey tabulated the responses of 1,478 R&D labs and sought similar (as compared to the previously highlighted survey) information related to appropriation mechanisms.[86] This survey found that, of patents, secrecy, lead time advantages, and the use of complementary marketing and manufacturing capabilities, "in no industry [were] patents identified as the most effective appropriability mechanism."[87] Furthermore, "patents tend[ed] to be the least emphasized by firms in the majority of manufacturing industries."[88] In the medical equipment and drugs industries, however, "patents [were] reported to be effective for more than 50% of product innovations, and in special purpose machinery, computers and autoparts, the effectiveness scores

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81 Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 3 BROOKINGS PAPERS ON ECON. ACTIVITY 783, 784 (1987).

82 *Id.* at 794–95.

83 *Id.* at 796.

84 *See infra* Section IV.A.2.

85 *See infra* Section IV.A.2.

86 Wesley M. Cohen et al., *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)* (Nat'l Bureau of Econ. Research, Working Paper No. 7552, 2000).

87 *Id.* at 9.

88 *Id.* at 1.

range from 40% to 50% of product innovations."[89] Moreover, as highlighted by Commissioner Ohlhausen in her review of this study,[90] large firms reported patents as the most effective appropriation mechanism not just in the drug industry, but also in the (relatively narrow industries of) toilet preparations, gum and wood chemicals, pipes/values/oil field machinery, switchgear, and autoparts.[91] The authors of the survey concluded that "patents [were] still not the dominant mechanism in most industries for protecting product innovations, [but] it now appears that they can be counted among the major mechanisms of appropriation in a more sizable minority of industries."[92] Others analyzing the data gathered in this survey concluded based on their own analysis that patents stimulate investment in R&D in various industries, most prominently in the biotechnology, medical device, and pharmaceutical industries, but also in the electronics and semiconductor industries.[93] The present survey again asks different questions and reaches somewhat different results. According to the present survey, patents similarly do not rank as the most important factor in investment decisions in any industry.[94] But in every industry they rate as more important than trade secrecy and similar in importance to first-mover advantage.[95] Finally, the two surveys both indicate that patents stimulate investment in technological development in the biotechnology, medical device, pharmaceutical, electronics, and semiconductor industries.[96]

A third survey summarized by Commissioner Ohlhausen recorded the responses of 1,332 early-stage technology companies to questions addressing the role of patents in spurring innovation.[97] Notably, 76% of venture-backed companies reported that venture capital investors had

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89 *Id.* at 9.

90 *See* Ohlhausen, *supra* note 67, at 136–37.

91 *See* Cohen, *supra* note 86, at 12.

92 *Id.* at 13.

93 Ashish Arora, Marco Ceccagnoli & Wesley M. Cohen, *R&D and the Patent Premium*, 26 INT'L J. INDUS. ORG. 1153, 1154, 1173 (2008).

94 *See infra* Section IV.A.

95 *See infra* Section IV.A.

96 *See infra* Section IV.A.

97 *See* Ohlhausen, *supra* note 67, at 140 (summarizing data reported in Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255 (2009).

indicated to the companies that patents were an important factor to their funding decisions.[98] As to particular industries, 85% of medical device companies, 73% of biotechnology companies, and 60% of software companies reported that venture capital investors considered patents important.[99] In the same survey, respondents indicated that in the biotechnology industry, patents exceeded first-mover advantage, secrecy, trademark, and copyright in importance to capture competitive advantage from technological inventions.[100] In the medical device industry, patents exceed all of these mechanisms except first-mover advantage.[101] In the software industry, however, patents ranked the lowest of all of these factors.[102]

Notably, the present survey directly asks venture capital and private equity investors their views of the importance of patent eligibility to their investment decisions, rather than relying upon indirect reports of their views by early-stage technology companies. Regardless, in some ways the results of the two surveys are consistent. Quite similar to the prior survey, 74% of the investors agreed that patent eligibility is an important consideration when their firms decide whether to invest in companies developing technology.[103] Similar too to the prior survey, agreement among investors in the medical device and biotechnology industries exceeded those in the software industry. In the present survey, 81% of investors in the medical device industry, 79% in the biotechnology industry, and 72% in the software and Internet industry considered patent eligibility as important,[104] compared to 85%, 73%, and 60% respectively of the start-up companies in these industries in the prior survey.[105]

Regarding the relative importance of various factors, however, the present survey somewhat differs from the prior survey. The two sets of respondents agree that in the biotechnology industry patents exceed first-mover advantage, secrecy, trademark, and copyright protection in

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98 Graham, *supra* note 97, at 1307.

99 *Id.*

100 *Id.* at 1290–91.

101 *Id.*

102 *Id.* at 1290–93.

103 *See infra* Section IV.A.1.

104 *See infra* Section IV.A.1.b.

105 *See* Graham, *supra* note 97, at 1290.

importance (relating to the ability to capture competitive advantage from technological inventions in the prior survey and to the investment decisions in the present survey).[106] But the present survey reveals the same order of importance for the medical device and, most notably, the software industry.[107] While in the prior survey the software industry patents ranked the lowest of all of the factors (first-mover advantage, secrecy, trademark, copyright, and patents) in terms of importance to the ability to capture competitive advantage from technological inventions,[108] in the present survey the availability of U.S. patents ranks the highest of all of these same factors in terms of importance to investment decisionmaking.[109]

This difference between the surveys may reflect a difference between the views of those working in early-stage technology companies and the views of investors. That is, entrepreneurs may underestimate the importance of patents to investors. If correct, this is an important finding, and entrepreneurs will no doubt want to take note and adjust their efforts to obtain patent protection for their inventions. It may, moreover, reflect a difference between the views of those whose sole focus is software development and investors who invest not only in software but also in other industries. It may also reflect a difference between views regarding patents as a means to capture competitive advantage from technological inventions, and views regarding patents as a signal of increased investment return both through competitive advantage and through other means of capturing value. Investors, for example, may view patents as a signal of the ability to obtain a higher return on investment through the ability to exclude competitors from using the same technology. But investors may also focus on patents as a signal of the ability to obtain a higher return on investment in other ways, for example by differentiation of the companies' technology in the marketplace, the ability of the company to gain funding from other investors to further their technological development and their intellectual property pursuits, the ability of the target's principals to develop not just technology but also a business plan, and the ability of the investors themselves to hedge their investment against any value of the enterprise's intellectual property. Or,

106 *Compare id.* at 1290–95, *with infra* Section IV.A.

107 *See infra* Section IV.A.

108 Graham, *supra* note 97, at 1290.

109 *See infra* Section IV.A.1.b.

of course, the difference could be explained by a combination of these or other reasons.

In short, the survey I have conducted is one that was sorely needed. As I have mentioned, multiple organizations have proposed ways to amend the patent statute to overturn the Supreme Court's new patent eligibility standard.[110] All of these organizations include interested individuals who believe that the Court's approach to patent eligibility has negatively impacted the marketplace in which inventors create ideas and bring those ideas to market. Prior generalized studies and surveys focused on the importance of patents generally, without exploring the impact of the recent Supreme Court decisions in the area of patent eligibility. Thus, this survey begins to fill an important gap in the literature and addresses a compelling research question that may have a significant impact on the development of the law governing patent eligibility.

II. HYPOTHESIS AND SURVEY METHODOLOGY

To begin to fill the gap in the existing literature related to the Supreme Court's eligibility decisions and their impact or lack of impact on investment in the development of technology, I conducted a survey of venture capital firms and private equity investors. I structured the survey to test my own hypothesis that the Court's decisions have had a significant impact on the investment decisions of those firms, and in particular has caused reduced investment in the life science industry. Here I describe my hypothesis and the methodology I used to test it.

A. *Hypothesis Tested*

I suspect that the Supreme Court's decisions in the area of eligibility subject matter have had a significant impact on investment in the development of technology and, moreover, that that impact has been negative in terms of reducing investments generally, and in particular in the life sciences industries. Thus, the hypothesis I sought to test is that the Court's alteration of the law governing patent eligibility has impacted decisionmaking with respect to investment in the development of

110 *See supra* note 4.

technology; that it had significant impact; and that the impact has been negative in the sense of reducing investment.

B. *Methodology Employed*

To gather relevant data, I conducted a survey of investors at venture capital and private equity investment firms. I decided to survey firms representing the various early stages of venture capital funding: seed, early, middle, growth, expansion, and late stage investors. Moreover, I decided that the survey would not focus on any one industry, but instead more broadly span as many different industries as the venture capital and private equity firms fund.

1. Overview

In general, I asked two types of questions. First, I asked directly whether the Supreme Court's decisions on patent eligibility have impacted the surveyed entity's decisions to invest in companies developing technology and, if so, how. This first type of question, however, required familiarity with at least one of the Court's decisions. Thus, second, I also asked more indirect questions related to the same issue, for example by asking about any changes to decisions to invest in companies over the relevant time period and whether those changes relate to any decreased availability of patents.

2. Detailed Summary

Here, I will provide a more detailed summary of the methodology I employed in my survey.

a. Who

I surveyed venture capitalist and private equity investors identified in a commercial database provided by a company known as "Massinvestor." I purchased from Massinvestor its 2017 national database of venture capital and equity firms. Massinvestor advertises this database as "the most comprehensive compilation of private capital sources available. The Directory profiles investment firms in all 50 states,

and represents a single, complete, authoritative resource."[111] Notably, Massinvestor identifies each of the people in its database as being associated with investment firms of various types: "Venture Capitalists, Private Equity firms, Family Offices, Angels, Incubators, Accelerators, Merchant Banks, Fund of Funds, Economic Development Groups, Venture Debt, Technology Transfer Offices, Secondary Purchasers, and Corporate VCs."[112]

I distributed the survey electronically by email to all 14,641 people identified in the database. I used financial incentives to encourage participation in the survey.[113] Thanks to a grant from Microsoft Corporation, I gave three progressive incentives. After conducting the survey for some time with no incentive, I later advertised a drawing for a Microsoft Surface, later fifteen dollar gift cards, and lastly twenty-five dollar gift cards. After distributing the survey by email and offering these incentives, I even later had research assistants place individual calls to investors to offer incentives orally to encourage more participation.

b. When, Where, and How

The survey asked for information on investment decisions. One part of the survey asked for a comparison of investments between 2009 and 2017 when the survey was conducted. I picked 2009 as the first year to survey because the Supreme Court decided its *Bilski v. Kappos* decision in 2010. The survey asked for information after the Supreme Court's most recent decision on eligibility; the Supreme Court decided *Alice Corp. v. CLS Bank International* in 2014, and the survey asked for information through 2017 when the survey was conducted. The complete data set thus covers about eight years, 2009 to 2017, both prior to the Supreme Court's decision in *Bilski* and after the Court's decision in *Alice*.

The survey instructed the respondents that, unless otherwise indicated, all questions related only to U.S. patents and only to financing of activities in the United States. It did so because the focus of this research is whether the Supreme Court's decisions have made an impact

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111 *United States Venture Capital and Private Equity Database*, MASSINVESTOR, https://massinvestor.3dcartstores.com/UnitedStates [https://perma.cc/E3BK-F3U3].

112 *Id.*

113 The sampling and incentives likely introduced selection effects that I consider later in this Article. *See infra* Section V.D.

on investment decisions, and the Supreme Court's decisions of course relate only to U.S. law.

I conducted the survey primarily electronically using email. I prepared the survey using Qualtrics software. Conducting the survey in this way allowed me to use embedded logic that caused some questions to appear or not appear depending on answers to earlier questions.[114] To distribute the survey, I sent an email with a short, unbiased description of the project with a link to a website that hosted the survey.[115] Respondents input their answers primarily using radio buttons. Research assistants conducting the survey by telephone utilized a script that repeated the language used in the electronic version of the survey.

I conducted the survey in the summer of 2017.

c. What

While the survey includes too many questions to describe in detail here, some overall comments on the content of the survey may prove useful. I began the survey by asking basic introductory questions related

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114 Thus, the survey did not present every respondent every question.

115 The description of the survey stated:

> Recent U.S. Supreme Court decisions have changed the law of 'patent eligibility.' They have made patents unavailable for certain things (like isolated human genes), and they have made it more difficult to obtain patents for other things (like medical diagnostics and computer software). This survey explores how these changes in the law of patent eligibility impact investment decisions. (For more detailed information on the law governing patent eligibility, you may click here www.uspto.gov/web/offices/pac/mpep/s2106.html [https://perma.cc/LMB5-VFP7].)
>
> This survey will ask questions about your firm's investment decisionmaking. Data received through this survey will be held in confidence in an online database accessible only with a login and password, and reported only in the aggregate, without identifying individual respondents or their firms. It should take you between 5 and 12 minutes to compete.
>
> Those who complete the survey will later receive a report of the results. The results will also serve as an important data point as various groups lobby Congress to amend the patent statute to address the appropriate scope of patent eligibility.
>
> Please note that, unless otherwise indicated, all questions relate only to U.S. patents and only to financing of activities in the United States.
>
> This survey is a research project of Prof. David Taylor at the SMU Dedman School of Law, who may be contacted at dotaylor@smu.edu. Your participation is voluntary; you may discontinue participation at any time without penalty. Clicking below indicates you have read this disclosure and agree to participate.

to whether patents encourage or discourage investment in efforts to develop technology. After these initial questions, I asked questions related to the effect of the ability of inventors to obtain patents on the behavior of the respondent's firm. In particular, I asked questions regarding whether the ability of inventors to obtain patents affects firm decisions whether to invest in particular industries.

A common theme of my questions, starting with these, was to ask separate questions for various industries. These industries include computer and other electronics; semiconductor; pharmaceutical; medical devices, methods, and other medical; biotechnology; communications; transportation (including automotive); construction; energy; and other.[116] I ultimately asked whether the ability of inventors to obtain patents in a particular industry affected their firms' decisions whether to invest in companies developing technology in that industry, and, if so, to what extent that decisionmaking is affected.

My next questions depended on whether the survey respondent knew one or more of the Supreme Court's recent cases on patent eligibility. If the respondent indicated familiarity with at least one of these cases, I proceeded to ask a series of questions related to the effect of these decisions on investment behavior. If a respondent indicated any of the Court's decisions affected firm decisions on how to invest, I then asked a series of follow-up questions. I concluded this section of the survey by asking an open-ended question soliciting examples of how the Supreme Court's decisions have affected firm decisions on how to engage in financing.

Those respondents who indicated a lack of familiarity with any of the Supreme Court's eligibility cases were asked a different set of questions. While the previous section explored the respondent's view as to how the Court's cases impacted their firms' investment decisions, in this section I asked questions eliciting information that attempted to answer the same questions when the respondent was not familiar with any of the Court's cases. In particular, I asked about how their firms' investment decisions have changed over the relevant time frame and whether any such changes (or indeed lack of change) reflected reduced availability of patents.

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116 I derived these categories of industries from those used by the authors of *Our Divided Patent System*, a recent article describing an empirical study. *See generally* John R. Allison et al., *Our Divided Patent System*, 82 U. CHI. L. REV. 2073 (2015).

In this discussion of the survey I have paraphrased the questions actually used in the survey. To review particular questions, their order, and their actual formulations, I have attached the entire survey as Appendix A to this Article.

III. DEMOGRAPHICS

In this Part, I provide data regarding the demographics of the survey respondents. I also compare the demographics of the survey respondents and non-respondents. I have attached all of the tables summarizing the data generated by the survey as Appendix B to this Article.

A. *Respondent Demographics*

A grand total of 475 investors participated in the survey.[117] These 475 investors represented at least 422 separate investment firms.[118] Of this total, 461 participated online and 14 participated on telephone calls with research assistants. Certain demographic information is known about the respondents based upon the purchased database and additional data received through the survey.

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117 Not every respondent answered every question on the survey, in part due to embedded logic in the survey, and as well because not every respondent completed every part of the survey. I note below the number of respondents to particular questions.

118 The particular investment firm is not known for three of the 475 respondents.

1. Investment Stage

The purchased database associated certain information with each investor. This information, for example, identified the stage or stages of investment on which each investor's firm focused. Thus, it is possible to identify the proportion of the respondents whose firms focus on different stages of investment.

Table 1: Investment Stages of Respondents' Firms

Stage	Percent
Early Stage	59%
Seed Stage	45%
Middle Stage	27%
Growth Stage	22%
Expansion Stage	15%
Late Stage	1%

Notably, the majority of the respondents, 59%, were early stage investors, and a full 45% were seed stage investors. The proportion of middle, growth, expansion, and late stage investors gradually declined from 27% down to 1%. The total of the percentages exceeds 100% because the data identified multiple investment stages for most firms.

2. Investment Industries

The respondents' firms invest in various industries. The industry in which the highest percentage of the respondents' firms invest was software and the Internet; a full 70% of the respondents report that their firms invest in this industry. By contrast, the industry in which the lowest percentage of the respondents' firms invest was construction at a still-healthy 42%. Investments in the remaining industries hovered between 63% (medical devices) and 47% (transportation).

Table 2: Investment Industries of Respondents' Firms

Industry	Percent
Software and the Internet	70%
Medical Devices	63%
Computer Electronics/Hardware	61%
Biotechnology	55%
Pharmaceutical	54%
Communications	53%
Energy	49%
Semiconductors	48%
Transportation	47%
Construction	42%

Note that more than half of the respondents reported their firms invest in the software and Internet, medical devices, computer electronics and hardware, biotechnology, pharmaceutical, and communications industries. Only energy, semiconductors, transportation, and construction fell below 50%. Again, the total of the percentages exceeds 100% because the data identified multiple investment industries for most firms.

The purchased database also identified the focus of the investments of each of the respondent's individual firms. The focus of more than half of the firms was information technology at 62%. The next closest foci included life sciences and health care at 46%, as well as software and the Internet at 40%. Every other focus garnered no more than 25% of the respondents' firms. Notably, just 15% of the respondents' firms focused on investments in medical devices. Note that the purchased data did not identify pharmaceuticals or biotechnology as separate categories for a firm focus.

Table 3: Investment Focus of Respondents' Firms

Firm Focus	Percent
Information Technology	62%
Life Sciences & Healthcare	46%
Software & the Internet	40%
Manufacturing & Industrial	25%
Business Services	23%
Communications & Networking	20%
Energy & Clean Tech	19%
Media & Digital Media	17%
Consumer Products & Services	16%
Financial Services	15%
Medical Devices	15%
Transportation & Distribution	10%
Retail & Restaurant	9%
Food & Agriculture	5%
Real Estate & Construction	5%
Semiconductors	4%
Sports & Entertainment	4%
Education & Training	3%
Defense & Homeland Security	3%
Storage & Hardware	3%
Electronics & Advanced Materials	2%

Again, the total of the percentages exceeds 100% because the data identified multiple foci for most firms.

For multiple reasons, in the remainder of my analysis of the survey results I utilize the respondents' identification of industries in which their firms invest, rather than the purchased database's identification of

investment firm focus. I do so because the survey itself requested this information, providing more accuracy on this point, and because the purchased database did not distinguish between the biotechnology and pharmaceutical industries.[119]

3. Familiarity with at Least One Eligibility Case

One of the questions in the survey asked if the respondent was familiar with one or more of the four recent Supreme Court eligibility decisions. The response to this question indicated whether the respondent was relatively knowledgeable about patent eligibility, an indication of what may be thought of as patent eligibility expertise. In total, 38% of the respondents indicated they were familiar with at least one of these cases.

Table 4: Familiarity with at Least One Eligibility Case

Type	Percent
Familiar	38%
Unfamiliar	62%

B. *Comparison with Non-Respondent Demographics*

The survey was sent to 14,641 investors and 3,304 investment firms in total. Given participation by 475 investors representing at least 422 investment firms, the firm response rate was at least 12.78% and the individual response rate was 3.24%.[120]

Notably, the demographics of the respondents differed somewhat from the demographics of the non-respondents. In terms of investment stage, a greater portion of the respondents were seed and early stage

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119 That said, use of the respondents' identification of industries did not allow me to compare the respondents and non-respondents' industry, and so below I use investment firm focus to make this comparison. *See infra* Section III.B.

120 While low, these response rates do not differ substantially from the most similar, recent survey. *See* Graham, *supra* note 97, at 1272 (reporting an 8.7% response rate).

investors as compared to the non-respondents. A smaller portion of the respondents were expansion, middle, and late stage investors.

Table 5: Investment Stages of Firms: Resp's v. Non-Resp's

Stage	Resp's	Non-Resp's
Early Stage	59%	49%
Seed Stage	45%	30%
Middle Stage	27%	46%
Growth Stage	22%	22%
Expansion Stage	15%	20%
Late Stage	1%	3%

Likewise, in terms of investment firm focus, the respondents' firms differed somewhat from the non-respondents' firms.

Table 6: Investment Focus of Firms: Resp's v. Non-Resp's

Firm Focus	Resp's	Non-Resp's
Information Technology	62%	55%
Life Sciences & Healthcare	46%	43%
Software & the Internet	40%	32%
Manufacturing & Industrial	25%	32%
Business Services	23%	33%
Communications & Networking	20%	22%
Energy & Clean Tech	19%	23%
Media & Digital Media	17%	21%
Consumer Products & Services	16%	24%
Financial Services	15%	16%
Medical Device	15%	13%
Transportation & Distribution	10%	14%
Retail & Restaurant	9%	11%
Food & Agriculture	5%	4%
Real Estate & Construction	5%	6%
Semiconductors	4%	4%
Sports & Entertainment	4%	5%
Education & Training	3%	6%
Defense & Homeland Security	3%	5%
Storage & Hardware	3%	3%
Electronics & Advanced Materials	2%	1%

Areas of more significant overrepresentation included information technology and software and the Internet. Areas of more significant underrepresentation included manufacturing and industrial, business services, and consumer products and services.[121]

IV. ANALYSIS OF SURVEY RESULTS

The survey has provided important data regarding the impact of the Supreme Court's eligibility decision on investor decisionmaking. Overall, this data helps to start answering the questions framed above: Whether the Court's alteration of the law governing patent eligibility has impacted decisionmaking with respect to investment; whether any impact has been significant; and whether any impact has been negative in the sense of reducing investment. In short, the results show that patent eligibility is an important factor in investment decisionmaking, and that reduced eligibility has had negative impact in every industry, but particularly in the biotechnology, medical device, and pharmaceutical industries, and particularly among those investors familiar with the recent cases changing the law governing patent eligibility. In this Part, I present the data generated by the survey and describe relevant conclusions to draw from that data, all organized around four principal findings. Again, I have attached all of the tables summarizing the data generated by the survey as Appendix B to this Article.

A. *First Finding: Patent Eligibility Is an Important Consideration for Investors*

The first principal finding is that patent eligibility is an important consideration for investors. Investors who responded to the survey overwhelmingly indicated patent eligibility is an important consideration when their firms decide whether to invest in companies developing technology.

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121 For both over- and underrepresentation, here I identify areas of focus with a greater than 4% difference in percentage of respondents versus non-respondents.

1. Patent Eligibility Is Important

Overwhelmingly, investors reported that patent eligibility is an important consideration when their firms decide whether to invest in companies developing technology. About 43% of the respondents strongly agreed that patent eligibility is an important consideration when their firms decide whether to invest in companies developing technology. Another 31% somewhat agreed with the same proposition. About 5% strongly disagreed, while about 9% somewhat disagreed. In total, 74% agreed while only 13% disagreed.[122]

Table 7: Patent Eligibility Is an Important Consideration in Firm Decisions Whether to Invest in Companies Developing Technology

Response	Percent
Strongly agree	43%
Somewhat agree	31%
Neither agree nor disagree	13%
Somewhat disagree	9%
Strongly disagree	5%

The recognition that patent eligibility is an important factor when investment firms decide whether to invest in companies developing technology begs follow-up questions, such as whether increased eligibility correlates to increased investment in these companies and whether decreased eligibility correlates to decreased investment in these companies. I asked two of these types of questions. The overall result is that investors reported that reduced patent eligibility for a technology makes it less likely that their firm will invest in companies developing that technology.

The survey first asked if the law of patent eligibility makes patents unavailable for a technology, whether their firms are less likely to invest in companies developing that technology. About 23% of the investors strongly agreed and 39% somewhat agreed, while about 7% strongly disagreed and 13% somewhat disagreed. Thus, in total, 62% agreed that

[122] There were 432 individual responses to this question.

their firms are less likely to invest given the unavailability of patents, while only 20% disagreed.[123]

Table 8: Less Likely to Invest if Patent Eligibility Makes Patents Unavailable

Response	Percent
Strongly agree	23%
Somewhat agree	39%
Neither agree nor disagree	19%
Somewhat disagree	13%
Strongly disagree	7%

The survey next asked if the law of patent eligibility makes patents more difficult to obtain for a technology, whether their firms are less likely to invest in companies developing that technology. About 19% of the investors strongly agreed and 40% somewhat agreed, while about 5% strongly disagreed and 17% somewhat disagreed. In total, 59% agreed that their firms are less likely to invest given more difficulty obtaining patents, while only 22% disagreed.[124]

Table 9: Less Likely to Invest if Patent Eligibility Makes Patents More Difficult to Obtain

Response	Percent
Strongly agree	19%
Somewhat agree	40%
Neither agree nor disagree	18%
Somewhat disagree	17%
Strongly disagree	5%

These results, while perhaps not surprising, nonetheless confirm one of the central premises upon which the patent system rests: the idea that patents help spur investment in development of technology.[125] Moreover,

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123 There were 426 individual responses to this question.

124 There were 421 individual responses to this question.

125 As discussed below, this and other "[s]urveys reveal that patents contribute to incentives to invest, most acutely in the bio-pharmaceutical and medical device fields but elsewhere to varying degrees as well." *See generally* Ohlhausen, *supra* note 67, at 149.

the results tie this investment-spurring theory directly to patent eligibility in particular.

a. Important for All Stages of Investment

In this survey, early stage investors reported the highest average view of the importance of patents, while late stage investors reported the lowest average view of the importance of patents. There was no significant difference, however, in views of whether patent eligibility is an important consideration when firms decide whether to invest in companies developing technology when taking into account the different stages of investment upon which firms focused.[126] That is, there was no statistically significant difference in responses as between firms that focus on seed, early, middle, growth, expansion, and late stage investments. Most notably, for all stages of investment, investors reported that patents are important.

Table 10: Importance of Patent Eligibility by Investment Stage

Stage	Mean (1–5 Scale)
Seed	3.95
Early	3.98
Middle	3.95
Growth	3.84
Expansion	3.88
Late	3.80

Perhaps a larger sample size would indicate an actual trend. Patent protection indeed may be most significant in the early stages of entrepreneurial activity.[127] The earlier the stage of entrepreneurial activity the greater the likelihood of technological development and invention, and thus the more significant to investors that patents be available to

126 I used an analysis of variance test to compare the mean responses between stages of funding, identifying means using numbers from 1 for "strongly disagree" to 5 for "strongly agree." I used a significance level of 0.05.

127 *See* Mark A. Thompson & Francis W. Rushing, *An Empirical Analysis of the Impact of Patent Protection on Economic Growth: An Extension*, 24 J. ECON. DEV. 67, 68 (1999) (noting that "protection [provided by] patents is the foundation for payoffs to entrepreneurs starting off the chain of events that leads to economic expansion").

protect those inventions. Later, after a technology has been developed or at least mostly developed, the relevant entrepreneurial activities shift to primarily non-inventive activities like manufacturing, marketing, and distribution. Investors in these later stages of entrepreneurial activity might focus less on the ability to patent prior inventions—it is likely any patent applications should have already been filed—and instead on the ability of the companies to capture market share quickly.[128] These investors still care about the eligibility of the underlying inventions, but other considerations likely begin to dominate their investment decisionmaking. That said, the point should not be overemphasized. There was no statistically significant difference in this survey. Even investors in later stages of entrepreneurial activity still ranked patent eligibility as important. For example, late stage investors still rated patent eligibility as important at 3.8 on a scale of 1–5.

b. Important for All Industries

In this survey, investors investing in the medical device, biotechnology, and pharmaceutical industries reported the highest average view of the importance of patents. Those investing in software and the Internet reported the lowest average view of the importance of patents. As with stages of investment, however, there was no statistically significant difference in views when taking into account different industries.[129] For example, there was no statistically significant difference in responses as between firms that invest in biotechnology versus software and the Internet. Again, most notably, for all industries, investors reported that patents are important.

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[128] *See* Graham, *supra* note 97, at 1259 ("[B]ecause early-stage firms tend to lack the kinds of complementary assets (such as well-defined marketing channels, manufacturing capabilities, and access to cheap credit) that ease entry into the market, they are arguably even more sensitive to IP rights than their more mature counterparts.").

[129] I used an analysis of variance test to compare the mean responses between industries, identifying means using numbers from 1 for "strongly disagree" to 5 for "strongly agree." I used a significance level of 0.05.

Table 11: Importance of Patent Eligibility by Industry

Industry	Mean (1–5 Scale)
Medical Devices	4.17
Biotechnology	4.13
Pharmaceutical	4.13
Energy	4.07
Semiconductors	4.04
Construction	4.01
Computer Electronics/Hardware	3.99
Transportation	3.99
Communications	3.98
Software and the Internet	3.92

Another way of understanding the data is to explore the percentage of investors in each industry who agreed (either strongly or somewhat) that patent eligibility is an important consideration in firm decisions whether to invest in companies developing technology. This view of the data reiterates the point that the great majority of investors in each industry find patent eligibility to be an important factor in firm investment decisionmaking, with the medical device, biotechnology, and pharmaceutical industries at the top of the list in this survey. In short, patents are important for every industry.

Table 12: Patent Eligibility Importance By Industry—Percent Strongly or Somewhat Agreeing Patent Eligibility Is an Important Consideration in Firm Decisions Whether to Invest in Companies Developing Technology

Industry	Percent
Medical Devices	81%
Biotechnology	79%
Pharmaceutical	79%
Energy	78%
Semiconductors	76%
Construction	76%
Computer Electronics/Hardware	75%
Transportation	75%
Communications	74%
Software and the Internet	72%

It would not be surprising to see a statistically significant difference in the views of importance of patent eligibility between investors focusing on the medical device, biotechnology, and pharmaceutical industries and investors focusing on software and the Internet. It has long been the predominate theory that patents are most necessary to spur inventive efforts in the medical device, biotechnology, and pharmaceutical industries given the significant costs involved in the development of technologies in these industries and the ease of copying or reverse engineering these technologies.[130] Likewise, empirical evidence indicates that patents play a particularly important role in creating incentives to invest and innovate in the life sciences industries.[131] Again, though, the point should not be overemphasized. Beyond the lack of statistical significance here, the survey indicates that, in the software and Internet industry, 72% of investors rank patent eligibility as important to their firms' investment decisionmaking.

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130 *See, e.g.*, Chetan Gulati, *The "Tragedy of the Commons" in Plant Genetic Resources: The Need for a New International Regime Centered Around an International Biotechnology Patent Office*, 4 YALE HUM. RTS. & DEV. L.J. 63, 73 (2001) (noting that "both [the pharmaceutical and biotechnology industries] are particularly dependent on strong patent protection because of a combination of the high costs of research and development that are necessary to produce new products and the relative ease with which they can be copied via reverse engineering").

131 *See* Ohlhausen, *supra* note 67, at 125 ("Surveys reveal that patents contribute to incentives to invest, most acutely in the bio-pharmaceutical and medical device fields but elsewhere to varying degrees as well."); *id.* at 130 ("[E]mpirical evidence that patents drive innovation in pharmaceuticals is especially strong . . . ." (citing Edwin Mansfield, *R&D and Innovation: Some Empirical Findings*, *in* R&D, PATENTS, AND PRODUCTIVITY 127, 142–43 (1984))); Bronwyn H. Hall, *Patents and Patent Policy*, 23 OXFORD REV. ECON. POL'Y 568, 574–75 (2007); Jean O. Lanjouw & Iain M. Cockburn, *New Pills for Poor People? Empirical Evidence After GATT*, 29 WORLD DEV. 265, 265, 287 (2001).

c. Investors with Familiarity with the Supreme Court's Eligibility Cases Identify Eligibility as Important More Often than Investors Without this Familiarity

Interestingly, there was a statistical difference when comparing the responses of investors who reported familiarity with at least one of the Supreme Court's recent eligibility decisions with the responses of investors who did not report any such familiarity. Those with this familiarity reported greater agreement that patent eligibility is an important consideration when their firms decide whether to invest in companies developing technology.[132] As discussed above, I refer to these investors as, at least relatively speaking, eligibility knowledgeable investors. In short, while eligibility knowledgeable investors and eligibility unknowledgeable investors both report that patent eligibility is an important consideration when their firms make decisions to invest in companies developing technology, eligibility knowledgeable investors place greater importance on patent eligibility.

Table 13: Importance of Patent Eligibility by Familiarity with at Least One Eligibility Case

Type	Mean (1–5 Scale)
Familiar	4.18
Unfamiliar	3.93

It may be that the more an investor knows about patent eligibility, at least in terms of more knowledge regarding the Supreme Court's eligibility cases, the more the investor believes patent eligibility is an important consideration in the decision whether to invest in a company developing technology. On the one hand, this correlation may indicate that the more an investor learns about the Supreme Court's eligibility cases, the more that knowledge (here, eligibility) impacts investment decisions. That is, there may be a cause and effect relationship. On the other hand, this correlation may simply reflect the idea that the more one

[132] Here I used a 2 sample non-parametric Mann-Whitney U Test to compare the mean responses between "experts" and "non-experts," using 1 for "strongly disagree" to 5 for "strongly agree" to identify means. I used a significance level of 0.05.

knows about a subject, the more importance that person places on his or her own knowledge of the subject.[133]

2. Patent Eligibility Is Not Most Important

The availability of patents given eligibility, however, was not the most important consideration to the investors. The survey asked respondents to rank eight factors (and an "other" category left blank so that they could input a factor) to identify the most important factors their firms rely upon when deciding whether to invest in companies developing technology.[134] However one considers the responses, the quality of a target company's people ranked as most important, followed by the quality of the company's technology, followed by the size of the potential market for the technology. The relative importance of the remainder of the considerations depends upon how one organizes the responses.

One way to understand the data is to consider the percentage of respondents who ranked each consideration as first, second, third, fourth, or fifth in importance. This method of organizing the data shows that first-mover advantage received slightly more fourth place rankings as compared to the availability of U.S. patent protection given U.S. patent eligibility. Interestingly, however, the availability of U.S. patent protection received many more fifth place rankings as compared to first-mover advantage.

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133 *See* Laura G. Pedraza-Fariña, *Understanding the Federal Circuit: An Expert Community Approach*, 30 BERKELEY TECH. L.J. 89 (2015) (describing the tendency of expert communities to emphasize the importance of their own expertise).

134 There were 395 individual responses to this question.

Table 14: Factors Relied upon when Deciding to Invest in Companies Developing Technology: Ranking (1–5 of 9)

Factor	1st	2nd	3rd	4th	5th
Quality of People	48%	23%	14%	5%	3%
Quality of Technology	24%	31%	30%	10%	3%
Size of Potential Market	19%	33%	26%	12%	3%
First-Mover Advantage	2%	5%	13%	29%	14%
Avail. of U.S. Patents	2%	4%	10%	27%	34%
Avail. of Trade Secrets	0%	1%	2%	5%	17%
Avail. of Foreign Patents	0%	1%	2%	5%	17%
Avail. of Copyrights	0%	0%	1%	4%	7%
Other	4%	3%	3%	4%	2%

Another way to understand the data is to calculate a weighted average, giving the most important consideration nine points on down to one point for the least important consideration. This method of organizing the data shows that the availability of U.S. patent protection given U.S. patent eligibility ranks as more important than first-mover advantage. This method also causes the availability of foreign patents to appear more important than the availability of trade secrets. Copyright protection is the least important listed consideration in either manner of organizing the data.

Table 15: Factors Relied upon when Deciding to Invest in Companies Developing Technology: Weighted Mean

Factor	Mean (1–9 Scale)
Quality of People	7.77
Quality of Technology	7.55
Size of Potential Market	7.24
Avail. of U.S. Patents	5.31
First-Mover Advantage	4.94
Avail. of Foreign Patents	3.72
Avail. of Trade Secrets	3.31
Avail. of Copyrights	3.13
Other	2.03

It is significant to recognize that the present survey focused on the availability of patents based on patent eligibility, and that investors ranked the availability of patents ahead of first-mover advantage and the availability of other forms of intellectual property. These results were not exactly consistent with other studies. A survey of start-up companies, for example, indicated that start-up companies view patents as valuable, but that start-up companies ranked patent availability slightly behind first-mover advantage in importance as an appropriability strategy.[135] I discuss this other survey, and how the present survey compares to that survey, in more detail below.[136]

Sorting this data by the industries in which the respondents' firms invest reveals that for every industry the availability of patents is less important than the quality of the people, the quality of the technology, and the size of the potential market. But for every industry the availability of patents exceeds the importance of first-mover advantage and the availability of foreign patents, trade secrets, and copyrights. Indeed, for all but one industry—the semiconductor industry—the order of importance of all of the factors did not vary. In the semiconductor industry, trade secrets and copyrights switched places in the order of importance; the availability of copyrights exceeded the availability of trade secrets in importance.

That said, investors did place different importance on the availability of patents by industry. Respondents whose firms invest in the medical device, pharmaceutical, and biotechnology industries placed the most importance (among investors in any industry) on the availability of U.S. patents. Respondents whose firms invest in the software and Internet industry placed the least importance (again among investors in any industry) on the availability of U.S. patents.

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135 Graham, *supra* note 97, at 1289.

136 *See infra* Section V.A.

Table 16: Importance of Availability of U.S. Patents when Deciding to Invest in Companies Developing Technology: Weighted Mean (By Industry)

Industry	Mean (1–9 Scale)
Medical Devices	5.42
Pharmaceutical	5.42
Biotechnology	5.41
Energy	5.36
Other	5.35
Semiconductors	5.31
Construction	5.31
Transportation	5.26
Communications	5.26
Computers	5.24
Software and the Internet	5.18

The difference among industries comports to some degree with the prior survey of start-up companies, which similarly revealed differing views between the life science and software industries.[137] Again, I compare the survey results in more detail below.[138]

This last recognition—that views among investors differ based upon the industries in which their firms invest—previews the second principal finding, which correlates reduced patent eligibility with particular reported investment behaviors in particular industries.

B. *Second Finding: Reduced Patent Eligibility Correlates with Particular Reported Investment Behaviors in Particular Industries*

The second principal finding is that reduced patent eligibility correlates with particular reported investment behaviors in particular industries. According to the investors, on average each industry would see reduced investment, but the elimination of patents or a reduction in patent eligibility would have a more devastating impact on the level of funding in technological development in the pharmaceutical, biotechnology, and medical device industries.

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137 Graham, *supra* note 97, at 1292.

138 *See infra* Section V.A.

1. On Average Investors Report the Elimination of Patent Protection Would Cause Investment Firms to Reduce Investment in Every Industry

Investors as a whole indicated that, for each industry in which the surveyed firms invest, the elimination of patents would cause the firms to decrease their investments in companies developing technologies in those industries. In other words, in every industry of the surveyed investment firms, the elimination of patents would cause the firms on average to decrease their investments.[139] This is shown by calculating a weighted average of responses to a question on point, giving the response "significantly increase investments" five points on down to one point for "significantly decrease investments." The weighted average for each industry is less than three, indicating that on average investors report that their firms would decrease investments in companies developing technologies in an industry in view of the elimination of patents in that industry.

Table 17: Impact of Elimination of Patents on Investment Decisions: Weighted Mean

Industry	Mean (1–5 Scale)
Construction	2.82
Software and the Internet	2.74
Transportation	2.67
Communications	2.61
Energy	2.50
Computer/Electronic Hardware	2.39
Semiconductors	2.23
Medical Devices	1.89
Biotechnology	1.83
Pharmaceutical	1.80

[139] There were 330 individual responses to this question.

2. More Investors Report Decreased Investment Caused by the Elimination of Patents in the Life Sciences Industries

For particular industries, however, the decrease in investments reported by investors as caused by the elimination of patents would be more pronounced. As shown using the weighted averages, the three industries with the least reported decrease in investments would be the construction, software and the Internet, and transportation industries. The three industries with the most reported decrease in investments would be the pharmaceutical, biotechnology, and medical device industries.

Another way to understand the data relating to the elimination of patents is to consider for each industry the percentage of respondents who indicated their firms would strongly increase investment, somewhat increase investment, experience no impact, somewhat decrease investment, and strongly decrease investment in view of the elimination of patents in an industry.

Table 18: Impact of Elimination of Patents on Investment Decisions: Responses

Industry	Strongly Increase	Somewhat Increase	No Impact	Somewhat Decrease	Strongly Decrease
Construction	1%	5%	75%	14%	6%
Soft. & the Internet	3%	10%	53%	27%	8%
Transportation	2%	7%	53%	31%	7%
Communications	2%	8%	48%	32%	10%
Energy	2%	4%	49%	30%	15%
Comp./Elecs. Hard.	4%	6%	33%	39%	18%
Semiconductors	4%	3%	33%	34%	27%
Medical Devices	6%	3%	11%	32%	47%
Biotechnology	7%	2%	14%	22%	55%
Pharmaceutical	7%	1%	19%	11%	62%

Considering the data in this way makes a few additional points clear. Investors overwhelmingly indicated, for example, that the elimination of patents would either not impact their firms' decisions whether to invest in companies or only slightly decrease investments in companies developing technology in the construction, software and Internet,

transportation, energy, and computer and electronic hardware industries. But investors, by contrast, overwhelmingly indicated that the elimination of patents would either somewhat decrease or strongly decrease their firms' investments in the pharmaceutical, biotechnology, and medical device industries. Thus, according to these investors, on average each industry would see reduced investment as a result of the elimination of patents, but the extent of the impact on particular industries would be different. The industries most negatively impacted would be the pharmaceutical, biotechnology, and medical device industries.

3. On Average Investors Report that the Decreased Availability of Patent Protection Would Cause Investment Firms to Reduce Investment in Every Industry

Investors as a whole indicated that, for each industry in which the surveyed firms invest, the decreased availability of patents would cause the firms to decrease their investments in companies developing technologies in those industries.[140] In other words, in every industry of the surveyed investment firms, the decreased availability of patents would cause the firms on average to decrease their investments. This is shown by calculating a weighted average of responses to a question on point, giving the response "significantly increase investments" five points on down to one point for "significantly decrease investments." The weighted average for each industry is less than three, indicating that on average investors report that their firms would decrease investments in companies developing technologies in an industry in view of the decreased availability of patents in that industry.

[140] There were 307 individual responses to this question.

Table 19: Impact of Decreased Availability of Patents on Investment Decisions: Weighted Mean

Industry	Mean (1–5 Scale)
Construction	2.78
Transportation	2.62
Software and the Internet	2.59
Communications	2.54
Energy	2.47
Computer/Electronic Hardware	2.26
Semiconductors	2.09
Medical Devices	1.83
Biotechnology	1.78
Pharmaceutical	1.70

4. More Investors Report Decreased Investment Caused by the Decreased Availability of Patents in the Life Sciences Industries

For particular industries, however, the decrease in investments reported by investors as caused by the decreased availability of patents would be more pronounced. As shown using the weighted averages, the three industries with the least reported decrease in investments would be the construction, transportation, and software and the Internet industries. The three industries with the most reported decrease in investments would be the pharmaceutical, biotechnology, and medical device industries.

Another way to understand the data relating to the decreased availability of patents is to consider for each industry the percentage of respondents who indicated their firms would strongly increase investment, somewhat increase investment, experience no impact, somewhat decrease investment, and strongly decrease investment in view of the decreased availability of patents in an industry.

Table 20: Impact of Decreased Availability of Patents on Investment Decisions: Responses

Industry	Strongly Increase	Somewhat Increase	No Impact	Somewhat Decrease	Strongly Decrease
Construction	1%	3%	71%	21%	3%
Transportation	2%	5%	54%	32%	7%
Soft. & the Internet	1%	6%	53%	30%	9%
Communications	1%	5%	52%	31%	11%
Energy	2%	4%	48%	33%	13%
Comp./Elecs. Hard.	2%	4%	33%	40%	21%
Semiconductors	1%	2%	30%	40%	27%
Medical Devices	1%	3%	14%	40%	42%
Biotechnology	3%	2%	17%	29%	50%
Pharmaceutical	3%	1%	14%	25%	56%

Considering the data in this way makes a few additional points clear. Investors overwhelmingly indicated, for example, that the decreased availability of patents would either not impact their firms' decisions whether to invest in companies or only slightly decrease investments in companies developing technology in the construction, transportation, software and Internet, energy, and computer and electronic hardware industries. But investors, by contrast, overwhelmingly indicated that the decreased availability of patents would either somewhat decrease or strongly decrease their firms' investments in the pharmaceutical, biotechnology, and medical device industries. Thus, according to these investors, on average each industry would see reduced investment as a result of the decreased availability of patents, but the extent of the impact on particular industries would be different. Again, the industries most negatively impacted would be the pharmaceutical, biotechnology, and medical device industries.

C. *Third Finding: The Supreme Court's Eligibility Decisions Have Impacted Firm Investment Behaviors*

The third principal finding is that the Supreme Court's eligibility cases have impacted many firms' existing investments and, more

significantly going forward, firms' investment behaviors. A substantial portion of investors familiar with the Supreme Court's eligibility decisions reported that those cases have impacted their firms' investment decisions, primarily in the sense of decreasing investments or shifting investments between industries. They report the industries most negatively impacted include the pharmaceutical, medical device, and biotechnology industries.

1. The Supreme Court's Eligibility Cases Negatively Impacted Firm's Existing Investments

To understand investors' views of the impact of the Supreme Court's eligibility cases, the survey first requested investors to identify whether they were familiar with at least one of the four recent cases. More than one third, 38% to be exact, indicated they were familiar with at least one of the cases.[141] The survey then asked several follow-up questions to those respondents who were familiar with at least one of the cases.

About 40% of knowledgeable investors indicated that the Court's decisions had somewhat negative or very negative effects on their firms' existing investments, while only about 14% of these investors reported somewhat positive or very positive effects.[142]

Table 21: Impact of Supreme Court's Eligibility Cases on Existing Investments

Response	Percent
Very positive	1%
Somewhat positive	13%
No Impact	46%
Somewhat negative	33%
Very negative	7%

141 There were 373 individual responses to this question.

142 There were 138 individual responses to this question.

The impact on existing investments, however, reflects only the static impact of the Supreme Court's eligibility cases. What is more important is the dynamic impact—in other words, the impact on investment decisionmaking in the future, given the importance of the development of technology, particularly in terms of the cumulative effects of continuing improvements.

2. The Supreme Court's Eligibility Cases Affected Firms' Decisionmaking

On a going forward basis, one third of the investors who knew about at least one of the Court's eligibility cases indicated that these cases affected their firms' decisions whether to invest in companies developing technology. Sixty-one percent, on the other hand, indicated that the cases did not affect their firms' investment decisionmaking.[143]

Table 22: Have Any of the Supreme Court's Eligibility Cases Affected Firm Decisions Whether to Invest in Companies

Response	Percent
Yes	33%
No	61%
Don't know	6%

[143] There were 135 individual responses to this question.

Of investors at firms investing in the pharmaceutical, medical device, semiconductor, and biotechnology industries, 37-39% indicated the cases did affect their firms' investment decisionmaking. Of investors at firms investing in software and the Internet, 32% indicated such impact. Despite these numbers, there was no statistically significant difference in these responses based on industry or stage of funding.[144]

Table 23: Respondents Indicating the Supreme Court's Eligibility Cases Have Affected Firm Decisions Whether to Invest in Companies, by Industry

Industries	Percent
Pharmaceutical	39%
Medical Devices	38%
Semiconductors	38%
Biotechnology	37%
Transportation	36%
Communications	35%
Computer/Electronic Hardware	34%
Construction	34%
Energy	33%
Software and the Internet	32%

The survey asked a series of follow-up questions to the investors who indicated that the Supreme Court's eligibility cases had affected their firms' decisions whether to invest in companies. In terms of which case affected firm decisionmaking, investors most often identified *Association for Molecular Pathology v. Myriad*, while the case that received the least votes was *Bilski*.[145]

144 In other words, investors consistently reported the Supreme Court's eligibility cases primarily caused decreased investments, regardless of their investment firm's focus in terms of stage of funding or industry. Here I used a chi-square test of multiple proportions to test the equality of the proportion of respondents who answered "yes," broken down by stages of funding/industries. I used a significance level of 0.05.

145 There were 85 individual responses to this question.

Table 24: Which of the Supreme Court's Eligibility Cases Affected Firm Decisions Whether to Invest in Companies

Response	Percent
Ass'n for Molecular Pathology v. Myriad	38%
Mayo v. Prometheus	29%
Alice v. CLS Bank	20%
Bilski v. Kappos	13%

This result—that the Supreme Court's decision in *Myriad* rated as the most significant in terms of impacting investment firm decisions—is somewhat surprising. It is arguably the narrowest of the four decisions, given its focus on eligibility of DNA segments and cDNA,[146] as opposed to, more generally, business methods, medical procedures, or computer software.[147] By contrast, it is unsurprising that *Bilski* is ranked lowest given that the Court did not make any major pronouncements in that case. Instead, the Court merely indicated that the Federal Circuit's test for eligibility was not the exclusive test and, in somewhat of a temporary confirmation of expansive eligibility, held that business methods are not categorically ineligible for patenting.[148] The most significant of the four cases, at least in terms of changing the law of patent eligibility, probably was *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, a decision derided by at least one commentator as "one of the worst decisions in the patent space EVER!"[149] Notably, *Myriad* and *Mayo* address biotechnology and medical procedures, while *Alice* and *Bilski* address computer-related technologies including software and business methods. Thus, yet again, the survey results indicate that investors see the Supreme Court's cases as more significantly impacting investment decisions in the area of biotechnology as compared to software.

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146 *See generally* Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576 (2013).

147 *See generally* Alice Corp. v. CLS Bank Int'l, 573 U.S. 208 (2014) (addressing computer software); Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66 (2012) (medical procedures and in particular medical diagnostics); Bilski v. Kappos, 561 U.S. 593 (2010) (business methods).

148 *See generally Bilski*, 561 U.S. 593.

149 Gene Quinn, *Killing Industry: The Supreme Court Blows* Mayo v. Prometheus, IP WATCHDOG (Mar. 20, 2012), http://www.ipwatchdog.com/2012/03/20/supreme-court-mayo-v-prometheus/id=22920 [https://perma.cc/66BW-2JNB].

3. How the Supreme Court's Eligibility Cases Affected Firms' Decisionmaking: Decreased Investments and Shifting of Investments

The relatively eligibility knowledgeable investors whose firm decisionmaking was impacted by the Supreme Court's eligibility cases reported these cases primarily caused decreased investments and shifting of investments between industries.[150]

Table 25: How Have the Cases You Selected Affected Firm Decisions Whether to Invest in Companies

Response	Percent
Decreased investments overall	49%
Shifted investments between industries	34%
Increased investments overall	8%
Other	9%

Notably, the percentage of these investors who reported increasing investments as a result of the Supreme Court's known eligibility decisions stood at 8%, significantly below the percentage indicating decreased investments at 49%. There was no statistical significance, however, in terms of any variations in answers based upon stage of funding or industry.[151]

4. Shifting of Investments Away from Life Sciences Industries

As mentioned, one of investors' responses to the Supreme Court's eligibility cases was to indicate shifting of investments from one industry to another. Investors who shifted investments primarily identified shifting investments out of the pharmaceutical, biotechnology, medical device, and software and Internet industries. There was little indication of shifting investments out of the communications or computer and electronic hardware industries, and no indication of any shifting of

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150 There were 53 individual responses to this question.

151 Here, I used a chi-square test of multiple proportions to test the equality of the proportion of respondents who answered "increased investments" or "decreased investments" or "shifted investments," broken down by stages of funding/industries. I used a significance level of 0.05.

investments out of the construction, transportation, energy, or semiconductor industries.[152]

Table 26: Investments Shifted Away from These Industries

Industries	Percent
Pharmaceutical	26%
Biotechnology	24%
Medical Devices	21%
Software and the Internet	21%
Communications	6%
Computer/Electronic Hardware	3%
Construction	0%
Transportation	0%
Energy	0%
Semiconductors	0%

Respondents identified shifting investments primarily into the computer and electronic hardware, energy, medical device, and software and Internet industries. To a lesser degree, investors indicated they shifted investments into the pharmaceutical, biotechnology, semiconductor, construction, and communications industries. No one indicated their firm shifted investments into transportation.[153]

[152] There were 34 individual responses to this question.

[153] There were 31 individual responses to this question.

Table 27: Investments Shifted into These Industries

Industries	Percent
Computer/Electronic Hardware	16%
Energy	16%
Medical Devices	13%
Software and the Internet	13%
Pharmaceutical	6%
Biotechnology	6%
Semiconductors	6%
Construction	3%
Communications	3%
Transportation	0%

One curious thing about this data is that some respondents identified shifting investments into the same industries other respondents identified shifting investments out of. The medical device and software and Internet industries fall within this category. It is possible what explains this anomaly is the importance of higher levels of knowledge of eligibility law. Based on the data discussed below with respect to the fourth principal finding (and given the holdings of the relevant cases), it seems likely the less an investor knows about eligibility law, the more likely that investor will report shifting investments into the medical device and software and Internet industries. Conversely, it seems likely the more an investor knows about eligibility law, the less likely that investor will report shifting investments into the medical device and software and Internet industries. This variance in eligibility law knowledge (even within the category of investors familiar with at least one of the Supreme Court's cases) may explain differences in responses. Of course, what may also explain the difference is simple variability in individual decisionmaking, in other words the randomness of individual decisions. Furthermore, investors no doubt make investment decisions based upon the particular bargain they are able to negotiate with target companies; the decision whether to invest is not a fixed, binary decision but dependent on the negotiated return on the investment, for example, how much equity the investor may receive. Thus, the bargain or cost of capital may get worse for the start-up company given the Supreme Court's eligibility decisions, for example, but many investors assuredly

still desire to invest at the lowest cost, or, in other words, for the maximum return. And, all else being equal, the Supreme Court's decisions may have reduced the cost to particular investors to such an extent that they decide to invest more at least compared to the state of the world prior to the Supreme Court's eligibility decisions.

D. *Fourth Finding: Eligibility Knowledgeable Investors Reported Different Changes in Firm Investment as Compared to Non-Eligibility Knowledgeable Investors*

The fourth principal finding is that investors familiar with at least one of the Supreme Court's eligibility cases indicated different changes in firm investment behavior as compared to investors without any such familiarity.

1. Most Investors Lack Familiarity with the Supreme Court's Eligibility Cases

As a preliminary point, the survey shows that most investors indicated they were unfamiliar with the four recent Supreme Court eligibility cases. As discussed above, 62% indicated they were unfamiliar.

2. Eligibility Knowledgeable Investors Reported More Impact as Compared to Non-Eligibility Knowledgeable Investors

Moreover, as discussed above, about one third of investors familiar with at least one of the Supreme Court's eligibility cases reported that these cases impacted their firms' investment behavior, with 49% of these investors reporting decreased investment and 34% reporting shifting of investment between industries. Those investors who reported shifting of investments indicated primarily that investments moved away from the pharmaceutical, biotechnology, medical device, and software and Internet industries.

Investors unfamiliar with the Supreme Court's cases, by contrast, overwhelmingly reported that the decreased availability of patents since 2009 (prior to the Supreme Court's eligibility cases) had not impacted their firms' changes in investment behavior.[154] I asked this question in an attempt, however imperfectly, to compare the responses of eligibility knowledgeable investors and eligibility unknowledgeable investors with respect to their belief in how changes in the law of patent eligibility resulting in decreased availability of patents have impacted their firms' investment behavior.

Table 28: Has Decreased Availability of Patents Since 2009 Contributed to Your Firm's Change in Investments (Unknowledgeable Investors Only)

Type of Change	Yes	No	Don't Know
No Change	2%	95%	4%
Inc'd investments overall	0%	88%	12%
Dec'd investments overall	14%	82%	5%
Shifted investments b/w industries	4%	84%	12%

Given that these respondents were not familiar with any of the Supreme Court's eligibility cases, it perhaps would not be surprising if they had indicated they did not know whether any decreased availability of patents had impacted their firms' investment behavior. Yet these respondents overwhelmingly selected no impact rather than reporting lack of knowledge of impact. By answering the question, they seem to have indicated they were aware of decreased availability of patents, even if they were not specifically familiar with the cause being the Court's eligibility cases. Moreover, regardless of the cause of decreased availability of patents, even these eligibility unknowledgeable respondents reported more often decreasing investments as compared to increasing investments as a result of the decreased availability of patents. Indeed, none of these respondents indicated that decreased availability of patents caused their firms to increase investments, while 14% reported decreased availability of patents contributed to decreased investments.

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154 There were 58 individual responses to this question from investors who indicated no change, 125 from investors who indicated increased investments, 22 from investors who indicated decreased investments, and 49 from investors who indicated shifting of investments between industries.

3. Eligibility Knowledgeable Investors Reported Different Shifting of Investments as Compared to Non-Eligibility Knowledgeable Investors

Investors without eligibility knowledge indicated more often, as compared to investors with eligibility knowledge, that their firms have shifted investments out of certain industries. While eligibility knowledgeable investors most often reported shifting investments out of the pharmaceutical industry, unknowledgeable investors reported shifting investments out of energy and semiconductors, industries that did not even make the list for knowledgeable investors. Also, notably, eligibility knowledgeable investors reported three times as often shifting investments out the software and Internet industry as compared to unknowledgeable investors. Eligibility unknowledgeable investors also more moderately reported shifting investments out of the biotechnology and medical device industries as compared to knowledgeable investors.[155]

Table 29: Eligibility Unknowledgeable Investors Shifted Investments Away from These Industries

Industries	Percent
Energy	17%
Semiconductors	12%
Pharmaceutical	11%
Medical Devices	11%
Biotechnology	10%
Communications	10%
Computer/Electronic Hardware	10%
Software and the Internet	7%
Construction	3%
Transportation	2%

[155] There were 115 individual responses to this question from eligibility unknowledgeable investors.

In terms of industries into which investors shifted investments, there were also differences between eligibility knowledgeable and unknowledgeable investors. Investors without eligibility knowledge indicated more often, as compared to investors with eligibility knowledge, that their firms have shifted investments into the software and Internet industry as compared to all other industries. While eligibility unknowledgeable investors reported 32% of the time shifting of investments into this industry, knowledgeable investors reported shifting investments into software and the Internet merely 13% of the time.[156]

Table 30: Eligibility Unknowledgeable Investors Shifted Investments into These Industries

Industries	Percent
Software and the Internet	32%
Computer/Electronic Hardware	11%
Transportation	11%
Medical Devices	10%
Communications	8%
Biotechnology	5%
Energy	5%
Pharmaceutical	3%
Construction	3%
Semiconductors	2%

In short, over the time period of the Supreme Court's eligibility cases, eligibility knowledgeable investors reported more often reduced investment in software and the Internet as compared to unknowledgeable investors, who more often reported increased investment in software and the Internet over the same time period.

[156] There were 97 individual responses to this question from eligibility unknowledgeable investors.

4. Eligibility Knowledgeable Investors' Comments Were Overwhelmingly Negative

The survey asked eligibility knowledgeable investors to describe examples of how any of the Supreme Court's decisions on patent eligibility in the seven years prior to the survey have affected their firms' decisions on how to invest in companies.

To get a sense of the feelings of the eligibility knowledgeable investors who provided comments, first, all of the descriptions were coded as positive, negative, or other. Positive descriptions included responses with positive characterizations of the impact of the Supreme Court's cases as well as responses indicating increased investment. Negative descriptions included responses with negative characterizations of the impact of the Supreme Court's cases as well as responses indicating decreased investment. Other descriptions included neither positive nor negative characterizations, nor indications of changes in investments. Remarkably, almost 83% of the comments fell into the negative category, while only 13% fell into the positive category.

Table 31: Eligibility Knowledgeable Investors' Comments: Positive or Negative

Characterization	Percent
Positive	13%
Negative	83%
Other	4%

Eligibility knowledgeable investors' descriptions were also coded by industry. In total, these descriptions addressed only three industries. The most common industry discussed by these investors was software and Internet (35%), followed by biotechnology (30%), and the pharmaceutical industry (13%). A significant portion of the descriptions was generalized and not specific to any industry (35%).[157]

[157] Some descriptions, however, addressed multiple industries, and so the grand total of these portions exceeds 100%.

Table 32: Eligibility Knowledgeable Investors' Comments: Percent by Industry

Industries	Percent
Software and the Internet	35%
Biotechnology	30%
Pharmaceutical	13%
Medical Devices	0%
Semiconductors	0%
Transportation	0%
Communications	0%
Computer/Electronic Hardware	0%
Construction	0%
Energy	0%
Generalized	35%

Matching positive and negative comments with the industries addressed by those comments provides the ability to get a sense of the feelings of these eligibility knowledgeable investors who provided descriptions of the impact of the Supreme Court's eligibility decisions. Within the software and Internet industry, for example, eligibility knowledgeable investors reported negative impact in 63% of the comments and positive impact in 25% of the comments. Within the biotechnology industry, eligibility knowledgeable investors reported negative impact in 86% of the comments and positive impact in 14% of the comments. And within the pharmaceutical industry, eligibility knowledgeable investors reported negative impact in 100% of the comments. Likewise, in the residual category, where the comments did not address any particular industry, eligibility knowledgeable investors reported negative impact in 100% of the comments.

Table 33: Eligibility Knowledgeable Investors' Comments: Percent Positive and Negative by Industry

Industries	Positive	Negative
Software and the Internet	25%	63%
Biotechnology	14%	86%
Pharmaceutical	0%	100%
Medical Devices	0%	0%
Semiconductors	0%	0%
Transportation	0%	0%
Communications	0%	0%
Computer/Electronic Hardware	0%	0%
Construction	0%	0%
Energy	0%	0%
Generalized	0%	100%

What is perhaps even more interesting, however, is the substance of the descriptions provided by eligibility knowledgeable investors when asked about the impact of the Supreme Court's decisions. While there were too many descriptions to discuss every one here, a few representative examples will provide a glimpse into the prevailing sentiments.

Regarding the software and Internet industry, representative comments reflect the view that the Supreme Court's decisions have reduced investment in software-based inventions and made software-based companies vulnerable to copycats. One eligibility knowledgeable investor simply stated: "We no longer place any value or advocate for any budget for software patents." Another investor lamented that "[p]atents on computer-software based inventions are much harder to get now, but software has been the engine of high tech for years. Lack of patent protection makes companies more vulnerable." At least some investors, however, indicated they have increased investments in the software field. One, for example, tersely explained his or her firm "[i]nvested more after *Alice*."

In the biotechnology and pharmaceutical industries, representative comments reflect reduced investment in diagnostics, an increase in uncertainty, and adverse impact on investments more generally. One eligibility knowledgeable investor, for example, simply stated: "We have

been far more cautious investing in diagnostics due to *AMP v. Myriad*." Another provided a longer explanation and a prediction:

> The specific decisions have increased [sic] uncertainty and the treden [sic] is the most worrying because biotech, which will drive 100 percent of the cures for disease that will save so many lives and so much money compared to our ineffective healthcare system, is 100 percent driven by patents. The potential patent reforms and the direction of the courts will reduce investments markedly if they keep going that direction.

Still another investor recognized the underlying premise of denying patent eligibility on claims to naturally occurring phenomena, but still complained about the result with respect to investment decisions: "In the biotech/pharma area, the notion of naturally occurring phenomena being harder to patent is easier to fathom, but it still makes a difference in terms of availability of patent protection and the resulting adverse influence on decisions to invest."

As already mentioned, some of the comments did not address particular industries but instead provided generalized commentary on the impact of the Supreme Court's eligibility decisions on the investment market. As mentioned, all of these comments were negative. Here is a sampling of those comments:

- "Caused us to defer investment till more clear milestones were achieved to reduce risk. More due diligence to understand market impact. Passed on several deals due to uncertainty of potential litigation or market impact."
- "These SC decisions have dramatically impacted the secondary market for patents. The secondary markets were once a useful hedge when making seed stage investments to cutting edge technology companies—if a company failed, at least you could sell or license the IP to recover some or all of the invested funds. That critical hedge is now missing. There is a hole in the innovation ecosystem as a result of these disastrous SC decisions."
- "They have impacted the value of licensing from universities and company valuations based on patents that are affected by court decisions."

Thus, these investors identified various problems caused by these Supreme Court decisions on investments generally, not limited to delayed or reduced investment. They, however, also explained why the Court's decisions impacted investment, highlighting uncertainty, potential litigation, market impact, elimination of the ability to hedge investments, reduced value of licensing from universities, and reduced company valuations.

V. CLARION CALL TO FIX PATENT ELIGIBILITY LAW?

Proponents of reform may claim the results of the survey represent a clarion call to fix patent eligibility law. Certainly, the results provide data for an evidence-based evaluation of competing arguments in the ongoing debate about the need for congressional intervention in the law of patent eligibility. And the results do indicate reports of reduced investment generally, and in particular in the biotechnology, medical device, and pharmaceutical industries, as a result of the Supreme Court's patent eligibility cases.

A. *Where the Results Fit Within the Existing Literature*

The results of the survey supplement the results of other broader studies and surveys. Together, these studies and surveys support the idea that the availability of patents is an important factor in attracting venture capital and private equity investment in businesses developing technology in all industries, but particularly in the biotechnology, medical device, and pharmaceutical industries. What the current survey uniquely highlights, however, is the negative impact of the Supreme Court's recent patent eligibility decisions on this investment. That is a new finding, and one that deserves extended consideration.

Despite the number and breadth of the prior studies and surveys discussed above—and their support for the idea that the patent system promotes investment generally and in particular in the health sciences industries—not one of them explores particular patent law doctrines that might drive investment decisions.[158] Indeed, in her own summary of this

[158] *See supra* Section I.C.

literature, Commissioner Ohlhausen recognized that "the empirical evidence to date remains incomplete about the precise circumstances in which incremental strengthening of patent rights enhances or hurts innovation."[159]

Given the Supreme Court's recent upheaval in the law governing patent eligibility and, moreover, the extreme reduction in patent eligibility combined with the proliferation of calls to overturn the Court's new test for patent eligibility, it seemed to me the perfect time to conduct a survey to explore the impact of the Court's cases on investment in technological development. Commissioner Ohlhausen, I suspect, would agree. Beyond highlighting the lack of empirical evidence about the impact of incremental strengthening or weakening of patent rights, her analysis acknowledged both that the Supreme Court "has limited the sphere of patentable subject matter"[160] and, more generally, that "the collective legal environment has been hostile to U.S. patent owners."[161] She recognized, moreover, that problems critics associate with business method and software patents in particular—ambiguity, patent thickets, royalty stacking, modest disclosures, and issuance "without the benefit of a rich prior art with which to make informed non-obviousness and novelty decisions"—have been attributed "to the Federal Circuit's 1998 decision in *State Street Bank* [*& Trust Co. v. Signature Financial Group, Inc.*]."[162]

That case, as it turns out, addressed the legal doctrine of patent eligibility; the court held that methods are eligible for patenting if they achieve a "useful, concrete, and tangible result."[163] According to Commissioner Ohlhausen, the results of that decision included "thousands of business method patents" issued "often without the benefit of a rich prior art with which to make informed nonobviousness and novelty decisions."[164] In turn, those poor quality patents caused a "disconnect between invention and commercialization" and "ha[ve]

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159 Ohlhausen, *supra* note 67, at 150.

160 *Id.* at 107.

161 *Id.* at 108.

162 *Id.* at 113–14.

163 State St. Bank & Tr. Co. v. Signature Fin. Grp., Inc., 149 F.3d 1368, 1373 (Fed. Cir. 1998) (quoting *In re* Alappat, 33 F.3d 1526, 1557 (Fed. Cir. 1994)), *abrogated by* Bilski v. Kappos, 561 U.S. 593 (2010).

164 Ohlhausen, *supra* note 67, at 114.

likely generated a perception—whether justified or not—that some patents do not drive innovation and protect against copying, but simply tax those who develop and market technologies."[165] Thus, she has acknowledged that many recent complaints regarding patent law focus on business method and software patents, and that these complaints may be tied back to the Federal Circuit's prior law governing patent eligibility.

Notably, the Supreme Court's recent patent eligibility cases effectively replaced the test for eligibility set forth in *State Street Bank*, the Federal Circuit case Commissioner Ohlhausen highlighted. No longer is the test whether an invention achieved a "useful, concrete, and tangible result," but instead whether the invention includes an "inventive concept."[166] In this way, Commissioner Ohlhausen practically laid out the case for the survey I conducted.

In addition, Commissioner Ohlhausen's conclusions—the result of her study of the then-existing state of the econometric and survey literature—may be tested against my new survey results. Her "view—in light of the relevant theory, econometric evidence, and the U.S. experience with a successful innovation policy of which patents form a central part—is that strong patent rights should remain at the heart of the U.S. industrial policy."[167] But "[t]hat does not mean uncritical embrace of ever-broader patents in all industries."[168]

In short, my survey—the first of its kind—provides empirical survey data unlike any existing study to the extent it focuses particularly on the law of patent eligibility. This data is necessary to address the central question of the Supreme Court's impact on investment in technological development, to analyze the need to modify the current law governing patent eligibility, and to determine whether any modification ought to take into account differential impact on particular industries. And, as shown above and summarized below, the data indicates the Court's cases have impacted decisionmaking regarding investment in technological development, there is a need to modify the current law governing patent eligibility (at least if there is a desire to return to prior levels of investment in technological development), and that any modification may take into account differential impact on particular industries.

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165 *Id.*

166 *See supra* Section I.A.

167 Ohlhausen, *supra* note 67, at 109.

168 *Id.*

B. *The Survey Highlights the Importance of Patent Eligibility and the Negative Impact of the Supreme Court's Eligibility Cases*

The results of the survey highlight the importance of patent eligibility and the negative impact of the Supreme Court's eligibility cases on venture capital and private equity investment in all industries, but particularly in the most important areas of technological development in terms of its impact on public health: the biotechnology, medical device, and pharmaceutical industries. The results indicate to me at least that Congress should at least consider overturning the Supreme Court to prevent any more lost technological development in the United States.

The survey results indicate that investors as a whole believe patent eligibility is an important consideration in deciding whether to invest in a company developing technology.[169] Furthermore, the results indicate that a significant portion of the investors who are familiar with the Supreme Court's cases believe these cases have reduced their firms' investments in technological development in all industries.[170] These investors report primarily decreased investments, but also shifting of investments between industries, and in particular out of life sciences industries.[171] That is not a good report if the goal is to maintain the same level of investments, let alone increase investments, in the development of technology, and in particular in the life sciences industries. And this result is particularly remarkable given that the elimination or reduction of patents would presumably reduce the risk of exposure to patent litigation for companies in which these investors invest. Investors seem to think the upside of patent eligibility is greater than its downside—that is, that patent protection is worth more than the risk of patent infringement lawsuits.

According to the survey results, moreover, the most significant harm to investment in technological development has occurred in the life sciences industries.[172] Investors reported that the Supreme Court's eligibility cases most severely impacted technological development in the biotechnology, medical device, and pharmaceutical industries. While the particular impact of delay and lost inventions in the life sciences

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169 *See supra* Section IV.A.

170 *See supra* Section IV.C.2.

171 *See supra* Sections IV.C.3, IV.C.4.

172 *See supra* Section IV.C.4.

industries is unknown, if the reported decreased investment in, and shifting of investment out of, the life sciences industries are true, it is highly likely the Court's decisions have delayed or altogether prevented the development of medicines and medical procedures.

On the other hand, most investors (62%) were not familiar with any of the Supreme Court's eligibility cases, and even among investors with familiarity most (61%) had not changed their investment decisionmaking after these decisions. Only 38% of investors were familiar with any of the Court's eligibility cases; only 33% of those familiar with at least one of these cases reported that the case(s) impacted their investment decisionmaking; and of the resulting small subset of investors, only 49% reported decreased investments. In other words, only about 6% (38% x 33% x 49%) reported decreased investment resulting from the Supreme Court's eligibility cases. And even that number must be offset by the approximately 1% (38% x 33% x 8%) that reported increasing investments as a result of these cases. Thus, one might argue, the survey has shown only that, net, about 5% of investors report decreased investment as a result of the Supreme Court's eligibility cases. And that, so the argument goes, is slight. Moreover, the survey did not reveal the size of changes in investments, individually or collectively, in terms of dollars.

This simplified characterization of the data, however, fails to tell the whole story. It is incomplete, for example, in its appreciation for the impact of the Supreme Court's eligibility cases because it fails to consider the shifting of investments between industries. Moreover, even 5% of investors decreasing investment represents substantial impact on investment in technological development. And perhaps the more investors become familiar with the Supreme Court's eligibility cases, the more their views will change to reflect the almost 50% of investors familiar with at least one of the Supreme Court's cases who reported decreased investments as a result of those cases—and so the relevant portion of investors who decrease investments will only increase over time. Still another problem is the dynamic impact of reduced investment, here lost cumulative effects of continuing improvements, which is like lost compound interest. Next, consider the differential impact between industries, and in particular the life sciences industries where decreased investment no doubt results in delay—and may also result in loss—of the invention and marketing of medicines and medical procedures, even life-

saving medicines and procedures. Furthermore, even among those unfamiliar with the Supreme Court's cases, there were reports of negative impact of patent eligibility on investments. In short, the survey paints a problematic story of reduced investment in technological development in the United States as a direct result of the Supreme Court's decisions.

C. *Limitations on Use of the Survey Data*

That said, the data should be taken with a grain of salt. Surveys, for example, reveal stated preferences, but not necessarily actual preferences. I have already highlighted some of the ways to characterize the data to support maintaining the status quo with respect to eligibility law.[173] Moreover, I have pointed out that some of the questions received a small number of responses.[174] Additional reasons exist limiting the significance of the survey results.

The views of the investors who responded to the survey may not perfectly represent the views of all investors and investment firms. Besides the limited sample size, Massinvestor's database may not be representative. The views of individual investors, furthermore, may not reflect the views of the investors' firms. The data set, moreover, reflects that almost all of these investors' firms invest in multiple industries and in multiple stages. This may explain why answers to some of the questions did not exhibit statistically significant differences between industries and between investment stages. Moreover, it is at least possible that the description of the survey or the first part of the survey, which asked about the importance of patent eligibility to investment decisions, impacted responses to the second part of the survey, which asked more specific questions about the impact of changes to patent eligibility law on investment decisions. After reading the description and answering the questions in the first part, respondents may have felt like patents were more or less important than they actually were to these respondents prior to reading the description and answering the questions in the first part of

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173 *See supra* Section V.B.

174 *See supra* Section V.B. Given that some of the questions asked in the survey elicited few respondents, the results may not be representative of the entire database of venture capital and private equity investors, let alone these types of investors more generally.

the survey. If so, the results of the second part of the survey could have been biased in favor or against the importance of patents.[175] The first part, however, likely did not impact responses to questions asking about any differences between technologies. Hindsight bias is another possibility given that I asked questions about how investment decisions have changed over a long time period. Respondents may have subconsciously answered questions in a way that shows that they predicted the Supreme Court's patent eligibility decisions even when they likely did not, for example, by indicating that their investment decisions did not change as a result of these decisions when in fact they did.

Selection bias is always a concern with any survey. Indeed, decisions made while designing the survey necessarily impacted the survey results. Selecting the 2017 version of the database, for example, introduced selection bias in some ways. The collection of investors identified in this database in 2017 no doubt differs from the collection of venture capitalists that might have been identified in a similar database in 2009, prior to the Supreme Court's four most recent eligibility cases. And this difference may influence the outcome of the survey in various ways. Suppose, for example, that at least some firms that engaged in venture capital financing in 2009 decided to stop engaging in venture capital financing after the Supreme Court's *Mayo* decision in 2013. In that situation, the survey of firms identified in the database in 2017 does not cover the entire data set of firms whose investment decisions changed based on the Supreme Court's eligibility decisions. On the other hand, suppose that some firms decided to begin venture capital financing in 2011 after the Supreme Court's *Bilski* decision. In that situation, the survey of the firms identified in a 2009 database would similarly not capture all of the firms whose investment decisions changed based on the Supreme Court's eligibility decisions. I decided to use the 2017 version of the database, and simply to recognize the imperfectness and inherent

[175] Thus, there is at least a possibility of priming or demand effect. That said, I drafted the description and the questions in an attempt not to cause priming or demand effect.

selection effect.[176] Unlike other surveys related to patent reform topics,[177] however, the survey here was not sent to an inherently biased sample, nor did it indicate one way or the other whether the survey was intended to provide data to support or defeat proposed legislation related to patent eligibility.[178]

In addition, the respondents may not have understood each question or, for other reasons, not answered questions accurately. For example, particularly for investors without knowledge of the Supreme Court's eligibility cases, some investors may not have understood eligibility as a distinct concept from patentability (which requires not just eligibility but also novelty, non-obviousness, and compliance with the disclosure requirements of the patent statute). As another example, it may be difficult for some firms to differentiate between U.S. and foreign activity. Investment decisions no doubt often present questions of whether to invest in U.S. or foreign companies, or U.S. domestic operations versus global operations. More significantly, respondents may not really understand how the Supreme Court's patent eligibility cases have actually impacted their firms' decisionmaking. And at least some questions may have presented dichotomies dependent upon undefined circumstances. For example, to answer the question whether a firm is less likely to invest in companies developing technology if the law of patent eligibility makes patents unavailable for that technology, some respondents may have thought the answer depends upon the particular technology at issue and whether trade secret protection would work to

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176 I could have added questions to my survey to try to account for this selection bias. I could have asked, for example, whether the surveyed entity was aware of firms that exited venture capital financing in light of the Supreme Court's eligibility decisions. In light of the limited space and time in my survey as well as the imprecise nature of the question, however, I did not include these types of questions.

177 *See, e.g.*, David L. Schwartz & Jay P. Kesan, *Analyzing the Role of Non-Practicing Entities in the Patent System*, 99 CORNELL L. REV. 425, 434–36 (2014) (describing the probability of "strong selection bias" in a survey conducted by a defensive patent aggregator).

178 *Id.* at 446 (indicating the survey in question was sent by a defensive patent aggregator to its clients and prospective clients with "documentation inform[ing] potential subjects that the results of the study would be used to lobby for changes in the patent laws"). Here, by contrast, the recipients received an introduction stating that "[t]he results [of the survey] will . . . serve as an important data point as various groups lobby Congress to amend the patent statute to address the appropriate scope of patent eligibility," without taking a position on the question, without indicating the personal views of the creator of the survey, and furthermore neutrally explaining that the "survey explores how these changes in the law of patent eligibility impact investment decisions." *See supra* note 115.

protect any investment leading to its commercialization. Even given this possibility, it seems likely that investors' answers simply reflect normal circumstances they encounter.

Another limitation is that, even if the views of individual investors reflect their firms' views and selection bias is not a significant problem, different firms invest in different amounts. In other words, there are small investments and large investments, and firms may be small investors or large investors. It may be that large investors have different views compared to small investors, and so the impact of the Supreme Court's cases on investment as a whole may be different than the impact the average investor reports.

The survey also does not really answer the question of whether increased investment in technological development is a net benefit for society. It is a basic premise of the patent system that patents incentivize investment in technological development, and therefore the burden is no doubt on opponents of the patent system to develop reliable data that the patent system disserves technological development. At some point, however, increasing investment in any industry becomes suboptimal given opportunity costs. The survey does not attempt to answer the question of whether more investment would advance social welfare given associated costs.

Even recognizing these limitations, the survey does provide useful data that can be used to begin analyzing the question of whether the Supreme Court's eligibility cases have impacted investment decisionmaking. The survey directly surveyed investors to explore whether patent eligibility is a factor they consider when making their decisions on investments in technological development and how their decisionmaking has changed in view of and over the same time period as the Court's cases. As discussed, despite limitations on the significance of some of the results, the survey does provide evidence that these cases have generally reduced investment in the development of technologies in all industries, but particularly in the biotechnology, medical device, and pharmaceutical industries. That advances the state of the literature significantly, and in my view provides an additional reason for Congress to consider whether the Court's cases ought to be overruled by statute.

CONCLUSION

The survey I conducted was the first of its kind—one gathering data that identifies changes in investment behavior and links those changes to Supreme Court decisions in the area of patent eligibility. As a result, it has provided critical data useful to evaluate empirically whether Congress should amend the patent statute to end the Supreme Court's "drastic and far-reaching experiment in patent eligibility standards."[179] This data fills major gaps left by prior studies generally linking patents and innovation.[180] Likewise, this data augments the overwhelming anecdotal evidence of negative effects of the Court's heightened eligibility standard on investment in technological development in the United States.[181]

Most importantly, the survey uniquely highlights one of the most significant negative effects of the Supreme Court's recent patent eligibility decisions: reduced venture capital and private equity investment in technological development generally, but particularly in the biotechnology, medical device, and pharmaceutical industries. Future work may be able to confirm these negative effects, for example by exploring revealed preferences through actual investment behaviors of venture capital and private equity investors. In the meantime, the major takeaway is clear: The Supreme Court's "drastic and far-reaching experiment in patent eligibility standards" has likely resulted in lost investment in the life sciences that has delayed or altogether prevented the development of medicines and medical procedures.

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179 *See* Lefstin, *supra* note 2, at 554.

180 Ohlhausen, *supra* note 67, at 125 (describing "abundant empirical work finding that patent strength and R&D expenditures are correlated;" "research show[ing] that strong IP rights are associated with economic growth in developed economies;" and "[s]urveys reveal[ing] that patents contribute to incentives to invest, most acutely in the bio-pharmaceutical and medical device fields but elsewhere to varying degrees as well").

181 *See, e.g.*, Thomas, *supra* note 3; U.S. PATENT & TRADEMARK OFFICE, *supra* note 3; Taylor, *supra* note 6, at 243.

APPENDIX A

1. Please indicate whether you agree or disagree:

Patent eligibility is an important consideration when your firm decides whether to invest in a company developing technology.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

2. Please indicate whether you agree or disagree:

If the law of patent eligibility makes patents unavailable for a technology, your firm is less likely to invest in a company developing that technology.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

3. Please indicate whether you agree or disagree:

If the law of patent eligibility makes patents more difficult to obtain for a technology, your firm is less likely to invest in a company developing that technology.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

4. What factors does your firm rely upon when deciding whether to invest in a company developing technology? Please rank the following factors in

order of priority, with the most important at the top. (You may drag and drop the factors to re-order them.)

Quality of the company's technology

Availability of U.S. patent protection given U.S. patent eligibility

Availability of foreign patent protection given foreign patent eligibility

Availability of copyright protection

Availability of trade secret protection

First mover advantage

Quality of the company's people

Size of the potential market for the technology

Other _____

5. For each industry in which your firm invests, please indicate how the elimination of patents would affect your firm's decision whether to invest in a company developing technology in that industry (you should skip industries in which your firm does not invest):

	Strongly increase investment	Somewhat increase investment	No impact	Somewhat decrease investment	Strongly decrease investment
Software, Internet	○	○	○	○	○
Computer and other electronic hardware	○	○	○	○	○
Semiconductor	○	○	○	○	○
Pharmaceutical	○	○	○	○	○

Medical devices, methods, and other medical	○	○	○	○	○
Biotechnology	○	○	○	○	○
Communications	○	○	○	○	○
Transportation (including automotive)	○	○	○	○	○
Construction	○	○	○	○	○
Energy	○	○	○	○	○
Other (please specify) _____	○	○	○	○	○

6. For each industry in which your firm invests, please indicate how a decreased availability of patents would affect your firm's decision whether to invest in a company developing technology in that industry (you should skip industries in which your firm does not invest):

	Strongly increase investment	Somewhat increase investment	No impact	Somewhat decrease investment	Strongly decrease investment
Software, Internet	○	○	○	○	○
Computer and other electronic hardware	○	○	○	○	○
Semiconductor	○	○	○	○	○
Pharmaceutical	○	○	○	○	○
Medical devices, methods, and other medical	○	○	○	○	○
Biotechnology	○	○	○	○	○
Communications	○	○	○	○	○
Transportation (including automotive)	○	○	○	○	○
Construction	○	○	○	○	○

Energy	○	○	○	○	○
Other (please specify) _____					

The Supreme Court has decided four cases in the past seven years on the issue of patent eligibility:

- Bilski v. Kappos (2010) (finding a method of hedging risk to be patent ineligible);
- Mayo Collaborative Services v. Prometheus Labs, Inc. (2012) (finding a method for identifying effective drug doses to be patent ineligible);
- Association for Molecular Pathology v. Myriad Genetics, Inc. (2013) (finding isolated DNA to be patent ineligible but cDNA to be patent eligible); and
- Alice Corp. v. CLS Bank Int'l (2014) (finding a computer-implemented method of intermediated settlement to be patent ineligible).

7. Are you familiar with one or more of these decisions?

- Yes
- No

[If "No" was selected in response to Question 7, the survey skipped to Question 15.]

8. Has the effect of these decisions on your firm's existing investments been positive or negative?

- Very positive
- Somewhat positive
- No impact
- Somewhat negative
- Very negative

9. Have any of these Supreme Court decisions affected your firm's decisions whether to invest in companies?

- Yes
- No
- Don't know

[If "No" or "Don't know" was selected in response to Question 9, the survey skipped to Question 15.]

10. Which decisions affected your firm's decisions whether to invest in companies? (You may select more than one.)

- Bilski v. Kappos (2010)
- Mayo Collaborative Services v. Prometheus Labs., Inc. (2012)
- Association for Molecular Pathology v. Myriad Genetics, Inc. (2013)
- Alice Corp. v. CLS Bank Int'l (2014)

11. How have the cases you selected affected your firm's decisions whether to invest in companies? (You may select more than one.)

- Increased investments overall
- Decreased investments overall
- Shifted investments between industries
- Other (please specify) _____

[If the answer to Question 11 included "Shifted investments between industries," the survey presented Questions 12 and 13.]

You indicated your firm has shifted investments between industries.

12. *Out of* which industries have you shifted investments (you may select more than one)?

- Software, Internet
- Computer and other electronic hardware
- Semiconductor
- Pharmaceutical
- Medical devices, methods, and other medical
- Biotechnology
- Communications
- Transportation (including automotive)
- Construction
- Energy
- Other (please specify) _____

13. *Into* which industries have you shifted financing (you may select more than one)?

- Software, Internet
- Computer and other electronic hardware
- Semiconductor
- Pharmaceutical
- Medical devices, methods, and other medical
- Biotechnology
- Communications
- Transportation (including automotive)
- Construction
- Energy
- Other (please specify) _____

14. If you are willing, please describe examples of how any of the Supreme Court's decisions on patent eligibility in the last seven years have affected your firm's decisions on how to invest in companies. You can skip this question if you would rather.

[If "Yes" was selected in response to Question 7, at this point the survey skipped to Question 22.]

15. Since 2009, how have your firm's investments in companies changed (you may select more than one)?

- ☐ No change
- ☐ Increased investments overall
- ☐ Decreased investments overall
- ☐ Shifted investments between industries
- ☐ Other (please specify) _____

[If "No change" was selected in response to Question 15, the survey presented Question 16.]

16. Has a decreased availability of patents since 2009 contributed to your firm's lack of change in investments?

- ☐ Yes
- ☐ No
- ☐ Don't know

[If "Increased investments overall" was selected in response to Question 15, the survey presented Question 17.]

17. Has a decreased availability of patents since 2009 contributed to your firm's increased investments?

- ☐ Yes
- ☐ No
- ☐ Don't know

[If "Decreased investments overall" was selected in response to Question 15, the survey presented Question 18.]

18. Has a decreased availability of patents since 2009 contributed to your firm's decreased investments?

- ☐ Yes
- ☐ No
- ☐ Don't know

[If "Shifted investments between industries" was selected in response to Question 15, the survey presented Questions 19–21.]

You indicated your firm has shifted investments between industries.

19. Has a decreased availability of patents since 2009 contributed to your firm's shifting of investments between industries?

- Yes
- No
- Don't know

20. *Out of* which industries have you shifted investments (you may select more than one)?

- Software, Internet
- Computer and other electronic hardware
- Semiconductor
- Pharmaceutical
- Medical devices, methods, and other medical
- Biotechnology
- Communications
- Transportation (including automotive)
- Construction
- Energy
- Other (please specify) _____

21. *Into* which industries have you shifted financing (you may select more than one)?

- Software, Internet
- Computer and other electronic hardware
- Semiconductor
- Pharmaceutical
- Medical devices, methods, and other medical
- Biotechnology
- Communications
- Transportation (including automotive)
- Construction
- Energy
- Other (please specify) _____

22. Are you willing to engage in a short telephone interview at a later date?

Yes
No

APPENDIX B

Table 1: Investment Stages of Respondents' Firms

Stage	Percent
Early Stage	59%
Seed Stage	45%
Middle Stage	27%
Growth Stage	22%
Expansion Stage	15%
Late Stage	1%

Table 2: Investment Industries of Respondents' Firms

Industry	Percent
Software and the Internet	70%
Medical Devices	63%
Computer Electronics/Hardware	61%
Biotechnology	55%
Pharmaceutical	54%
Communications	53%
Energy	49%
Semiconductors	48%
Transportation	47%
Construction	42%

Table 3: Investment Focus of Respondents' Firms

Firm Focus	Percent
Information Technology	62%
Life Sciences & Healthcare	46%
Software & the Internet	40%
Manufacturing & Industrial	25%
Business Services	23%
Communications & Networking	20%
Energy & Clean Tech	19%
Media & Digital Media	17%
Consumer Products & Services	16%
Financial Services	15%
Medical Devices	15%
Transportation & Distribution	10%
Retail & Restaurant	9%
Food & Agriculture	5%
Real Estate & Construction	5%
Semiconductors	4%
Sports & Entertainment	4%
Education & Training	3%
Defense & Homeland Security	3%
Storage & Hardware	3%
Electronics & Advanced Materials	2%

Table 4: Familiarity with at Least One Eligibility Case

Type	Percent
Familiar	38%
Unfamiliar	62%

Table 5: Investment Stages of Firms: Resp's v. Non-Resp's

Stage	Resp's	Non-Resp's
Early Stage	59%	49%
Seed Stage	45%	30%
Middle Stage	27%	46%
Growth Stage	22%	22%
Expansion Stage	15%	20%
Late Stage	1%	3%

Table 6: Investment Focus of Firms: Resp's v. Non-Resp's

Firm Focus	Resp's	Non-Resp's
Information Technology	62%	55%
Life Sciences & Healthcare	46%	43%
Software & the Internet	40%	32%
Manufacturing & Industrial	25%	32%
Business Services	23%	33%
Communications & Networking	20%	22%
Energy & Clean Tech	19%	23%
Media & Digital Media	17%	21%
Consumer Products & Services	16%	24%
Financial Services	15%	16%
Medical Device	15%	13%
Transportation & Distribution	10%	14%
Retail & Restaurant	9%	11%
Food & Agriculture	5%	4%
Real Estate & Construction	5%	6%
Semiconductors	4%	4%
Sports & Entertainment	4%	5%
Education & Training	3%	6%
Defense & Homeland Security	3%	5%
Storage & Hardware	3%	3%
Electronics & Advanced Materials	2%	1%

Table 7: Patent Eligibility Is an Important Consideration in Firm Decisions Whether to Invest in Companies Developing Technology

Response	Percent
Strongly agree	43%
Somewhat agree	31%
Neither agree nor disagree	13%
Somewhat disagree	9%
Strongly disagree	5%

Table 8: Less Likely to Invest if Patent Eligibility Makes Patents Unavailable

Response	Percent
Strongly agree	23%
Somewhat agree	39%
Neither agree nor disagree	19%
Somewhat disagree	13%
Strongly disagree	7%

Table 9: Less Likely to Invest if Patent Eligibility Makes Patents More Difficult to Obtain

Response	Percent
Strongly agree	19%
Somewhat agree	40%
Neither agree nor disagree	18%
Somewhat disagree	17%
Strongly disagree	5%

Table 10: Importance of Patent Eligibility by Investment Stage

Stage	Mean (1–5 Scale)
Seed	3.95
Early	3.98
Middle	3.95
Growth	3.84
Expansion	3.88
Late	3.80

Table 11: Importance of Patent Eligibility by Industry

Industry	Mean (1–5 Scale)
Medical Devices	4.17
Biotechnology	4.13
Pharmaceutical	4.13
Energy	4.07
Semiconductors	4.04
Construction	4.01
Computer Electronics/Hardware	3.99
Transportation	3.99
Communications	3.98
Software and the Internet	3.92

Table 12: Patent Eligibility Importance By Industry—Percent Strongly or Somewhat Agreeing Patent Eligibility Is an Important Consideration in Firm Decisions Whether to Invest in Companies Developing Technology

Industry	Percent
Medical Devices	81%
Biotechnology	79%
Pharmaceutical	79%
Energy	78%
Semiconductors	76%
Construction	76%
Computer Electronics/Hardware	75%
Transportation	75%
Communications	74%
Software and the Internet	72%

Table 13: Importance of Patent Eligibility by Familiarity with at Least One Eligibility Case

Type	Mean (1–5 Scale)
Familiar	4.18
Unfamiliar	3.93

Table 14: Factors Relied upon when Deciding to Invest in Companies Developing Technology: Ranking (1–5 of 9)

Factor	1st	2nd	3rd	4th	5th
Quality of People	48%	23%	14%	5%	3%
Quality of Technology	24%	31%	30%	10%	3%
Size of Potential Market	19%	33%	26%	12%	3%
First-Mover Advantage	2%	5%	13%	29%	14%
Avail. of U.S. Patents	2%	4%	10%	27%	34%
Avail. of Trade Secrets	0%	1%	2%	5%	17%
Avail. of Foreign Patents	0%	1%	2%	5%	17%
Avail. of Copyrights	0%	0%	1%	4%	7%
Other	4%	3%	3%	4%	2%

Table 15: Factors Relied upon when Deciding to Invest in Companies Developing Technology: Weighted Mean

Factor	Mean (1–9 Scale)
Quality of People	7.77
Quality of Technology	7.55
Size of Potential Market	7.24
Avail. of U.S. Patents	5.31
First-Mover Advantage	4.94
Avail. of Foreign Patents	3.72
Avail. of Trade Secrets	3.31
Avail. of Copyrights	3.13
Other	2.03

Table 16: Importance of Availability of U.S. Patents when Deciding to Invest in Companies Developing Technology: Weighted Mean (By Industry)

Industry	Mean (1–9 Scale)
Medical Devices	5.42
Pharmaceutical	5.42
Biotechnology	5.41
Energy	5.36
Other	5.35
Semiconductors	5.31
Construction	5.31
Transportation	5.26
Communications	5.26
Computers	5.24
Software and the Internet	5.18

Table 17: Impact of Elimination of Patents on Investment Decisions: Weighted Mean

Industry	Mean (1–5 Scale)
Construction	2.82
Software and the Internet	2.74
Transportation	2.67
Communications	2.61
Energy	2.50
Computer/Electronic Hardware	2.39
Semiconductors	2.23
Medical Devices	1.89
Biotechnology	1.83
Pharmaceutical	1.80

Table 18: Impact of Elimination of Patents on Investment Decisions: Responses

Industry	Strongly Increase	Somewhat Increase	No Impact	Somewhat Decrease	Strongly Decrease
Construction	1%	5%	75%	14%	6%
Soft. & the Internet	3%	10%	53%	27%	8%
Transportation	2%	7%	53%	31%	7%
Communications	2%	8%	48%	32%	10%
Energy	2%	4%	49%	30%	15%
Comp./Elecs. Hard.	4%	6%	33%	39%	18%
Semiconductors	4%	3%	33%	34%	27%
Medical Devices	6%	3%	11%	32%	47%
Biotechnology	7%	2%	14%	22%	55%
Pharmaceutical	7%	1%	19%	11%	62%

Table 19: Impact of Decreased Availability of Patents on Investment Decisions: Weighted Mean

Industry	Mean (1–5 Scale)
Construction	2.78
Transportation	2.62
Software and the Internet	2.59
Communications	2.54
Energy	2.47
Computer/Electronic Hardware	2.26
Semiconductors	2.09
Medical Devices	1.83
Biotechnology	1.78
Pharmaceutical	1.70

Table 20: Impact of Decreased Availability of Patents on Investment Decisions: Responses

Industry	Strongly Increase	Somewhat Increase	No Impact	Somewhat Decrease	Strongly Decrease
Construction	1%	3%	71%	21%	3%
Transportation	2%	5%	54%	32%	7%
Soft. & the Internet	1%	6%	53%	30%	9%
Communications	1%	5%	52%	31%	11%
Energy	2%	4%	48%	33%	13%
Comp./Elecs. Hard.	2%	4%	33%	40%	21%
Semiconductors	1%	2%	30%	40%	27%
Medical Devices	1%	3%	14%	40%	42%
Biotechnology	3%	2%	17%	29%	50%
Pharmaceutical	3%	1%	14%	25%	56%

Table 21: Impact of Supreme Court's Eligibility Cases on Existing Investments

Response	Percent
Very positive	1%
Somewhat positive	13%
No Impact	46%
Somewhat negative	33%
Very negative	7%

Table 22: Have Any of the Supreme Court's Eligibility Cases Affected Firm Decisions Whether to Invest in Companies

Response	Percent
Yes	33%
No	61%
Don't know	6%

Table 23: Respondents Indicating the Supreme Court's Eligibility Cases Have Affected Firm Decisions Whether to Invest in Companies, by Industry

Industries	Percent
Pharmaceutical	39%
Medical Devices	38%
Semiconductors	38%
Biotechnology	37%
Transportation	36%
Communications	35%
Computer/Electronic Hardware	34%
Construction	34%
Energy	33%
Software and the Internet	32%

Table 24: Which of the Supreme Court's Eligibility Cases Affected Firm Decisions Whether to Invest in Companies

Response	Percent
Ass'n for Molecular Pathology v. Myriad	38%
Mayo v. Prometheus	29%
Alice v. CLS Bank	20%
Bilski v. Kappos	13%

Table 25: How Have the Cases You Selected Affected Firm Decisions Whether to Invest in Companies

Response	Percent
Decreased investments overall	49%
Shifted investments between industries	34%
Increased investments overall	8%
Other	9%

Table 26: Investments Shifted Away from These Industries

Industries	Percent
Pharmaceutical	26%
Biotechnology	24%
Medical Devices	21%
Software and the Internet	21%
Communications	6%
Computer/Electronic Hardware	3%
Construction	0%
Transportation	0%
Energy	0%
Semiconductors	0%

Table 27: Investments Shifted into These Industries

Industries	Percent
Computer/Electronic Hardware	16%
Energy	16%
Medical Devices	13%
Software and the Internet	13%
Pharmaceutical	6%
Biotechnology	6%
Semiconductors	6%
Construction	3%
Communications	3%
Transportation	0%

Table 28: Has Decreased Availability of Patents Since 2009 Contributed to Your Firm's Change in Investments (Unknowledgeable Investors Only)

Type of Change	Yes	No	Don't Know
No Change	2%	95%	4%
Inc'd investments overall	0%	88%	12%
Dec'd investments overall	14%	82%	5%
Shifted investments b/w industries	4%	84%	12%

Table 29: Eligibility Unknowledgeable Investors Shifted Investments Away from These Industries

Industries	Percent
Energy	17%
Semiconductors	12%
Pharmaceutical	11%
Medical Devices	11%
Biotechnology	10%
Communications	10%
Computer/Electronic Hardware	10%
Software and the Internet	7%
Construction	3%
Transportation	2%

Table 30: Eligibility Unknowledgeable Investors Shifted Investments into These Industries

Industries	Percent
Software and the Internet	32%
Computer/Electronic Hardware	11%
Transportation	11%
Medical Devices	10%
Communications	8%
Biotechnology	5%
Energy	5%
Pharmaceutical	3%
Construction	3%
Semiconductors	2%

Table 31: Eligibility Knowledgeable Investors' Comments: Positive or Negative

Characterization	Percent
Positive	13%
Negative	83%
Other	4%

Table 32: Eligibility Knowledgeable Investors' Comments: Percent by Industry

Industries	Percent
Software and the Internet	35%
Biotechnology	30%
Pharmaceutical	13%
Medical Devices	0%
Semiconductors	0%
Transportation	0%
Communications	0%
Computer/Electronic Hardware	0%
Construction	0%
Energy	0%
Generalized	35%

Table 33: Eligibility Knowledgeable Investors' Comments: Percent Positive and Negative by Industry

Industries	Positive	Negative
Software and the Internet	25%	63%
Biotechnology	14%	86%
Pharmaceutical	0%	100%
Medical Devices	0%	0%
Semiconductors	0%	0%
Transportation	0%	0%
Communications	0%	0%
Computer/Electronic Hardware	0%	0%
Construction	0%	0%
Energy	0%	0%
Generalized	0%	100%