Declining Patent Reliability and Venture Capital Reallocation

[Forthcoming, in *Bringing Medicines to Life: How Intellectual Property Enables Innovation in the Life Sciences* (eds. Jonathan M. Barnett and Bowman Heiden, Cambridge University Press 2026)]

Mark F. Schultz[1]

Abstract

Between 2004 and 2017, venture capital investment in patent-intensive industries fell from over 50% to 28% of total U.S. VC funding. The share of VC for pharmaceutical startups collapsed from 7% to under 1%, while medical devices lost half their share. This reallocation coincided with patent system changes, *eBay*, *Mayo*, *Myriad*, *Alice*, and the America Invents Act, that made patents harder to obtain, easier to invalidate, and more difficult to enforce. Did weakened patent reliability drive capital away from life sciences innovation?

This chapter examines venture capital reallocation by combining sector-level quantitative analysis with qualitative evidence from innovator interviews. While existing literature demonstrates that patents matter for individual startups, this research tracks how capital shifted across the entire economy during a period when the patent system weakened. The analysis uses comprehensive PitchBook data covering over 200 industry categories, supplemented by interviews with life sciences entrepreneurs, venture capitalists, and technology transfer professionals explaining how patent uncertainty reshaped investment decisions.

Three strands of evidence converge. Quantitative data show declines concentrated in patent-intensive sectors with long development timelines and high capital requirements. Economic theory explains the mechanism: reduced expected returns contract innovation investment proportionally. Qualitative testimony reveals practitioners explicitly attributing changed behavior to patent uncertainty: venture capitalists avoiding early-stage investments, device innovators shifting from high-impact implants to wellness products, and diagnostic commercialization stalling after *Mayo*. This convergence suggests patent reliability substantially influences not just firm outcomes but systemic capital allocation, determining which therapeutic approaches receive funding and ultimately which treatments reach patients.

I. Introduction

Between 2004 and 2017, venture capital investment in patent-intensive industries fell from over 50% to roughly 28% of total U.S. venture funding.[2] Pharmaceutical startups' share collapsed

[1] Goodyear Tire & Rubber Company Endowed Chair in Intellectual Property Law; Faculty Chair, IPPI: The IP Policy Institute, The University of Akron School of Law. I received an honorarium for contributing a chapter to this volume on the subject matter addressed herein; however, I was given no constraints or guidance regarding its specific composition, including its point of view or findings

[2] Author's calculations from PitchBook Data, Inc., *PitchBook Database: U.S. Venture Capital Deals, 2004–2017* (custom dataset, on file with author).

from 7% to under 1%, and medical devices lost half their share.[3] These declines coincided with substantial patent system changes, including *eBay Inc. v. MercExchange* (2006),[4] *Mayo Collaborative Services v. Prometheus Laboratories, Inc.* (2012),[5] *Association for Molecular Pathology v. Myriad Genetics, Inc.* (2013),[6] and *Alice Corp. v. CLS Bank International* (2014),[7] and the America Invents Act of 2011,[8] which collectively made patents harder to obtain, easier to invalidate, and more difficult to enforce.

Venture capital plays a critical bridging role in life sciences innovation. While large pharmaceutical companies conduct substantial R&D, venture-backed startups frequently develop the platform technologies and early-stage therapeutics that larger firms later acquire and scale.[9] Academic laboratories generate scientific breakthroughs but typically lack the resources and expertise to navigate clinical trials, regulatory approval, and manufacturing scale-up. Venture capital finances this essential translation from discovery to approved treatment.[10] Changes in venture capital allocation therefore signal shifts in which therapeutic approaches and disease areas receive development funding.

This chapter asks whether patent system changes contributed to the observed capital reallocation. The empirical foundation for this analysis was first developed by the author in a 2020 policy white paper,[11] which documented broad patterns of venture capital reallocation. This chapter revisits those findings in a scholarly frame, situating them within the academic literature, refining the methodological discussion, and considering their implications for innovation policy. Using comprehensive PitchBook data from 2004–2017, it documents the timing and scale of venture capital's reallocation away from patent-intensive industries, drawing insights into those findings with case studies based on interviews with leading innovators and investors.

The approach does not provide formal econometric identification of causal effects. Its value lies in showing the broader systemic consequences of weakened patent reliability: whole sectors losing share of investment, capital flowing into industries with shorter development cycles and

---

[3] *Id.*

[4] *eBay Inc. v. MercExchange, LLC.,* 547 U.S. 388 (2006) (establishing four-factor test for injunctions, making them more difficult to obtain for patent holders)

[5] *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66 (2012) (holding that a method of optimizing drug dosage by correlating metabolite levels with health outcomes was an unpatentable "law of nature").

[6] *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013) (holding that isolated, naturally occurring DNA is not patent-eligible, but complementary DNA (cDNA), which is not naturally occurring, may be).

[7] *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208 (2014) (holding that implementing an abstract idea on a computer does not make it patent-eligible).

[8] Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011).

[9] *See generally* Rebecca S. Eisenberg, *Public Research and Private Development: Patents and Technology Transfer in Government-Sponsored Research*, 82 Va. L. Rev. 1663 (1996) (describing the role of startups and patent protection in translating scientific discoveries into therapies).

[10] Paul Gompers & Josh Lerner, THE VENTURE CAPITAL CYCLE 1-15 (2d ed. 2004).

[11] Mark F. Schultz, *The Importance of an Effective and Reliable Patent System to Investment in Critical Technologies,* Alliance of U.S. Startups & Inventors for Jobs (USIJ) Study (July 2020), https://static1.squarespace.com/static/5746149f86db43995675b6bb/t/5f2829980ddf0c536e7132a4/1596467617939/USIJ+Full+Report_Final_2020.pdf

less IP dependence, and practitioners themselves attributing changes in behavior to patent-system uncertainty.

The existing literature has largely focused on the importance of patents to venture capital funding at the firm level. Econometric studies and surveys show that patents increase startup financing, growth, and survival, particularly in biotechnology and pharmaceuticals.[12] In this volume, Ted Sichelman provides a thorough review of this work, synthesizing evidence on how startups use patents and how investors respond.[13]

This chapter is complementary to that body of work but takes a different vantage point: a macro, sector-level analysis of venture capital allocation across the U.S. economy during a period of patent-system weakening.

Its contribution is twofold. First, it extends prior firm-level studies by offering a descriptive account of systemic reallocation across industries. Second, it links those sectoral trends to legal change through qualitative evidence, showing how investor expectations about patent enforceability and exclusivity translated into reallocation decisions.

II. Background: Patent Law Shifts and Investment in Innovation

Beginning in 2006, the U.S. patent system underwent a series of legal and legislative changes that, taken together, made patents harder to obtain, easier to challenge, and more difficult to enforce. For industries such as life sciences, where innovation depends on long development timelines and heavy upfront costs, these shifts altered the basic calculus of risk and return.

Whatever the legal or policy merits of each individual change, they collectively made patent protection less certain and reliable, with predictable results. Altering the security of the property rights on which returns depend introduces an element of risk and uncertainty that causes investors to discount their expected returns. Economic research has established that reducing expected returns from biopharma investment (in other words, revenue) leads to decreased R&D investment. Surveys of investors regarding their decisions in the wake of patent eligibility changes confirms this sensitivity.

A. The Changing Patent Landscape, 2006–2017

[12] *See* Deepak Hegde, Alexander Ljungqvist & Chenchuan Raj, *Quick or Broad Patents? Evidence from U.S. Startups*, 35 REV. FIN. STUD. 2705 (2021); Joan Farre-Mensa, Deepak Hegde & Alexander Ljungqvist, *What Is a Patent Worth? Evidence from the U.S. Patent 'Lottery'*, 75 J. FIN. 639 (2019); Patrick Gaule, *Patents and the Success of Venture Capital-Backed Startups: Evidence from Biotechnology*, 66 J. INDUS. ECON. 613 (2018); Carolin Haeussler, Dietmar Harhoff & Elisabeth Mueller, *How Patenting Informs VC Investors—The Case of Biotechnology*, 43 RES. POL'Y 1286 (2014); Jan Hoenig & Joachim Henkel, *Quality Signals? The Role of Patents, Alliances, and Team Experience in Venture Capital Financing*, 44 RES. POL'Y 1049 (2015); Stuart J.H. Graham, Robert P. Merges, Pamela Samuelson & Ted Sichelman, *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255 (2009).

[13] Ted Sichelman, *Biomedical Startups & Patenting: 17 Years Since the Berkeley Patent Survey* (forthcoming in this volume).

One of the first major changes came in *eBay Inc. v. MercExchange* (2006), where the Supreme Court made it much more difficult for patent holders to obtain injunctions against infringers.[14] Before *eBay*, an injunction was the typical remedy, which meant patents provided strong leverage in negotiations. After *eBay*, injunctions became harder to secure, especially for companies that license their technology rather than manufacture products. For startups in pharmaceuticals or devices, this weakened the ability to assure investors that competitors could be kept off the market.

The next wave of doctrinal change concerned patent eligibility. In a trilogy of cases, *Mayo Collaborative Services v. Prometheus Laboratories, Inc.* (2012),[15] *Association for Molecular Pathology v. Myriad Genetics, Inc.* (2013),[16] and *Alice Corp. v. CLS Bank International* (2014),[17] the Supreme Court narrowed the scope of patentable subject matter. In diagnostics and personalized medicine, claims that rely on correlations between biological markers and health outcomes were characterized as unpatentable laws of nature. The Court also held that isolated, naturally occurring DNA sequences are not patent-eligible, although complementary DNA (cDNA) may be. Together, these decisions created substantial uncertainty, as promising lines of biomedical research no longer carried the same assurance of patent protection.

Congress also reshaped the patent system through the America Invents Act of 2011.[18] The Act created new proceedings at the Patent Trial and Appeal Board, particularly inter partes review, that allowed third parties to challenge patents after they had been granted.[19] In its early years, the PTAB invalidated patents at high rates, leading critics to call it a "death squad" for patent rights.[20] For investors, this raised the risk that even carefully vetted patents could be struck down after large sums had already been committed. The Act also shifted the United States from a first-to-invent to a first-to-file system.[21] This change arguably favored larger, well-resourced firms that could file quickly and put smaller, resource-constrained startups at a disadvantage.

For industries like software, where products can be protected through speed to market, trade secrecy, or alternative business models, these shifts were significant but not existential. For the life sciences, where innovation is slow, expensive, and easily copied once disclosed, the changes struck at the core of the business model.

---

[14] 547 U.S. 388 (2006).

[15] *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66 (2012) (holding that a method of optimizing drug dosage by correlating metabolite levels with health outcomes was an unpatentable "law of nature").

[16] *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013) (holding that isolated, naturally occurring DNA is not patent-eligible, but complementary DNA (cDNA), which is not naturally occurring, may be).

[17] *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208 (2014) (holding that implementing an abstract idea on a computer does not make it patent-eligible).

[18] Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (codified in scattered sections of 35 U.S.C.).

[19] 35 U.S.C. §§ 311–319 (2018) (establishing inter partes review as a proceeding before the Patent Trial and Appeal Board).

[20] JOHN R. THOMAS, CONG. RSCH. SERV., R44905, INTER PARTES REVIEW OF PATENTS: INNOVATION ISSUES 2 (2017) (quoting then-Federal Circuit Chief Judge Randall Rader).

[21] Leahy-Smith America Invents Act § 3, 125 Stat. at 285–87 (amending 35 U.S.C. § 102 to implement a first-inventor-to-file system).

B. The Response of Investors to Changes in Patent Policy

Economic theory provides clear predictions about how investment in innovation responds to policy changes. The central concept is "innovation elasticity," which measures how sensitive research and development is to expected revenues. When revenues fall, whether from weaker patent protection, price regulation, or other policies, firms and investors scale back their R&D activity.

A comprehensive review by the USC Schaeffer Center surveyed fifteen empirical studies of pharmaceutical innovation elasticity.[22] Despite differences in methodology, the studies reached a consistent conclusion: innovation elasticity is positive. In practical terms, this means that when revenues decline, so does R&D. The Schaeffer Center concluded that a reasonable range of elasticity estimates lies between 0.25 and 1.5. A 10% reduction in expected revenues would therefore reduce pharmaceutical innovation by 2.5 to 15% percent.

Survey evidence complements these econometric findings. Professor David Taylor of SMU Law School asked 475 venture capital and private equity investors how patent eligibility decisions affected their behavior.[23] Substantial percentages of responders indicated that the availability of patents was important to their investment decisions:

- 74 percent said patent eligibility is an important factor in investment decisions.[24]
- 62 percent said their firms were less likely to invest when patents are unavailable.
- 33 percent of investors who knew about the Court's eligibility decisions reported that eligibility decisions had affected their investment decisions, shifting out of technology industries.[25]

The same survey revealed important cross-industry differences. Investors indicated they would reduce investment dramatically if patents were unavailable in biotechnology (77 percent), medical devices (79 percent), and pharmaceuticals (73 percent).[26] By contrast, they reported that eliminating patents in software, transportation, or energy would affect their decisions only slightly. This divergence illustrates why legal changes to patents matter most in life sciences.[27]

These findings align with a broader empirical literature on patents and startup financing, largely focused on firm level outcomes. As Ted Sichelman details in his chapter in this volume, dozens of studies now document the role of patents in attracting venture capital to startups, with particularly strong effects in life sciences.[28]

---

[22] Darren Filson et al., *The Elasticity of Pharmaceutical Innovation: How Much Does Revenue Drive New Drug Development?* (USC Schaeffer Ctr. for Health Pol'y & Econ., White Paper Series, Feb. 2025).
[23] David O. Taylor, Patent Eligibility and Investment , 41 CARDOZO L. REV. 2019 (2020).
[24] *Id.* at 2054.
[25] *Id.* at 2028-29.
[26] *Id.* at 2028.
[27] *Id.*
[28] Ted Sichelman, *Biomedical Startups & Patenting: 17 Years Since the Berkeley Patent Survey* (forthcoming in this volume).

This econometric work confirms the importance of patents to young firms across various dimensions.[29] For example, Farre-Mensa, Hegde, and Ljungqvist show that the grant of a first patent significantly increases a startup's growth and financing prospects.[30] Hegde, Ljungqvist, and Raj find that the timing and breadth of patents shape startup survival and growth.[31] Other contributions underscore related mechanisms: Ziedonis and co-authors show that patents provide salvage value for failed firms, thereby cushioning downside risk for investors.[32]

Much of this research observes that patents are particularly important in the life sciences. The Berkeley Patent Survey, for example, found that life sciences entrepreneurs place far greater weight on patents than do software and internet startups, reflecting their reliance on enforceable exclusivity to finance long-horizon projects.[33] Gaule demonstrates that patents materially improve the prospects of VC-backed biotechnology firms.[34] Haeussler, Harhoff, and Müller demonstrate that in biotechnology specifically, patent filings accelerate venture investment by signaling quality and reducing information asymmetries for investors.[35]

This literature focuses on firm-level outcomes and uses econometric or survey methods to identify causal effects. Taken together, this research complements the elasticity estimates and survey evidence presented above, confirming that patents function both as appropriability mechanisms and as signals, with particularly important effects in the life sciences.

By contrast, this chapter provides a sector-level descriptive analysis of how venture capital reallocated across the U.S. economy during a period of patent-system weakening. It combines quantitative data with case studies based on innovator and investor interviews to capture systemic consequences that micro-level studies cannot observe.

One reason for the sensitivity of investors to patent protection for life sciences investment likely lies in the structure of life sciences innovation. Developing a new treatment often requires ten to twelve years of research and clinical trials, costs in the billions, and the ability to withstand a failure rate of more than ninety percent.[36] Once disclosed, new treatments and devices are

---

[29] *See generally* Ted Sichelman, *Biomedical Startups & Patenting: 17 Years Since the Berkeley Patent Survey* (forthcoming in this volume).
[30] Joan Farre-Mensa, Deepak Hegde & Alexander Ljungqvist, *What Is a Patent Worth? Evidence from the U.S. Patent "Lottery"*, 75 J. FIN. 639 (2019).
[31] Deepak Hegde, Alexander Ljungqvist & Joris J. Morand Raj, *Quick or Broad Patents? Evidence from U.S. Startups*, 35 REV. FIN. STUD. 2705 (2022).
[32] Carlos Serrano & Rosemarie Ziedonis, *Do patent assets have a second life when startups fail? An analysis of the redeployment likelihood and mode of transfer*, 46 STRAT. MGT. J. 82 (2024); David H. Hsu & Rosemarie H. Ziedonis, *Resources as Dual Sources of Advantage: Implications for Valuing Entrepreneurial-Firm Patents*, 34 STRAT. MGMT. J. 761 (2013).
[33] Stuart J.H. Graham, Robert P. Merges, Pamela Samuelson & Ted Sichelman, *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255 (2009).
[34] Patrick Gaule, *Patents and the Success of Venture Capital-Backed Startups: Evidence from Biotechnology*, 66 J. INDUS. ECON. 613 (2018)
[35] Carolin Haeussler, Dietmar Harhoff & Elisabeth Müller, *How Patenting Informs VC Investors—The Case of Biotechnology*, 43 RES. POL'Y 1286 (2014).
[36] Joseph A. DiMasi et al., *Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs*, 47 J. HEALTH ECON. 20, 26–30 (2016) (estimating average out-of-pocket and capitalized costs of $2.6 billion per approved drug); Erika Lietzan & Kristina M.L. Acri née Lybecker, *Distorted Drug Patents*, 95 WASH.L. REV. 1317, 1327-29 (2020) (reporting average drug development times of 10–12 years before FDA approval); *see also* Robert Harrison,

relatively easy to copy. Trade secrecy offers little protection, since regulators require full disclosure of safety and efficacy data, and competitors can reverse-engineer products once they are on the market. In such an environment, enforceable patents are the key assurance that investors can eventually earn a return.

In short, both theory and evidence point to the same conclusion. When patents become less reliable, investors reduce their exposure to long-horizon, high-risk innovation. This effect is visible across many industries, but it is especially pronounced in life sciences, where patent protection is central to the innovation model.

III. Venture Capital Investment Shifts, 2004–2017

To evaluate whether patent-system changes coincided with shifts in innovative investment, this section examines patterns of U.S. venture capital allocation across industries. The focus is not on absolute dollar flows but on each sector's *share* of the venture capital market, which captures how investors reallocated capital relative to other opportunities. This approach helps control for macroeconomic growth and cyclical fluctuations, and it provides a clear picture of which industries gained or lost favor during the period when patent reliability weakened.

Between 2004 and 2017, pharmaceuticals, biotechnology, and medical devices, all sectors highly dependent on enforceable patent rights, lost significant venture capital share, while software and other less patent-reliant industries grew. These findings derive from a dataset first compiled in 2019, which provides a consistent panel for that period. Developments since then, including the pandemic surge in life sciences investment and the Inflation Reduction Act's effects on pricing incentives, fall outside this analysis and merit separate examination.

A. Data and Methods

The analysis uses PitchBook's venture capital database, a commercial database that aggregates deal information from press releases, regulatory filings, websites, and direct verification.[37] The dataset covers U.S. venture capital transactions from 2004 through 2017, reporting dollars invested, number of deals, and number of portfolio companies across more than 200 industry categories.[38]

To understand venture capital allocation changes and its potential relation to patent strength, the analysis examines shifts between patent-intensive and non-patent-intensive industries. Defining "patent-intensive" industries required linking PitchBook's proprietary industry taxonomy to established economic classifications. The study uses the definition from the U.S. Patent and Trademark Office (USPTO) 2016 study of patent intensive industries, which defines "patent-intensive" industries as those in manufacturing with patenting per employee at or above the

---

Phase II and phase III failures: 2013–2015, 15 NATURE REV DRUG DISCOV. 817–818 (2016); Michael Hay, et al., *Clinical Development Success Rates for Investigational Drugs,* 32 NATURE BIOTECHNOLOGY 1 (2014) (noting that approximately 90% of clinical candidates fail, most often due to efficacy or safety issues).

[37] PitchBook, *Research Process*, https://pitchbook.com/research-process

[38] PitchBook–NVCA, *Venture Monitor* (Q4 2019), https://pitchbook.com/news/reports (providing industry taxonomy and data coverage).

manufacturing-sector average.[39] The USPTO's designation included pharmaceuticals, biotechnology, medical devices. semiconductors, and other advanced hardware. Non-patent-intensive categories include software, consumer services, and food and beverage. Because PitchBook does not use NAICS codes, a concordance was constructed between PitchBook categories and NAICS industries, which was then aligned with the USPTO's patent-intensive list.[40]

Recognizing that the USPTO's 2016 designation applied only to manufacturing, the analysis also drew on the European Union Intellectual Property Office's economy-wide classifications to interpret PitchBook categories outside manufacturing and provide a robustness check. The EUIPO has similarly found that manufacturing sectors are substantially more patent-reliant than software or services, a distinction that supports treating PitchBook's non-manufacturing categories as "less patent-intensive" for comparative purposes.[41]

The study window of 2004–2017 reflects the PitchBook dataset obtained for this project in 2019, when the original analysis was conducted. This window captures the period of major patent system changes while predating distinct post-2019 dynamics including pandemic-driven funding surges and Inflation Reduction Act pricing provisions that merit separate analysis.

Several robustness checks confirm that the observed patterns are not artifacts of classification or denominator choice. The decline of patent-intensive industries is visible in both company counts and dollar shares, and appears under alternative groupings of industries. These consistency checks suggest that the results reflect genuine reallocation patterns rather than data anomalies.

This approach has limits. Unlike econometric studies that exploit quasi-experimental variation in patent examination to estimate firm-level outcomes,[42] this analysis does not identify causal effects with statistical precision. Instead, the contribution is descriptive: documenting how venture capital shifted across sectors during a period of legal change and shedding potential light on those patterns with qualitative interviews that explain how investors and innovators perceived the role of patent reliability in shaping their decisions.

B. Findings

---

[39] U.S. PATENT & TRADEMARK OFF., *Intellectual Property and the U.S. Economy: Industries in Focus* 3 (2012); U.S. PATENT & TRADEMARK OFF., *Intellectual Property and the U.S. Economy: 2016 Update* 33 (2016). In 2022, after we performed the original analysis, the USPTO changed its methodology to expand its coverage of patent-intensive industries beyond manufacturing. *See* U.S. PATENT & TRADEMARK OFF., *Intellectual Property and the U.S. Economy: Third edition* (2022). We did not re-do the analysis to reflect this newer methodology, but the USPTO results largely reflect the conclusions we reached by supplementing the USPTO's methodology with the EUIPO's then-more extensive coverage.
[40] See PitchBook–NVCA, *Venture Monitor* (Q4 2019) (describing category definitions used to construct concordance), and U.S. PATENT & TRADEMARK OFF., *Intellectual Property and the U.S. Economy: 2016 Update* 33 (2016).
[41] EUR. UNION INTELL. PROP. OFF., *Intellectual Property Rights Intensive Industries and Economic Performance in the European Union* (2019).
[42] See, e.g., Joan Farre-Mensa, Deepak Hegde & Alexander Ljungqvist, *What Is a Patent Worth? Evidence from the U.S. Patent "Lottery"*, 75 J. FIN. 639 (2019), and other studies cited in the Sichelman chapter in this volume.

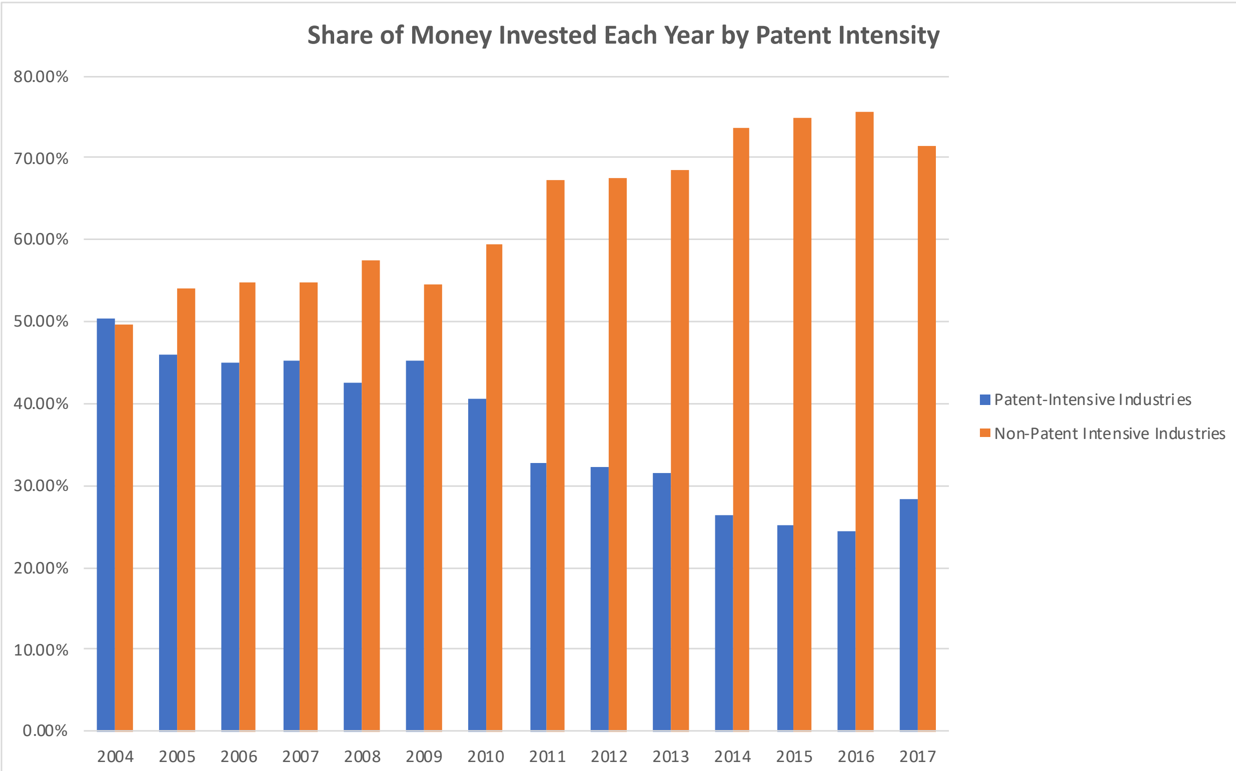
1. The Decline of Patent-Intensive Industries

The most striking pattern in the data is the retreat of venture capital from patent-intensive manufacturing. In 2004, these industries, including pharmaceuticals, biotechnology, medical devices, semiconductors, and related hardware, accounted for more than half of all U.S. venture capital funding. By 2017, their share had fallen to roughly 28 percent, with the low point at just under 25 percent in 2016. In a little over a decade, sectors that once dominated the venture capital landscape lost more than twenty percentage points of market share.

This contraction was not simply a matter of slower growth compared to booming software. Total venture capital investment expanded substantially over the period, yet patent-intensive industries failed to keep pace. In some cases, they even declined in absolute terms. For example, companies creating semiconductors receive less funding in both relative ***and*** absolute terms, as they received about $1 billion less in funding during the later period than the early period.

The consistency of this downward trajectory is notable. Year-to-year fluctuations occurred, but the long-run trend was one of sustained erosion in the venture capital share of patent-reliant sectors. Figure 1 illustrates this sustained decline.

Figure 1: Share of Money Invested Each Year by Patent Intensity



Source: Pitchbook Data, on file with author

2. Software's Rise and Patent-Intensive Manufacturing's Retreat

The counterpart to the decline in patent-intensive manufacturing was the rapid ascent of software. In 2004, manufacturing companies accounted for about 42 percent of firms receiving venture funding, while software firms represented roughly 32 percent. By 2017, these positions had reversed: manufacturing fell to 29 percent, while software climbed to 41 percent. In dollar terms, software's share rose from about one-quarter to more than one-third of all venture investment, while manufacturing dropped from over half to about one-third.

This was not a small shift. In little more than a decade, venture capitalists redirected billions of dollars in relative terms from patent-reliant manufacturing toward software-based ventures. The timing coincided with a period of extraordinary opportunity in software: the introduction of the iPhone in 2007, the explosive growth of social media platforms, the maturation of cloud computing, and the creation of the app economy. These developments generated a wave of startups that offered rapid growth prospects without the long development timelines or heavy patent dependence of manufacturing and life sciences.

While software's exceptional opportunities clearly attracted capital, three patterns indicate that patent system changes also played a substantial role. First, semiconductors, another hardware sector, declined in absolute dollars, receiving roughly $1 billion less during 2013-2017 than 2004-2008 despite overall VC market growth. Second, pharmaceutical investment collapsed to 0.79% of total VC, representing near-total abandonment rather than mere slower growth. Third, medical devices lost half their share within seven years. If software opportunities alone explained the reallocation, we would expect proportional slower growth across all non-software sectors. Instead, the declines concentrated in patent-intensive industries with long development timelines and high capital requirements, precisely those most dependent on enforceable exclusivity.

The broader reallocation thus reflected both push and pull forces. Patent-intensive industries struggled to maintain their position, while software presented an unusually attractive alternative. Table 1 captures this cross-sectoral reversal.

Table 1: Share of Money Invested Each Year by Sector

	Manufacturing	Services	Software	Other
2004	52%	17%	25%	6%
2005	48%	19%	26%	7%
2006	48%	18%	25%	9%
2007	48%	20%	26%	6%
2008	45%	21%	27%	7%
2009	48%	19%	27%	6%
2010	44%	20%	29%	8%
2011	36%	24%	33%	7%
2012	37%	22%	34%	7%
2013	35%	25%	36%	4%
2014	29%	21%	44%	5%
2015	30%	26%	39%	5%
2016	28%	18%	49%	6%
2017	35%	20%	37%	9%

Source: Pitchbook Data, on file with author

3. Life Sciences in Relative Decline

The sharpest declines occurred in the life sciences.

Pharmaceutical startups saw their share of venture capital shrink from roughly 7 percent in 2004 to under 1 percent by 2017, a decline of nearly 90 percent. By the end of the period, pharmaceuticals accounted for less than one cent on the dollar of total U.S. venture funding, a near withdrawal of venture investors from early-stage drug development.

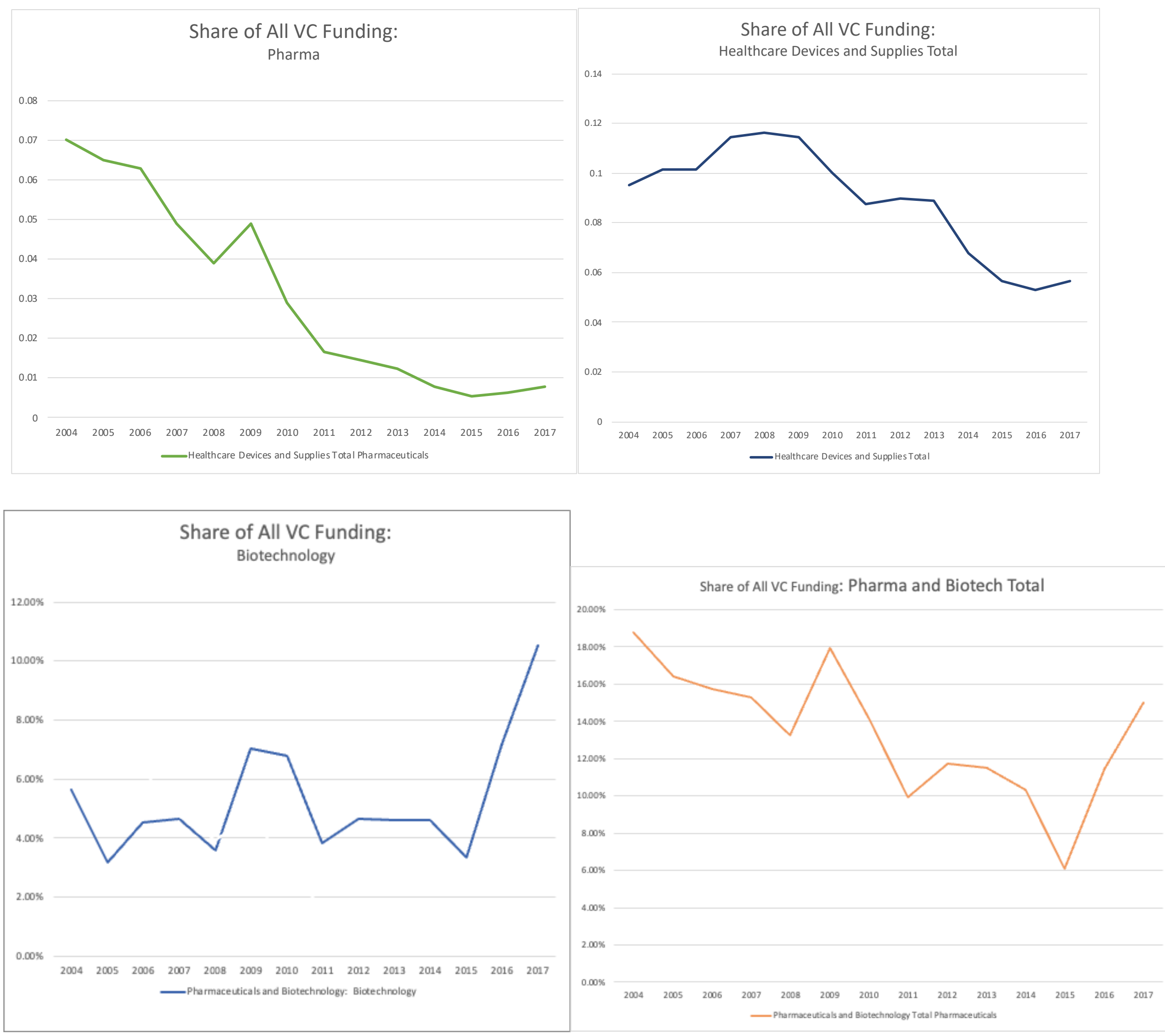
Medical devices followed a similar trajectory. After peaking near 12 percent of venture capital in 2008, the sector steadily lost ground, falling to about 6 percent by 2015 and remaining at that level through 2017. Within a decade, venture investors had cut their relative commitments to device companies in half.

Biotechnology displayed a more complex pattern. Funding levels declined through 2014 but rebounded in 2016–2017. Even with that rebound, however, the overall life sciences picture remained negative. Biotechnology's late gains could not offset the pharmaceutical collapse or the sustained contraction in devices. The late-period biotech recovery, whether driven by platform technology breakthroughs like CRISPR, successful CAR-T clinical trials, or other factors, merit further investigation but fall outside this Chapter's scope

Taken together, pharmaceuticals, biotechnology, and medical devices lost about one-fifth of their collective share of U.S. venture capital between 2004 and 2017. These declines are striking not only in scale but also in concentration. They affected precisely the industries that depend most heavily on patent protection, require long development timelines, and involve substantial capital commitments before revenue generation.

Figure 2 and Tables 3 and 4 illustrate these trends.

Figure 2: Trends in Patent-Intensive Life Sciences



Source: Pitchbook Data, on file with author

Table 3: Share of Money Invested Healthcare Devices and Supplies

	Diagnostic Equipment	Medical Supplies	Monitoring Equipment	Other Devices & Supplies	Surgical Devices	Therapeutic Devices	TOTAL: Healthcare Devices and Supplies
2004	2%	1%	1%	1%	3%	3%	10%
2005	2%	1%	1%	1%	3%	3%	10%
2006	2%	1%	1%	1%	4%	3%	10%
2007	2%	1%	1%	1%	3%	4%	11%
2008	2%	1%	1%	1%	3%	4%	12%
2009	2%	0%	1%	1%	4%	5%	11%
2010	2%	0%	0%	0%	3%	3%	10%
2011	2%	0%	0%	1%	3%	3%	9%
2012	2%	1%	1%	1%	2%	3%	9%
2013	2%	0%	1%	1%	3%	3%	9%
2014	1%	0%	2%	0%	2%	2%	7%
2015	1%	0%	1%	1%	1%	1%	6%
2016	1%	0%	0%	0%	1%	2%	5%
2017	1%	0%	1%	0%	1%	2%	6%

Table 4: Share of Money Invested Pharmaceuticals and Biotechnology

	Biotechnology	Discovery Tools (Healthcare)	Drug Delivery	Drug Discovery	Other Pharmaceuticals & Biotechnology	Pharmaceuticals	Total: Pharmaceuticals and Biotechnology
2004	6%	1%	1%	4%	0%	7%	19%
2005	3%	1%	1%	5%	1%	6%	16%
2006	5%	0%	1%	4%	0%	6%	16%
2007	5%	0%	1%	4%	0%	5%	15%
2008	4%	1%	2%	3%	0%	4%	13%
2009	7%	0%	1%	4%	0%	5%	18%
2010	7%	0%	1%	3%	0%	3%	14%

2011	4%	0%	1%	3%	0%	2%	10%
2012	5%	0%	1%	4%	0%	1%	12%
2013	5%	0%	1%	4%	0%	1%	11%
2014	5%	0%	0%	4%	0%	1%	10%
2015	3%	0%	0%	2%	0%	1%	6%
2016	7%	0%	1%	3%	0%	1%	11%
2017	11%	0%	0%	3%	0%	1%	15%

4. Winners and Losers Across Industries

Comparison of average shares at the beginning and end of the study period highlights which industries gained and which lost ground (see Table 5).

On the winning side, software-related industries dominated. Social networking and platform companies captured progressively larger shares throughout the 2010s, fueled by the rise of firms like Facebook, Twitter, and LinkedIn. Consumer food and beverage also saw surprising growth, surpassing pharmaceuticals in venture capital share by 2017, a reversal that would have seemed implausible only a decade earlier.

On the losing side, life sciences stood out. Pharmaceutical funding shrank from about 7 percent to less than 1 percent of total VC, medical device investment halved, and semiconductors fell both in share and absolute dollars, receiving roughly a billion dollars less in 2013–2017 than in 2004–2008. These declines were not scattered randomly across the economy; they were concentrated in industries with long development cycles, high capital requirements, complex regulatory hurdles, and reliance on enforceable patents for exclusivity.

Table 5 captures this reordering of venture capital priorities.

Table 5: Industries Winning & Losing Share of Venture Capital Funding Since 2004

Industry Sector	**Share of All VC Funding 2004 - 2008**	**Share of All VC Funding 2013 - 2017**	**Absolute Share Change**	**Percentage Change**
Industry Sectors Gaining Share				
Financial Services	1.60%	4.10%	2.50%	147.10%
Food and Beverage	0.40%	1.50%	1.10%	248.50%
Healthcare Technology Systems	1.20%	2.60%	1.40%	112.60%
Restaurants, Hotels and Leisure	0.40%	1.40%	1.00%	266.50%
Software	25%	40%	15.00%	57.60%
Total	**28.60%**	**49.60%**	**21.00%**	

Industry Sectors Losing Share				
Computer Hardware	3.40%	1.20%	-2.20%	-63%
Healthcare Devices and Supplies	10.70%	6.20%	-4.50%	-42.60%
Pharmaceuticals and Biotechnology	15.60%	12.40%	-3.20%	-20.10%
Semiconductors	3.40%	0.60%	-2.80%	-82.70%
Total	**33.10%**	**20.40%**	**-12.70%**	

5. Robustness and Alternative Explanations

The patterns documented here are robust across measures of dollars, deals, and companies. Still, alternative explanations merit attention.

- **The Great Recession:** The global economic downturn that began in 2008 was consequential and did affect the aggregate amount of capital that was invested, with overall levels falling in 2009 before resuming their upward climb and exceeding pre-recession levels 2011. However, such changes in aggregate dollars should not make a difference as this Chapter's methodology examines each sector's share of the venture capital market. In any event, life sciences investments the results presented here show that downward trends in shares either continued or briefly paused after this shock.
- **Software boom**: Extraordinary opportunities in software clearly drew capital, but the depth of the life sciences decline, especially in pharmaceuticals, where absolute dollars also stagnated, suggests that more may have been at work.
- **Rising development costs**: Drug development costs rose during this period, but higher costs should have shifted investment toward later-stage projects, not out of the sector altogether.
- **Technological maturation**: The "low-hanging fruit" thesis cannot fully explain the drop, as the period also saw major new therapeutic breakthroughs in gene therapy, immunotherapy, and mRNA-based treatments.

While each of these factors contributed, none adequately explains the concentration of decline in patent-intensive industries or the timing coinciding with patent system changes. Taken together, these explanations account for at least part of the story. But the timing and sectoral specificity of the declines, combined with interview evidence from practitioners (Part IV), support the conclusion that patent-system weakening contributed substantially to the reallocation of venture capital.

Subsequent developments, including the pandemic-driven surge in life sciences venture funding and the pricing provisions of the Inflation Reduction Act, have reshaped the innovation landscape. Those dynamics fall outside the scope of this chapter, which focuses on 2004–2017, when patent-system changes were likely the dominant source of uncertainty shaping venture capital allocation.

IV: Case Studies from Innovators and Investors

The quantitative data documented in Section III demonstrate that venture capital investment shifted dramatically away from patent-intensive industries between 2004 and 2017. But descriptive data alone cannot explain why these shifts occurred or whether patent system changes contributed to investment reallocation. This section presents case studies from successful innovators and investors who experienced these changes firsthand, providing qualitative evidence linking patent system weakening to altered investment behavior.

The case studies presented here are drawn from semi-structured interviews conducted in late 2019 and early 2020 as part of the earlier white paper examining patent system effects on innovation.[43] Interviewees were selected based on substantial track records in life sciences innovation and investment, representing diverse roles across the innovation ecosystem: company founders, venture capital investors, general counsel, and technology transfer professionals. The study conducted multiple interviews with leaders in pharmaceutical, biotechnology, and medical device sectors to capture practitioner perspectives on how patent-system changes affected innovation and investment decisions.

The individuals profiled here were chosen because their accounts illustrate distinct mechanisms through which patent system changes influenced investment behavior. They represent diverse perspectives across medical devices (Makower and Bright), biotechnology and pharmaceuticals (Rossi), patent strategy and intellectual property management (Cassidy), and technology commercialization (Kander). Together, their testimony reveals how patent system weakening affected not just investment volumes but the types of innovations pursued, the therapeutic areas addressed, and the risk profiles acceptable to investors.

A. The Essential Role of Patents: Dr. Derrick Rossi

Dr. Derrick Rossi exemplifies the scientist-entrepreneur whose work depends fundamentally on patent protection. A leading biomedical researcher, Rossi was the academic founder of Moderna Therapeutics and played a pivotal role in developing mRNA technology. Dr. Rossi, currently the CEO of the biotech startup Convelo, also helped found three other promising startups that are working to bring cutting-edge treatments to patients: Moderna, Magenta Therapeutics, and Intellia Therapeutics.

Rossi's perspective on patents, expressed in an interview conducted in late 2019, shortly before the COVID-19 pandemic, reflects the economic realities of biotechnology development:

"Developing innovative medical treatments costs hundreds of millions and is a 10-year road. That's a lot of investment. If you could not protect it at the end of the day, you would not have an

[43] Mark F. Schultz, *The Importance of an Effective and Reliable Patent System to Investment in Critical Technologies,* Alliance of U.S. Startups & Inventors for Jobs (USIJ) Study (July 2020), https://static1.squarespace.com/static/5746149f86db43995675b6bb/t/5f2829980ddf0c536e7132a4/1596467617939/USIJ+Full+Report_Final_2020.pdf

industry. There has to be the promise of protection and the ability to market it. Losing the ability to patent would be the end of this industry."[44]

These statements capture several key points. First, the temporal horizon: biotechnology development requires sustained investment over decade-long timelines before any revenue materializes. Second, the magnitude: hundreds of millions of dollars must be committed with substantial uncertainty about technical and regulatory success. Third, the necessity: without exclusivity protection, the entire business model collapses because competitors could immediately copy successful innovations without bearing development costs and risks.

Moderna's experience illustrates these dynamics. The company was founded in 2010, and by early 2020, it had yet to launch a single commercial product or turn a profit. Nevertheless, Moderna raised over $2 billion in investment through 2018 and another $600 million in its IPO, all based on promise rather than proof. It spent billions on mRNA technology development which was finally ready for application, just as COVID-19 arose. This level of investment with a long-time horizon requires the security of patents.

Rossi recalled that investors and pharmaceutical partners alike insisted on a strong patent position before committing capital. "You could be working on the coolest thing in the world," he explained, "but if you don't have IP, you don't have a company." He emphasized that intellectual property serves as "the future prospect that reassures investors."

For biotechnology startups, compelling science represents the threshold condition, but the intellectual property provides the foundation for securing investment. As he explained regarding his work with other startups, he wanted a robust portfolio of patent filings before engaging with pharmaceutical companies, "not only to protect the company's work prior to talking to potential investors, but also to assure pharma that we had protectable assets. I put a massive push on this from day one."

B. Shifting Innovation Focus: Josh Makower and Eb Bright

Josh Makower of New Enterprise Associates and Eb Bright of Exploramed have collaborated successfully for decades, launching medical device products and investing in healthcare innovation.Their partnership provides insight into how patent system changes alter not just investment volumes but the types of innovations pursued.

Makower and Bright described a deliberate shift in their innovation and investment focus:

"We have moved our investments from economically riskier implants that address serious medical needs to a greater focus on quality of life products."[45]

[44] All quotations, unless otherwise cited are from an interview with Derrick Rossi conducted in December 2019. Notes on file with the author.
[45] All quotations, unless otherwise cited are from an interview with Eb Bright conducted in December 2019 and an interview with Josh Makower conducted in January 2020. Notes on file with the author.

This seemingly simple statement reveals profound consequences. Medical implants addressing serious conditions—cardiovascular disease, joint deterioration, chronic diseases like diabetes and kidney conditions—require extensive development timelines, complex regulatory approval processes, and substantial capital investment. These innovations depend heavily on patent protection because development costs reach hundreds of millions of dollars, clinical trial periods extend 5-10 years before approval, manufacturing requires specialized facilities, competitors can reverse-engineer devices once disclosed, and alternative protection mechanisms prove impractical for FDA-approved devices.

By contrast, consumer wellness devices like wearable breast pumps involve shorter development timelines, lower regulatory barriers, reduced capital requirements, and less dependence on patent protection for commercial viability.

Bright explicitly acknowledged the public health implications of this shift:

"While quality of life is important, we are less likely to address issues such as cardiovascular disease and chronic diseases such as diabetes and kidney conditions. These high-impact types of diseases are not being addressed like they would have been previously. Everybody is less well off."

Thus, two successful, experienced medical device innovators with both the expertise and capital to develop breakthrough treatments have deliberately redirected their efforts away from serious diseases toward lower-risk, lower-impact innovations. The cause, they report, is patent system uncertainty that makes high-risk medical device development economically irrational under current conditions.

Makower articulated the broader consequences:

"Neither the healthcare system nor available treatments are ideal. We all experience pain and suffering that does not need to exist. If innovators can reduce health care costs, more people get treated. If innovators can develop better treatments, more people get healthier. Fundamentally, all these changes to the patent system affect our health and quality of life."

Makower also emphasized that patent reliability affects investment calculations across the medical device sector: "It makes every deal riskier, which has to be factored into every decision, from development, to investment, to evaluation, to exit." For venture capital firms, patent protection represents "a relatively binary check. The IP needs to be there, and the product needs to be non-infringing."

C. Patent Challenges and Investment Behavior: Barney Cassidy

Barney Cassidy served as General Counsel at Juno Therapeutics, a CAR-T cell therapy company that was acquired by Celgene for $9 billion in 2018 (Celgene was subsequently acquired by Bristol Myers Squibb). His experience provides particular insight into how post-grant patent challenges affect venture capital investment decisions and how patent portfolio strength influences company valuations.

CAR-T cell therapy uses the body's own immune system to fight cancer by extracting T cells from patients' blood, adding artificial receptors that enable the cells to kill cancer cells, and returning the modified cells to patients' bodies where they multiply and attack tumors. The therapy developed by Juno demonstrated remarkable efficacy, with clinical trials showing complete tumor elimination in 53% of relapsed blood cancer patients who had exhausted all other treatment options.

Cassidy emphasized the centrality of intellectual property to Juno's success:

"The heart of the company was the IP that enabled us to develop the drugs we did. It's unquestionable that it was absolutely imperative that we have strong patent protection. It took in the neighborhood of $2.5 billion to develop this therapy, and we needed to secure that investment with patents."[46]

For Juno, patents served dual functions: protecting the company's innovations and attracting the substantial investment required for development. As Cassidy explained, "investors are very cautious about investing, unless there is a very strong set of patent assets held by the company. As GC that was my focus."

However, Juno's experience also illustrated the challenges created by patent system changes, particularly inter partes review proceedings. When a rival company (Kite, later acquired by Gilead) challenged Juno's patents through IPR, Juno ultimately prevailed both in the IPR proceeding and in subsequent patent infringement litigation that resulted in a $1.2 billion verdict for willful infringement.

Yet even this successful defense required diverting substantial resources to patent litigation during critical development stages. As Cassidy explained, the costs of defense fell heavily on startups: “A company facing a series of IPRs faces a choice of funding litigation or innovation. There is a more direct tradeoff for early-stage companies.” For investors evaluating early-stage opportunities, even the prospect of ultimately prevailing cannot offset the risk that patent challenges will drain capital at the most vulnerable stage of company development.

Despite Juno’s success, Cassidy was critical of the IPR system as initially implemented:

"The purpose of the IPR system was to reduce litigation, but it became a playground for opponents... The ability of challengers to file serial IPRs to tie up and undermine a patent—one after the other, rather than being required to bring all claims at once."

Most significantly, Cassidy described how patent system changes have altered venture capital investment patterns:

"Problems with IPRs and other changes to the patent system have had negative effects on investment. They have made it more difficult to obtain investment in early stage companies that

---

[46] All quotations, unless otherwise cited are from an interview with Barney Cassidy conducted in January 2020. Notes on file with the author.

have potential to bring disruption to the status quo... Many VCs decline to invest as broadly in early stage companies as they once did. Instead, they prefer to invest in later stage companies that have less exposure to patent challenges as an existential event."

D. The Diagnostics Challenge: Dr. Mary Kander

The Supreme Court's Mayo decision created particular challenges for personalized medicine by narrowing patent eligibility for diagnostic methods. Mary Kander, who has extensive experience with medical diagnostics commercialization at Cleveland Clinic, explained the practical impact:

"The inability to patent diagnostics is not impacting research, but it is impacting the ability to license."[47]

This distinction proves important. Academic research continues because universities operate under different incentive structures, as faculty advancement depends on publications rather than commercial returns. However, translating research into clinical applications requires private investment, which depends on licensing arrangements that presuppose patent protection.

Kander continued:

"Personalized medicine is based on being able to determine the presence of biomarkers in a patient. That's the future—being able to determine which drugs to use and the dosage to administer based on a patient's individual characteristics. The unavailability of diagnostic patents, or uncertainty regarding their validity, is likely to affect an important component of personalized medicine."

Personalized medicine represents one of the most promising frontiers in healthcare—using genetic and molecular information to target treatments to individual patients rather than relying on population averages. Cancer treatment increasingly depends on identifying specific mutations that indicate which therapies will prove effective for particular patients. Cardiovascular medicine similarly benefits from diagnostic tests predicting drug responses.

Yet Mayo's holding that correlations between test results and medical conditions constitute unpatentable natural laws undermines the business model supporting diagnostic development. Companies that invest millions developing and validating diagnostic tests find themselves unable to prevent competitors from immediately copying successful tests, eliminating the exclusivity period necessary to recoup investment.

From the technology transfer perspective, Kander noted that decisions about whether to pursue commercialization begin with viability assessments where patentability ranks among top considerations. In most fields, her team is unlikely to move forward without patent protection "because investors are not going to fund a project where there are not patents."

---

[47] All quotations, unless otherwise cited are from an interview with Mary Kander conducted in January 2020. Notes on file with the author.

E. Connecting Qualitative and Quantitative Evidence

The case studies provide causal mechanisms explaining the quantitative patterns documented in Section III. When Makower and Bright describe shifting from implants to wellness devices, this corresponds to the medical device share decline from 12% to 6% observed in the data. When Cassidy explains how IPR proceedings and patent uncertainty cause venture capitalists to avoid early-stage investments, this corresponds to pharmaceutical venture capital's collapse from 7% to 0.79% share. When Kander explains how Mayo undermines diagnostic commercialization, this connects to broader biotechnology investment volatility. When Rossi emphasizes that decade-long, multi-hundred-million-dollar investments require patent protection, this corresponds to the fundamental dependence on exclusivity documented across all life sciences sectors.

The convergence between quantitative data and qualitative case studies strengthens the inference that patent system changes contributed substantially to venture capital reallocation. Investment patterns shifted in ways consistent with patent system changes, and the individuals making investment decisions explicitly attribute their changed behavior to patent system weakening. Cassidy's reflections prove particularly valuable because it directly links a specific patent system change (IPRs) to specific investor behaviors (avoiding early-stage investments), providing concrete evidence of the causal pathway.

While neither evidence type alone proves causation definitively - correlation does not equal causation, and retrospective accounts may suffer from various biases - their convergence provides substantial support for the conclusion that patent system changes contributed significantly to venture capital reallocation away from life sciences. The case studies reveal not just that investment shifted, but *how* and *why*: through deliberate decisions by experienced innovators and investors responding rationally to increased patent uncertainty.

F. The Counterfactual Question

These case studies also illuminate an important policy question: what innovations would have been pursued absent patent system changes? When Bright states that "cardiovascular disease and chronic diseases such as diabetes and kidney conditions" receive less attention, he identifies specific therapeutic gaps associated with patent system changes. When Cassidy describes venture capitalists avoiding early-stage investments due to patent challenges, he identifies a stage-specific funding gap affecting precisely the riskiest, most innovative companies. These gaps will not appear in near-term statistics, as the drugs and devices not developed due to reduced investment will never show up in "innovations lost" columns because they never existed. The cost manifests as suffering not relieved, deaths not prevented, and quality of life not improved, which are outcomes difficult to measure but nonetheless real.

This temporal asymmetry between visible benefits and invisible costs creates systematic bias in policy evaluation. Policymakers observe and respond to immediate, measurable effects while discounting future, counterfactual consequences. The case studies provide partial correction by making visible what would otherwise remain invisible: the innovation decisions changed by patent system weakening.

V. Conclusion

This chapter has asked whether changes in the U.S. patent system after 2006 contributed to a reallocation of venture capital away from patent-intensive industries, particularly in the life sciences. The evidence shows a pronounced shift. Between 2004 and 2017, pharmaceuticals fell from roughly 7 percent of all venture capital to less than 1 percent, medical devices lost half their share, and patent-intensive manufacturing overall declined from more than half to less than one-third of the venture market.

Three strands of evidence converge on the same conclusion. Quantitative data from PitchBook document the timing and magnitude of reallocation, showing that declines were concentrated in sectors most reliant on reliable patent protection. Economic theory and elasticity studies explain why: when expected returns fall, investment contracts. Qualitative testimony from investors and innovators confirms the mechanism, describing how patent uncertainty reshaped the types of projects pursued and the stages of investment deemed viable.

This analysis does not provide econometric identification of causal effects. Its contribution lies in complementing firm-level studies with a sector-level perspective that captures systemic consequences. While existing literature has demonstrated that patents matter for individual startups, this chapter shows that weakened patent reliability coincided with capital flowing out of entire industries. That reallocation is visible only when venture capital is tracked across the economy, not just at the firm level.

The implications for policy are significant. Life sciences innovation combines long development timelines, high failure rates, and easy reverse engineering, making it uniquely dependent on enforceable exclusivity. Legal reforms and judicial decisions that reduced predictability and enforceability thus carried disproportionate consequences for biopharmaceutical and device startups. When investors must commit large sums years before a product reaches the market, even incremental changes to expected returns can have immediate and dramatic effects on capital allocation.

These findings suggest that patent reforms should account for differential impacts across industries, particularly in sectors where long development timelines and high capital requirements make patent reliability essential. What might be gained by a particular proposal should be weighed against the signals it sends to long term investors in important sectors.

Patent policy will never operate in a vacuum. Other factors—technological waves, development costs, regulation—also shape the allocation of capital. But the evidence presented here underscores that patent reliability is not peripheral. It influences the direction of innovative investment, and by extension, the treatments that reach patients. Policies that weaken patents reshape not only firm strategies but also the flow of capital across industries, with lasting consequences for the future of medicine.