ATTACKING INNOVATION

XUAN-THAO NGUYEN* **& JEFFREY A. MAINE****

ABSTRACT

Economists generally agree that innovation is important to economic growth and that government support for innovation is necessary. Historically, the U.S. government has supported innovation in a variety of ways: (1) a strong legal system for patents; (2) direct support through research performed by government agencies, grants, loans, and loan guarantees; and (3) indirect support through various tax incentives for private firms. In recent years, however, we have seen a weakening of the U.S. patent system, a decline in direct funding of research, and a weakening of tax policy tools used to encourage new innovation. These disruptive changes threaten the future of innovation in the United States, potentially driving innovation activities offshore to Europe and China. This Article concludes that the current innovation crisis demands changes to both the patent and tax systems in order to instill confidence in the innovation landscape.

* Gerald L. Bepko Chair; Director, Center for Intellectual Property & Innovation, Indiana University Robert H. McKinney School of Law. As always, Professor Nguyen would like to thank Erik Hille and Khai-Leif Nguyen-Hille.

** Maine Law Foundation Professor of Law, University of Maine School of Law. Professor Maine would like to thank Joe Greene and Anna Mikhaylina for providing valuable research and editorial assistance.

CONTENTS

INTRODUCTION

Twelve years ago, there were about 700,000 new start-up firms every year in the United States, according to the Ewing Marion Kaufman Foundation, but that number has fallen 30% to 500,000 firms and continues downwards.[1] In a study conducted by the Chronicle of Higher Education, more than half of the 11,000 researchers surveyed across the nation had abandoned projects central to their labs due to economic pressure.[2] In the study entitled *The Future Postponed*, MIT delivered a shocking list revealing that none of the notable scientific highlights in recent years were U.S.-led achievements.[3] The data confirms a new reality that not many care to acknowledge: innovation in the United States is dwindling.[4] Several key reasons for this dire situation stem from the multiple and pervasive attacks on innovation. Most startlingly, the attacks are often in disguise as benefiting innovation.[5] As a result, there has been an almost universal

[1] Carl J. Schramm, Professor at Syracuse Univ., Former President, Ewing Marion Kaufman Found. for Entrepreneurship, and Bd. Member, IIPCC, Presentation at International IP Commercialization Council Program on Promoting Innovation, Investment and Job Growth by Fixing America's Patent System: Entrepreneurship, IP and the Benefits to the U.S. Economy 6-7 (May 8, 2017) (transcript available at https://www.dropbox.com/sh/qnz1q7jtr32gtz5/AADP7ROru1xhneHIrsu9Zlqla?dl=0&preview=IIPCC+WDC+May+8+2017+-+Prof+Carl+Schramm+Presentation+Transcript.PDF [https://perma.cc/7Y5A-TRNL]); *see also* Jane Wollman Rusoff, *'Burn the Business Plan' When Starting Your Own Firm: Carl Schramm*, THINKADVISOR (Mar. 1, 2018, 10:29 AM), https://www.thinkadvisor.com/2018/03/01/burn-the-business-plan-when-starting-your-own-firm/ [https://perma.cc/GMB7-4QFQ] ("Twenty years ago the U.S. was benefiting from one 1 million startups a year. Ten years ago it was about 700,000 a year. This year there will be fewer than 500,000 startups.").

[2] Paul Basken & Paul Voosen, *Strapped Scientists Abandon Research and Students*, CHRON. HIGHER EDUC. (Feb. 24, 2014), https://www.chronicle.com/article/Strapped-Scientists-Abandon/144921 ("Nearly half [of survey respondents] have already abandoned an area of investigation they considered central to their lab's mission.").

[3] MIT COMM. TO EVALUATE THE INNOVATION DEFICIT, THE FUTURE POSTPONED: WHY DECLINING INVESTMENT IN BASIC RESEARCH THREATENS A U.S. INNOVATION DEFICIT, at v (2015), https://dc.mit.edu/sites/default/files/Future%20Postponed.pdf [https://perma.cc/L6LZ-5NSP] (listing achievements such as "discovery of a new fundamental particle" and "development of the world's fastest supercomputer").

[4] MIT has documented the innovation crisis by providing tangible examples of:

> under-exploited areas of science and likely consequences in the form of an innovation deficit, including: opportunities with high potential for big payoffs in health, energy, and high-tech industries; fields where we risk falling behind in critical strategic capabilities such as supercomputing, secure information systems, and national defense technologies; areas where national prestige is at stake, such as space exploration, or where a lack of specialized U.S research facilities is driving key scientific talent to work overseas.

Id. at v-vi.

[5] *See* Charles Duhigg & Steve Lohr, *The Patent, Used As a Sword*, N.Y. TIMES, Oct. 8, 2012, at A1; James Bessen, *The Evidence Is In: Patent Trolls Do Hurt Innovation*, HARV.

silence in legal scholarship on how law and policy have discouraged innovation, which has led to the current innovation crisis. This Article breaks that silence.

First, there has been a fierce attack in patent law, where strong patents were once considered incentives for innovation.[6] The attack on the patent system cloaked itself in the hysterical "patent troll" narrative that patent owners behave like trolls to extort innovative companies,[7] without any consideration of the fact that these infringers are using others' patented technologies without

BUS. REV. (Nov. 2014), https://hbr.org/2014/07/the-evidence-is-in-patent-trolls-do-hurt-innovation [https://perma.cc/T7MT-44TG] (calling for change to patent law to address patent trolls); Larry Downes, *The U.S. Supreme Court Is Reining in Patent Trolls, Which Is a Win for Innovation*, HARV. BUS. REV. (June 2, 2017), https://hbr.org/2017/06/the-u-s-supreme-court-is-reining-in-patent-trolls-which-is-a-win-for-innovation [https://perma.cc/L7YH-BUPS] (arguing that recent changes to law "will improve the innovation environment for companies in fast-changing industries"); *Patents*, ELECTRONIC FRONTIER FOUND., https://www.eff.org/patent [https://perma.cc/K8DB-CQ8S] (last visited Aug. 22, 2019); Richard A. Posner, *Why There Are Too Many Patents in America*, ATLANTIC (July 12, 2012), https://www.theatlantic.com/business/archive/2012/07/why-there-are-too-many-patents-in-america/259725 [https://perma.cc/CEY8-YX3V]; Gene Sperling, *Taking on Patent Trolls to Protect American Innovation*, WHITE HOUSE (June 4, 2013, 1:55 PM), http://www.whitehouse.gov/blog/2013/06/04/taking-patent-trolls-protect-american-innovation [https://perma.cc/77YS-HHXS].

[6] Some have called for the abolishment of the patent system. *See generally* MICHELE BOLDRIN & DAVID K. LEVINE, AGAINST INTELLECTUAL MONOPOLY (2008) (questioning whether legal intellectual property regime achieves intended purpose of creating incentives for innovation); ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT, at xi (2004) (suggesting that current patent policy and practice is generating seriously negative consequences for inventors).

[7] The hysteria continues to persist in academia and the media. *See, e.g.*, Eduardo Porter, *Patent 'Trolls' May Be Poised For Comeback*, N.Y. TIMES, Nov. 22, 2017, at B1 ("Companies no longer have to pay ransom so the threat of lawsuits over dubious royalty payments—filed by aggressive litigants known as trolls—will go away."); *see also* Peter Detkin, Founder, Intellectual Ventures, Remarks at 12th Annual Advanced Patent Law Institute: The Current Patent Landscape in the U.S. and Abroad 45 (Mar. 9-10, 2017) (transcript available at https://sls.gmu.edu/cpip/wp-content/uploads/sites/31/2017/04/The-Current-Patent-Landscape-in-the-U.S.-and-Abroad-FINAL-TRANSCRIPT.pdf [https://perma.cc/3P8K-UBQF]) ("[I]n 10 years of patent law debates about how the system needs to be changed, there's a lot of hysteria and a lot of stories, but very little data. I think it's very important for those who are the policymakers in the room . . . that you rely on data, not anecdotes when considering what changes should be made."). In fact, the patent system today is akin to a bank robber who cries victimization when he is caught. *See* Damon C. Matteo, Chief Exec. Officer, Fulcrum Strategy, Remarks at 12th Annual Advanced Patent Law Institute: The Current Patent Landscape in the U.S. and Abroad 29 (Mar. 9-10, 2017) (transcript available at https://sls.gmu.edu/cpip/wp-content/uploads/sites/31/2017/04/The-Current-Patent-Landscape-in-the-U.S.-and-Abroad-FINAL-TRANSCRIPT.pdf [https://perma.cc/3P8K-UBQF]).

reciprocating compensation.[8] Heeding the hysteria, the Supreme Court and the 2013 America Invents Act ("AIA") Patent Trial and Appeal Board ("PTAB") have become forerunners in creating a weak and uncertain patent system.[9] Innovations are deemed ordinary, or not worthy of receiving legal protection,[10] or just simply categorically ineligible for patent protection.[11] This has resulted in important sectors of the economy shutting down.[12] Furthermore, without

[8] The Federal Trade Commission ("FTC") released a study in 2016, conducted between January 2009 and mid-September 2014, that attempted to temper the hysteria with real data and analysis of twenty-two patent assertion entity respondents and more than 2500 affiliates and related entities. *See* FTC, PATENT ASSERTION ENTITY ACTIVITY 2-3 (2016). The FTC concluded that "a label like 'patent troll' is unhelpful because it invites pre-judgement about the societal impact of patent assertion activity without an understanding of the underlying business model that fuels such activity." *Id.* at 17.

[9] *See* Robert Greene Sterne, Attorney, Sterne, Kessler, Goldstein & Fox P.L.L.C., Remarks at 12th Annual Advanced Patent Law Institute: The Current Patent Landscape in the U.S. and Abroad 40-41 (Mar. 9-10, 2017) (transcript available at https://sls.gmu.edu/cpip/wp-content/uploads/sites/31/2017/04/The-Current-Patent-Landscape-in-the-U.S.-and-Abroad-FINAL-TRANSCRIPT.pdf [https://perma.cc/3P8K-UBQF]) (suggesting PTAB generated weakness and uncertainty of current patent system).

[10] KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 402, 427 (2007) (finding that "[g]ranting patent protection to advances that would occur in the ordinary course without real innovation retards progress" and that "ordinary innovation [is] not the subject of exclusive rights under the patent laws"); Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 YALE L.J. 1590, 1608 (2010) (rejecting cognitive approach to doctrine of obviousness because "cognition is an epistemic phenomenon that takes place at a particular moment in time while invention occurs across time"); Gregory Mandel, *The Non-Obvious Problem: How the Indeterminate Nonobviousness Standard Produces Excessive Patent Grants*, 42 U.C. DAVIS L. REV. 57, 120-21 (2008) (observing that *KSR International*'s dichotomy of real versus ordinary innovations ignores psychological evidence that "creativity is believed to vary along a continuum").

[11] *See* Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 573 U.S. 208, 212 (2014) ("[C]omputer implementation [of an abstract idea] fails to transform that abstract idea into a patent-eligible invention."); Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576, 596 (2013) (holding isolation of genes patent ineligible); Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 72 (2012) (holding recitation of law of nature ineligible for patent protection). Post-*Alice*, -*Mayo*, and -*Myriad*, the Federal Circuit applied the Supreme Court's new interpretations and found only three out of thirty cases patent eligible in areas other than biology. *See* Michael A. Sanzo, *Lengthening Shadows: Biotechnology and Patent Eligibility*, LANDSLIDE, May-June 2017, at 48, 52.

[12] The new patent system, as mandated by the Supreme Court's patent ineligibility rules that destroy important industries, has alarmed many, including David Kappos, the former United States Patent and Trademark Office ("USPTO") Commissioner. *See* Steven Lundberg, *Dave Kappos Calls for Abolition of Section 101*, NAT'L L. REV. (Apr. 14, 2016), https://www.natlawreview.com/article/dave-kappos-calls-abolition-section-101 (reporting that patent eligibility exclusion for key U.S. industries like biotechnology and software is

patent protection for inventions, investors are inclined to either reduce their investments in innovation and invention or shift attention to other jurisdictions where strong patent protection and certainty reign.[13]

Second, for most research universities and institutions, government funding and grants for innovations have diminished and been forced into a constant uncertainty.[14] The stagnation in science investment in the United States has opened the door for new breakthroughs to occur outside the United States, notably in China and Europe.[15] Part of the reason for the funding decline is the new anti-science rhetoric that has ridiculed scientific projects and injected much

causing prominent lawyers to recommend their clients seek stronger patent protection in Europe and China).

[13] *See id.* (noting that inventors have begun to "aggressively seek protection in other countries where protection for biotechnology and software is readily available"); Kevin Madigan & Adam Mossoff, *Turning Gold into Lead: How Patent Eligibility Doctrine Is Undermining U.S. Leadership in Innovation*, 24 GEO. MASON L. REV. 939, 939 (2017) (demonstrating through empirical evidence that, of 17,743 patent applications rejected by USPTO, 1694 were granted protection by European Patent Office, China's SIPO, or both).

[14] Illustratively, Gerald Denis, a Boston University School of Medicine associate professor of pharmacology and medicine in the Cancer Research Center and a fellow of the Obesity Society, summarized the current stage of anti-science:

> The last few years of funding uncertainties have been deadly, and several investigators I know have lost their jobs because grants were terminated. Cancer cohorts have been lost, long-term studies decimated. Who will be around to make the next set of American medical discoveries and advances? This is no way to maintain international scientific leadership.

Art Jahne, *Who Picks Up the Tab for Science? For Half a Century, the Government Funded Research. Times Are Changing*, B.U. RES.: THE BRINK (Apr. 6, 2015), http://www.bu.edu/research/articles/funding-for-scientific-research/ [https://perma.cc/C5NQ-JN2H]; *see also* Basken & Voosen, *supra* note 2 (stating that abandonment of research project and severe reduction in recruitment of graduate students and research fellows due to lack of funding have led survey respondents to use words like "depression, discouragement, and stress" in describing their concerns about the future).

[15] Following *The Future Postponed*, MIT released a second study, *The Future Postponed 2.0*. MIT COMM. TO EVALUATE THE INNOVATION DEFICIT, THE FUTURE POSTPONED 2.0: WHY DECLINING INVESTMENT IN BASIC RESEARCH THREATENS A U.S. INNOVATION DEFICIT (2016), http://www.futurepostponed.org/s/Future-Postponed-20-web.pdf [https://perma.cc/Z33B-TY8P]. The introduction states that:

> [A] recently-launched Chinese satellite, for example, is testing the use of quantum entanglement to provide a communications link back to Earth that would be untappable, and Chinese scientists have used gene editing tools to create a new strain of wheat that is resistant to a widespread fungal disease. The European Union has invested more heavily than the U.S. in R&D of new energy technologies and in many areas of space research.

Id. at 1.

uncertainty into ongoing research.[16] Moreover, the new patent law regime passed in 2013 removed the grace period for researchers because the first-to-invent system has been replaced by the first–to-file system.[17] Researchers must watch their publication or disclosure; otherwise they face a statutory bar for lack of novelty.[18] Additionally, once they obtain patents, universities and institutions face challenges to their ownership and commercialization of their patents. Consequently, the incentive to innovate in research centers across the United States is declining.[19]

Lastly, in its most recent attack, the U.S. government has significantly weakened the tax system governing innovation. In the Tax Cuts and Jobs Act of 2017 ("TCJA"), Congress eliminated an important tax deduction for research and development ("R&D"), eliminated preferential capital gains rate treatment for inventors, added an excise tax on the net investment income (including royalties) of certain private colleges and universities, and enacted a host of international tax provisions that may push innovation offshore. The TCJA is also notable for what it did not do. It did not enhance the current tax credit for R&D, and it did not adopt a so-called U.S. patent box (i.e., a low effective tax rate on intellectual property income). Congress ignored repeated calls for both of these measures—measures that many countries have adopted in recent years to attract valuable innovation activity to their borders. These disruptive changes to the U.S. tax system, which is now more noticeably misaligned with the tax systems in Europe and China, will undoubtedly have a negative impact on American innovation.

---

[16] *See* MATT RIDLEY, THE EVOLUTION OF EVERYTHING: HOW NEW IDEAS EMERGE 140 (2015) (arguing that government should stay out of natural evolution of science innovation and should leave it to private sector to finance research). *But see* Nathan Myhrvold, *Every Genius Needs a Benefactor*, SCI. AM., Feb. 2016, at 11, 11 (arguing that anti-science arguments are "dangerously wrong" because "[w]ithout government support, most basic scientific research will never happen").

[17] Arpita Bhattacharyya & Eric P. Raciti, *The Not-So-Amazing Grace Period Under the AIA*, CIPA J. (Sept. 2012), https://www.finnegan.com/en/insights/the-not-so-amazing-grace-period-under-the-aia.html [https://perma.cc/7MDV-4SKP] (stating that "the § 102(b)(1)(B) exception in the AIA does not appear to have been crafted to engender early publication of inventions," but causes "prior publication of an invention [to be] fraught with many downsides"). Universities and independent inventors have attempted to restore the grace period to pre-AIA era. *See* Dennis Crouch, *Grace Period Restoration Act of 2015*, PATENTLY-O (Apr. 14, 2015), https://patentlyo.com/patent/2015/04/grace-period-restoration.html [https://perma.cc/9QU3-G2NK].

[18] Bhattacharyya & Raciti, *supra* note 17 (illustrating uncertainties surrounding "grace period non-inventor disclosure" exception in AIA and advocating early filing).

[19] While innovations are in decline, schools with entrepreneurship programs ironically have drastically increased in number. *See* Schramm, *supra* note 1. Sadly, these programs are empty promises, as the students often generate worthless business plans. *Id.* (observing that 70% of business plans from entrepreneurship programs have no value).

The Article proceeds as follows. Part I explains ways in which the government has traditionally supported innovation, including a strong and inclusive patent system for innovation, direct funding of basic and applied research, and various tax incentives for private investment in innovation to compensate for failures in the market. Part II exposes recent changes in these innovation policy tools—a weakening of the patent system and decline in basic and late-stage R&D funding, as well as a weakening of the tax system governing innovation—and likely consequences. Part III argues that these disruptive changes threaten the future of domestic innovation, potentially driving innovation activities offshore. The Article concludes that in this innovation crisis stronger patent rights would assist in shaping a stronger economy.[20] Along with restoring stronger patents and increasing funding for basic and advanced research, enhancing tax incentives for innovation is necessary to cope with the rising tax competition from China and Europe.

I. GOVERNMENT SUPPORT OF INNOVATION

Economists generally agree that innovation[21] is important to economic growth and building national wealth.[22] Economists also generally agree that private

[20] *See* Maureen K. Ohlhausen, Acting Chairman, FTC, Address at the Hillsdale College Free Market Forum: Markets, Government, and the Common Good (Oct. 13, 2017) (transcript available at https://www.ftc.gov/system/files/documents/public_statements/1264483/ohlhausen_-_hillsdale_speech_10-13-17.pdf [https://perma.cc/2AQ4-TMES]) (discussing importance of "strong patent rights to the U.S. economy").

[21] The word "innovation" has many slightly different variations. *See, e.g.*, Pete Foley, *What Is Innovation? 15 Experts Share Their Innovation Definition*, IDEA TO VALUE (Mar. 18, 2016), https://www.ideatovalue.com/inno/nickskillicorn/2016/03/innovation-15-experts-share-innovation-definition/ [https://perma.cc/3JU3-UE85].

[22] *See* Michael J. Graetz & Rachael Doud, *Technological Innovation, International Competition, and the Challenges of International Income Taxation*, 113 COLUM. L. REV. 347, 348 (2013) (citing Joseph F. Brodley, *The Economic Goals of Antitrust, Efficiency, Consumer Welfare, and Technological Progress*, 62 N.Y.U. L. REV. 1020, 1026 (1987)) ("The importance of technological development to economic growth has been accepted [since 1957]."); Herbert Hovenkamp, *Restraints on Innovation*, 29 CARDOZO L. REV. 247, 253 (2007) ("[T]oday no one doubts his basic conclusion that innovation and technological progress very likely contribute much more to economic growth than policy pressures that drive investment and output . . . ."); Robert M. Solow, *Technical Change and the Aggregate Production Function*, 39 REV. ECON. & STAT. 312, 320 (1957) (suggesting that economic growth in U.S. at beginning of twentieth century largely stemmed from technological advances); Sandra Pianalto, President & Chief Exec. Officer, Fed. Reserve Bank of Cleveland, Speech at University of Akron JumpStart Exchange Event: The Importance of Innovation to Our Regional Economy (July 13, 2005) (transcript available at https://www.clevelandfed.org/newsroom-and-events/speeches/sp-20050713-the-importance-of-innovation-to-our-regional-economy.aspx [https://perma.cc/4ZNU-JSQD]) ("[N]early 90 percent of the rise in U.S. prosperity during the first half of the twentieth century came from technological growth, and not, as most economists had assumed, from the mere accumulation

investment in innovation is less than what those economic benefits warrant.[23] That is because private firms cannot capture all the benefits of their private investment in innovation due to the spillover effects of research. Numerous studies have found that the social returns to private spending greatly exceed the average private returns.[24] Through the lens of economic theory, this excess (the spillover effects or external benefits) takes on the appearance of market failure; specifically, too few resources are being spent on innovation. To remedy this market failure, the government has stepped in to support innovation.[25]

The U.S. government supports new innovation in a variety of ways. First, it provides legal protection for innovation. Second, it provides direct support in the form of research performed by government agencies, grants, direct loans,

of machinery."); Christine A. Varney, Assistant Attorney Gen., Antitrust Div. U.S. DOJ, Remarks as Prepared for the Joint Workshop of the United States Patent and Trademark Office, the Federal Trade Commission, and the Department of Justice on the Intersection of Patent Policy and Competition Policy: Implications for Promoting Innovation (May 26, 2010) (transcript available at https://www.justice.gov/atr/file/518211/download [https://perma.cc/MKP6-Q5SD]) ("Invention and innovation are critical in promoting economic growth, creating jobs, and maintaining our competitiveness in the global economy.").

[23] *See* GARY GUENTHER, CONG. RESEARCH SERV., RL31181, RESEARCH TAX CREDIT: CURRENT LAW AND POLICY ISSUES FOR THE 114TH CONGRESS 1-2 (2015) (noting that public policy must supplement private investment in technological R&D).

[24] *See* Edwin Mansfield, *Microeconomics of Technological Innovation*, *in* THE POSITIVE SUM STRATEGY: HARNESSING TECHNOLOGY FOR ECONOMIC GROWTH 309 (Ralph Landau & Nathan Rosenberg eds., 1986) (noting that social rates of return on technological innovation tend to be higher than private rate of returns); Charles I. Jones & John C. Williams, *Measuring the Social Return to R&D*, 113 Q.J. ECON. 1119, 1134 (1998) ("A number of studies in [the] literature purport to find large rates of return to R&D, suggesting substantial underinvestment."). Examples of positive spillover effects include attracting engineers, scientists, and other high-value workers, as well as luring capital essential for intellectual property. *See* Graetz & Doud, *supra* note 22, at 406 ("R&D incentives are intended to attract and benefit high-value workers, especially scientists and engineers; to lure the physical and financial capital essential for technological innovation; to reward national MNEs' activities; and to create valuable intangible capital.").

[25] *See* OFFICE OF TAX POLICY, U.S. DEP'T OF THE TREASURY, INVESTING IN U.S. COMPETITIVENESS: THE BENEFITS OF ENHANCING THE RESEARCH AND EXPERIMENTATION (R&E) TAX CREDIT 1 (2011) ("The R&E tax credit is designed to address this underinvestment and to increase the total amount of research activity undertaken in the United States."); ORG. FOR ECON. COOPERATION & DEV., TAX INCENTIVES FOR RESEARCH AND DEVELOPMENT: TRENDS AND ISSUES 7 (2002), http://www.oecd.org/sti/inno/2498389.pdf [https://perma.cc/325V-EXKH] ("Market incentives alone are insufficient to produce an adequate supply of R&D, making it crucial for governments to stimulate private R&D spending."); Graetz & Doud, *supra* note 22, at 349 (citing Jones & Williams, *supra* note 24, at 1133) ("[R]esearch and development . . . which is crucial to ongoing technological advances, is underproduced in the absence of government support.").

and loan guarantees. And third, the government provides indirect support, such as tax incentives. Each of these strategies deserves separate attention.

A. *A Strong and Inclusive Patent System for Innovation*

Patents are important to incentivizing innovation.[26] The United States modernized the patent system to encourage innovation by adopting the 1952 Patent Code and creating a specialized appellate court in 1982 for patent cases. Both momentous events fostered a philosophy of patent inclusion for new technology to be discovered and protected, and they provided a path to a strong and robust patent system.[27] Most importantly, the two events cemented the important role of patents, propelling the nation to value intangible property and paving ways for the nation to cope as manufacturing jobs were moving offshore for cheap labor.[28]

The notion of modernizing patent law evolved decades ago. While the nation was facing years of economic malaise caused by monopolistic trusts, on April 29, 1938, President Franklin Delano Roosevelt identified the then-antiquated patent system as one of the culprits of the malaise in his message to Congress.[29] He called for amendment of the patent law.[30] The intervening World War II years prolonged the troubled patent system, in which substantive patent law

[26] Laura G. Pedraza-Fariña, *Patent Law and the Sociology of Innovation*, 2013 WIS. L. REV. 813, 873 ("Patent law is one of the primary policy tools through which society provides incentives for technological innovation.").

[27] *See* A. Samuel Oddi, *Assault on the Citadel: Judge Rich and Computer-Related Inventions*, 39 HOUS. L. REV. 1033, 1035-36 (2002) (discussing intention of 1952 Code as drafted by Judge Rich).

[28] Gerald Sobel, *The Court of Appeals for the Federal Circuit: A Fifth Anniversary Look at Its Impact on Patent Law and Litigation*, 37 AM. U. L. REV. 1087, 1091 (1988) (stating that creation of Federal Circuit "brought about a philosophical change which strengthens the patent system" and that "setting in which this has occurred is significant" because "[a]s the nation's basic manufacturing industries suffer from competition with foreign suppliers, our ability to innovate new products and processes has become of utmost economic importance. The relative value of intangible technical knowledge has grown as basic manufacturing has moved to lower-cost areas abroad").

[29] Franklin D. Roosevelt, President of the United States, Recommendations to the Congress to Curb Monopolies and the Concentration of Economic Power (Apr. 29, 1938), *in* 7 THE PUBLIC PAPERS AND ADDRESSES OF FRANKLIN D. ROOSEVELT: THE CONTINUING STRUGGLE FOR LIBERALISM 315 (1941) (arguing that "effects of tax, patent and other government policies cannot be ignored" as drivers of then-current economic problems).

[30] President Roosevelt specifically emphasized patent licensing as a means to suppress industrial monopolies, and that "amendment should not deprive the inventor of his royalty rights, but generally speaking, future patents might be made available for use by any one upon payment of appropriate royalties." *Id.* at 318.

existed in judicial opinions but not in statutory provision.[31] The Patent Office's decisions on patent applications were not based on statutes, and the Supreme Court was hostile towards patents.[32] Notably, Justice Jackson, writing for the Court, propounded in 1949 that "the only patent that is valid is one which this Court has not been able to get its hands on."[33]

Against that backdrop, the post-World War II years of American exceptionalism[34] were ripe for modernizing the patent system. Congressional efforts to modernize the patent system for innovation took five years to accomplish, giving birth to the transformative 1952 Patent Code.[35] One of the key drivers whose vision, leadership, and hard work contributed to the creation of the 1952 Patent Code was Judge Giles S. Rich, the titan of patent law.[36]

[31] *See* Giles S. Rich, *Congressional Intent—Or, Who Wrote the Patent Act of 1952?*, *in* PATENT PROCUREMENT AND EXPLOITATION: PROTECTING INTELLECTUAL RIGHTS 63 (Sw. Legal Found. ed., 1963) ("In the late 1940's there was discontent in the patent bar. The practical value of patents was being downgraded. The courts were, on the average, applying a too stringent test for 'invention' . . . .").

[32] *See* George E. Frost, *Judge Rich and the 1952 Patent Code—A Retrospective*, 76 J. PAT. & TRADEMARK OFF. SOC'Y 343, 345-47 (1994) (describing pre-1952 administrative and judicial onslaught and birth of 1952 Patent Code); James F. Davis, *Judge Giles S. Rich: His Life and Legacy Revisited*, LANDSLIDE, Sept.-Oct. 2009, at 8, 10 (providing examples of Supreme Court's hostility towards patents in late 1940s, including diminished value of patents in *The Mercoid Cases*, which mortally wounded contributory infringement, a valuable tool to patent enforcement).

[33] Jungerson v. Ostby & Barton Co., 335 U.S. 560, 572 (1949) (Jackson, J., dissenting) ("It would not be difficult to cite many instances of patents that have been granted, improperly I think, and without adequate tests of invention by the Patent Office. But I doubt that the remedy for such Patent Office passion for granting patents is an equally strong passion in this Court for striking them down so that the only patent that is valid is one which this Court has not been able to get its hands on.").

[34] Michael C.C. Adams, *The American Experience During World War II*, OXFORD RES. ENCYCLOPEDIAS: AM. HIST. (Aug. 2016), http://americanhistory.oxfordre.com/view/10.1093/acrefore/9780199329175.001.0001/acrefore-9780199329175-e-344 [https://perma.cc/24MZ-LMSF] (stating that World War II "vastly enhanced the American sense of exceptionalism . . . the inherent goodness of America's intentions and its self-evident global mission to preserve democracy making its wrongdoing necessary and therefore innocent").

[35] *See* Frost, *supra* note 32, at 343.

[36] *See generally* Davis, *supra* note 32 (recalling and analyzing profound legacy left by Judge Rich to patent law and policy); *see also* Bradford J. Duft, *Fidelity*, 81 J. PAT. & TRADEMARK OFF. SOC'Y 767, 767 (1999) ("Mention of Judge Rich evokes a number of thoughts. . . . In broad, historic terms, we picture the father of modern patent law. Consequently, thinking of Judge Rich also reminds us of the Patent Act of 1952, which he co-authored.").

The 1952 Patent Code was a significant milestone in the development of patent law.[37] It enshrined into patent statutes that once a patent is granted by the Patent Office, it is presumed valid independently of the validity of other claims.[38] That means that each patent claim must meet all the statutory requirements for patentability.[39] The 1952 Patent Code logically clarified and codified patentability requirements into separate components: patentability subject matter, utility, novelty, and non-obviousness.[40] On the non-obviousness requirement, the Patent Code created an objective standard on which the courts and the Patent Office can rely to determine patentability, and the requirement soon became the "cornerstone for a new era in patent law."[41] Further, the 1952 Patent Code codified contributory infringement to empower patentees for

[37] Judge Rich, in his famous "Anatomy of the Patent Statute" opinion, explained how the problems of confusion, inaccuracy, and ambiguity plagued the old law and how the new law addressed them. *See In re* Bergy, 596 F.2d 952, 959-60 (C.C.P.A. 1979) ("The 1952 Act divided that statute up into its logical components and *added* the nonobviousness requirement, which until then had been imposed only by court decisions. This attempt at a clearcut statement to replace what had been a hodgepodge of separate enactments resulted in a new and official Title 35 in the United States Code with three main divisions. Part I pertains to the establishment and organization of the PTO. Part II, here involved, covers patentability of inventions and the grant of patents. Part III relates to issued patents and the protection of the rights conferred by them."), *vacated as moot sub nom.*, Diamond v. Chakrabarty, 44 U.S. 1028 (1980) (mem.).

[38] 35 U.S.C. § 282(a) (2012) ("A patent shall be presumed valid. Each claim of a patent . . . shall be presumed valid independently of the validity of other claims.").

[39] Microsoft Corp. v. i4i Ltd. P'ship, 564 U.S. 91, 96 (2011) ("To receive patent protection a claimed invention must, among other things, fall within one of the express categories of patentable subject matter, § 101, and be novel, § 102, and nonobvious, § 103.").

[40] Donald S. Chisum, *Weeds and Seeds in the Supreme Court's Business Method Patents Decision: New Directions for Regulating Patent Scope*, 15 LEWIS & CLARK L. REV. 11, 31 (2011) (praising "neatness in addressing patentability in numerical order: Section 101 (eligibility subject matter and utility), Section 102 (novelty), Section 103 (nonobviousness), and so on" and recalling Judge Rich's reference of ordering as "three doors" of patentability); David O. Taylor, *Confusing Patent Eligibility*, 84 TENN. L. REV. 157, 177-78 (2016) (explaining how Judge Rich delineated section 103 of nonobviousness from section 101 patentable subject matter in codifying common law for 1952 Patent Code).

[41] Davis, *supra* 32, at 10.

enforcement purposes,[42] a means-plus-function section,[43] and other aspects of substantive patent law. The codification of judicial decisions and clarification of various statutory provisions with explicit definitions enabled the Patent Office to issue Office Actions with clear reliance on statutory reasoning.[44] Overall, the new law transformed the antiquated patent system both substantively and procedurally. It marked a new beginning for a robust patent system in which more patent applications would be filed on new innovations soon to be discovered by the average inventor. It was a new era of patent incentive and inclusion.[45]

The patent system for innovation, however, was incomplete if one only considered the statutory regime; to interpret the law, jurists with a strong understanding of patent law and practice were needed.[46] This led to the

[42] *Id.* at 9 (noting that reestablishment of contributory infringement regime was main achievement of Patent Act of 1952); *see also* Erwin J. Basinski, *Some Comments on Contributory and Induced Patent Infringement; Implications for Software Developers*, 81 J. PAT. & TRADEMARK OFF. SOC'Y 777, 777-78 (1999) (stating that according to Judge Rich, "prior to 1952, the courts had confused the old equity maxim of 'unclean hands' and its application to patent law called 'the misuse doctrine' with the common law doctrine of 'contributory infringement.' . . . This had the effect of making the contributory infringement claim totally ineffective . . . . As a result, The Patent Act of 1952 added the revised Article 271 to clarify these issues" (footnote omitted)).

[43] *See* Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 933-34 (Fed. Cir. 1987) (explaining history of section 112, paragraph 6, of Patent Act of 1952).

[44] Frost, *supra* note 32, at 352-53 ("In 1944 the Supreme Court reversed the lower court in the *Halliburton* case. In the process it cast doubt on the validity of endless numbers of patent claims and on the settled Patent Office practice. 35 USC 112 changed the law as expressed in that case by affirming the validity of means claims . . . ." (footnote omitted)).

[45] Judge Rich, the principal author of the 1952 Patent Code, expressed his view on the incentive role of patent law to encourage the average inventors to invent:

> It is difficult to understand the attitude of those who feel that ideally a patent should be granted only for the meritorious invention which is capable of being a commercial success. Patents are not Nobel or Pulitzer prizes! They are not for exceptional inventors but for average inventors and should not be made hard to get. True, they are temporary monopolies, but therein alone lies their power as inducements to invent, to disclose, to invest, and to design around. Why must an invention be a commercially hot number to be patentable? If it is a total dud, how is the public injured by a patent on it? A monopoly on something nobody wants is pretty much a nullity. That is one of the beauties of the patent system. The reward is measured automatically by the popularity of the contribution . . . . The only possibility of doing damage is so to construe a patent on a dud as to cover a commercially meritorious invention made by a more competent inventor, but it is not noticeable that courts have a tendency to do that.

Giles S. Rich, *Principles of Patentability*, 28 GEO. WASH. L. REV. 393, 401-02 (1960) (emphasis omitted).

[46] See WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 7 (2003) (observing that creation of Federal Circuit is "perhaps

subsequent creation in 1982 of the Federal Circuit as the sole appellate court with jurisdiction to hear patent cases.[47] The creation of the Federal Circuit marked a pivotal recognition that patents are important to the economy and that uniform law for patents is necessary.[48] The Federal Circuit quickly established itself as the patent court of the nation.[49] Its impact on patent jurisprudence was immediately recognized. For example, in the first five years of existence, the Federal Circuit strengthened the statutory presumption of validity.[50] Its interpretation of the law dictated a heightened burden on those who wished to challenge the statutory presumption of validity, requiring the party asserting invalidity to prove it by clear and convincing evidence.[51] Consequently, the

the single most significant institutional innovation in the field of intellectual property in the last quarter-century").

[47] Richard H. Sayler, *The Case for Arbitrating Intellectual Property Licensing Disputes*, DISP. RESOL. J., Feb.-Apr. 2005, at 62, 64 ("Since its creation, the U.S. Court of Appeals for the Federal Circuit has in fact fulfilled one of its purposes—to speak with a single voice on important issues of patent law so that the rules governing the validity, enforceability, and infringement of patents do not vary from circuit to circuit as they sometimes did."); Larry D. Thompson, Jr., *Adrift on a Sea of Uncertainty: Preserving Uniformity in Patent Law Post-*Vornado *Through Deference to the Federal Circuit*, 92 GEO. L.J. 523, 525 (2004) ("In the eyes of many commentators, the Federal Circuit has done an admirable job achieving those goals.").

[48] Christianson v. Colt Indus. Operating Corp., 798 F.2d 1051, 1058 (7th Cir. 1986) ("The primary purposes for the creation of the Federal Circuit were to provide greater uniformity in the substantive law of patents and to prevent the inevitable forum shopping that results from conflicting patent decisions in the regional circuits."). Businesses responded to the creation of the Federal Circuit by increasing their focus on patents as strategic assets. *See* W.L. Gore & Assocs., Inc. v. Comptroller, No. 07-IN-OO-0084, 2010 WL 5927989, at *2 (Md. T.C. Nov. 9, 2010) (noting that Gore-Tex parent company decided to form patent holding company as response to "significant changes in Federal patent policy that led to the creation of the U.S. Court of Appeals for the Federal Circuit, which required increased focus on strategic management of patents").

[49] Michael J. Burstein, *Rules for Patents*, 52 WM. & MARY L. REV. 1747, 1757 (2011) ("[T]he Federal Circuit has become the most important expositor of the substantive law of patents in the United States."); Paul R. Gugliuzza, *The Federal Circuit as a Federal Court*, 54 WM. & MARY L. REV. 1791, 1795 (2013) (stating that Federal Circuit has consolidated its power to shape patent law).

[50] *See* Sobel, *supra* note 28, at 1089 (identifying areas in which Federal Circuit quickly made its impact, including strengthening statutory presumption of validity).

[51] *See, e.g.*, Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc., 796 F.2d 443, 446-47 (Fed. Cir. 1986) (finding that record below "contains no reference to this statutory presumption of validity, nor does it appear that the district court considered separately the validity of the three claims at issue. By merely holding that 'defendants have proved by clear and convincing evidence that the patent in suit (4,194,814) and each of its claims is invalid and therefore void,' the district court improperly denied the '814 patent its statutory presumption of validity as to each claim"). The Federal Circuit's clear and convincing

presumption of validity creates certainty for patent holders. With that certainty, the patent holders can rely on their patents for financing, commercialization, and protection.[52]

It should come as no surprise that Judge Rich, the author of the 1952 Patent Code, became the bridge between the modern patent statute and judicial interpretations of patent law. He first served on the Court of Customs and Patent Appeals in 1956 and continued to serve on the newly formed Federal Circuit from the day of its inception on October 1, 1982, until his death on July 9, 1999.[53] He penned 892 opinions and participated in over 3000 cases.[54] His contribution as a patent jurist was monumental in shaping the modern patent system to have a "policy of inclusion" of "newly evolving technology."[55]

Indeed, the Federal Circuit diligently addressed every area of patent law to encourage inclusion and innovation.[56] For example, the Federal Circuit permitted evidence of commercial success to be probative of a patented invention's non-obviousness,[57] elevating commercial success to a substantial consideration in patent validity.[58] This would be helpful to businesses and entrepreneurs that experienced early commercial success with their inventions and could now rely on that success to withstand a challenge to obviousness.[59] In

standard of proof was affirmed by the Supreme Court thirty years after Judge Rich first interpreted 35 U.S.C. § 282. *See* Microsoft Corp. v. i4i Ltd. P'ship, 564 U.S. 91, 95 (2011).

[52] For example, patent holders use patents as collateral when they borrow from lenders. The number of patents serving as collateral increased from 848 in 1980 to 178,855 in 2016. *See* Xuan-Thao Nguyen & Erik Hille, *Patent Aversion*: *An Empirical Study of Patents Collateral in Bank Lending, 1980-2016*, 9 U.C. IRVINE L. REV. 141, 157 (2018).

[53] Oddi, *supra* note 27, at 1033-34.

[54] *Id.* at 1034.

[55] *Id.* at 1035-36.

[56] *See generally* Damon C. Andrews, *Promoting the Progress: Three Decades of Patent Jurisprudence in the Court of Appeals for the Federal Circuit*, 76 MO. L. REV. 839 (2011) (providing comprehensive analysis of Federal Circuit's decisions over thirty years since creation and identifying areas where Federal Circuit has made significant development).

[57] *See* Merck & Co., Inc. v. Teva Pharm. USA, Inc., 395 F.3d 1364, 1376 (Fed. Cir. 2005) (noting importance of commercial success in context of obviousness analysis); Merck & Co., Inc. v. Biocraft Labs., Inc., 874 F.2d 804, 809 n.* (Fed. Cir. 1989) ("Commercial success is an indication of nonobviousness that must be considered in a patentability analysis . . . ."); Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1380 (Fed. Cir. 1986).

[58] *See generally* Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CALIF. L. REV. 803 (1988) (tracing origins of "secondary considerations" and Federal Circuit's line of cases on "commercial success").

[59] On the other hand, others disagree with the Federal Circuit's emphasis on commercial success for nonobviousness, as they believe that such emphasis would hurt small businesses because there would be "a shift of resources away from the inventive act toward the commercial act." Reed W.L. Marcy, Note, *Patent Law's Nonobviousness Requirement: The Effect of Inconsistent Standards Regarding Commercial Success on the Individual Inventor*, 19 HASTINGS COMM. & ENT. L.J. 199, 216-17 (1996); *see also* Merges, *supra* note 58, at 827

addition, the Federal Circuit warned against hindsight bias in obviousness analysis.[60]

In the computer-related revolution, the Federal Circuit mapped its jurisprudence on patentability subject matter with care in order to embrace the average inventor's innovations in business methods and software fields by favoring a broad construction of 35 U.S.C. § 101 for the new technological developments.[61] Specifically, in the *State Street Bank & Trust Co. v. Signature Financial Group, Inc.*[62] decision, the Federal Circuit widened the patent inclusion door to welcome business methods and software inventions if they involve some type of practice application and produce a "useful, concrete, and tangible result."[63] Consequently, innovations flourished as average inventors could reap the incentive benefits of securing patents in new fields.[64]

In the biotech revolution, the Federal Circuit widened the door on patentability of inventions related to seeds and seed-grown plants, gene

("[T]he Federal Circuit has transformed commercial success from a tiebreaker to a virtual trump card.").

[60] Andrews, *supra* note 56, at 854 (stating that Federal Circuit shaped its jurisprudence on nonobviousness further in *In re Dembiczak*, 175 F.3d 994 (Fed. Cir. 1999), *abrogated by In re* Gartside, 203 F.3d 1305 (Fed. Cir. 2000), where it "delineated its hindsight-bias analysis by refining the specificity with which an invention must have been obvious at a past moment in time").

[61] *See* Oddi, *supra* note 27, at 1039-40 (providing rich retrospective analysis of Federal Circuit's decisions, particularly of Judge Rich's seminal decisions, to have computer-related inventions sail past § 101 muster).

[62] 149 F.3d 1368 (Fed. Cir. 1998), *abrogated by In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008).

[63] *Id.* at 1373. The Court held that the invention involving "a data processing system for managing a financial services configuration of a portfolio established as a partnership" was patentable because "[g]iven the complexity of the calculations, a computer or equivalent device [was] a virtual necessity to perform the task." *Id.* at 1371-72. The Court addressed the "business method" exception to statutory subject matter and took the "opportunity to lay this ill-conceived exception to rest." *Id.* at 1375.

[64] *See generally* Josh Lerner, *Where Does* State Street *Lead? A First Look at Finance Patents*, *1971-2000*, 57 J. FIN. 901 (2002) (examining patents for financial formulas and methods after *State Street* decision); Josh Lerner et al., *Financial Patent Quality: Finance Patents After* State Street (Harvard Bus. Sch., Working Paper No. 16-068, 2015) http://www.hbs.edu/faculty/Publication%20Files/16-068_702dabb8-70c5-4917-a257-75dc8b0c4f6b.pdf [https://perma.cc/BS2G-C3JX] (analyzing new niche of patents relating to finance business methods).

sequences,[65] and personalized medicine.[66] Overall, inventors enjoyed patent protection for their inventions in different fields.

In addition to expanding the scope of patent law, the court modified the standard for injunctive relief to afford patentees the opportunity to receive a permanent injunction against defendants upon a finding of infringement. Relying on the predictability of the Federal Circuit's jurisprudence on permanent injunctions, patentees used that certainty as leverage when they negotiated settlements with defendants who had already been found to be infringing on the patents.[67] From willful infringement, good faith reliance on advice of counsel, and fraud defense, to every other facet of patent law, the Federal Circuit fully embraced its role as created by Congress, molding patent law into a new philosophy of strengthening the incentive to innovate.[68]

The Federal Circuit's strong patent philosophy developed amidst a new economic reality in the United States. Companies in every sector of manufacturing were moving from the United States to other countries for cheaper labor.[69] Foreign goods from electronics to automobiles flooded the U.S.

---

[65] Ass'n for Molecular Pathology v. U.S. Patent & Trademark Office, 653 F.3d 1329, 1333-34 (Fed. Cir. 2011) (holding that composition claims covering isolated DNA sequences and method claim for screening potential cancer therapeutics via changes in cell growth rate were patentable subject matter), *aff'd in part, rev'd in part sub nom.*, Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576 (2013).

[66] Prometheus Labs., Inc. v. Mayo Collaborative Servs., 628 F.3d 1347, 1349 (Fed. Cir. 2010) (holding that methods for calculating thiopurine dosage was patentable), *rev'd*, 566 U.S. 66 (2012).

[67] MercExchange, L.L.C. v. eBay, Inc., 401 F.3d 1323, 1339 (Fed. Cir. 2005) ("If the injunction gives the patentee additional leverage in licensing, that is a natural consequence of the right to exclude and not an inappropriate reward to a party that does not intend to compete in the marketplace with potential infringers."), *vacated*, 547 U.S. 388 (2006). The Federal Circuit's special rule for patent injunctive remedies did not last, as the Supreme Court vacated and remanded in *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 394 (2006); *see also id.* at 396-97 (Kennedy, J., concurring) ("When the patented invention is but a small component of the product the companies seek to produce and the threat of an injunction is employed simply for undue leverage in negotiations, legal damages may well be sufficient to compensate for the infringement and an injunction may not serve the public interest.").

[68] The patent system's incentive for innovation has been studied. *See generally* Matthew S. Clancy & GianCarlo Moschini, *Incentives for Innovation: Patents, Prizes, and Research Contracts*, 35 APPLIED ECON. PERSP. & POL'Y 206 (2013); Paul Belleflamme, Note, *Patents and Incentives to Innovate: Some Theoretical and Empirical Economic Evidence*, 13 ETHICAL PERSP. 267 (2006).

[69] Marilyn Geewax, *U.S. Manufacturing: A Remembrance and a Look Ahead*, NPR (Oct. 3, 2014, 7:06 AM), https://www.npr.org/2014/10/03/353044962/u-s-manufacturing-a-remembrance-and-a-look-ahead [https://perma.cc/Q74L-ZWZ7] ("In 1979, nearly 20 million Americans made goods for a living. Today, only about 12 million are still standing on factory floors."); Heather Long, *U.S. Has Lost 5 Million Manufacturing Jobs Since 2000*, CNN (Mar. 29, 2016, 3:47 PM), http://money.cnn.com/2016/03/29/news/economy/us-manufacturing-

market.[70] U.S. trade deficits expanded.[71] In addition, five new industries related to computers, electronics, and semiconductors have been identified as having contributed to manufacturing job losses in the United States.[72] The rise of these new industries, healthcare, and other services emphasizes the important role of innovations.[73] In fact, economists have identified that innovation is the key driver of economic growth.[74] Innovation is risky and requires many attempts, revisions, and do-overs. It also demands originality, patience, teamwork, and

jobs/index.html [https://perma.cc/LXF9-G2MW] (reporting decline in U.S. manufacturing jobs from 24% of workers employed in manufacturing in 1960, to 19% in 1980, 13% in 2000, and 8% in 2016); Mark Muro, *Manufacturing Jobs Aren't Coming Back*, MIT TECH. REV. (Nov. 18, 2016), https://www.technologyreview.com/s/602869/manufacturing-jobs-arent-coming-back/ (noting that "collapse of labor-intensive commodity manufacturing in recent decades and the expansion in this decade of super-productive advanced manufacturing" caused "massive 30-year decline of employment beginning in 1980" with U.S. manufacturing jobs "plung[ing] from 18.9 million jobs to 12.2 million").

[70] Linette Lopez, *The White House is Only Telling You Half of the Sad Story of What Happened to American Jobs*, BUS. INSIDER (July 25, 2017, 12:20 PM), http://www.businessinsider.com/what-happened-to-american-jobs-in-the-80s-2017-7 [https://perma.cc/A98J-TSBF] ("Industries like consumer electronics, automobiles, machine tools, steel and microelectronics were all hit especially hard by Japan's advancement.").

[71] *United States-China Economic Relations and China's Role in the Global Economy: Hearing Before the H. Comm. on Ways and Means*, 108th Cong. 19 (2003) (statement of N. Gregory Mankiw, Chairman, Council of Economic Advisors) ("The U.S. trade deficit with China in goods is large and more than doubled between 1995 and 2000. So far this year, the U.S. has a $125 billion (annualized) deficit with China, our single largest bilateral trade deficit.").

[72] As Professor Mankiw observed, the "five industries that have contributed most significantly to manufacturing job losses since July 2000 are: computer and electronic equipment (16.0 percent of all manufacturing job losses), machinery (10.8 percent), transportation equipment (10.7 percent), fabricated metal products (10.7 percent), and semiconductor and electronic components (7.5 percent)." *Id.* at 22.

[73] *See, e.g.*, John Haughom, *Innovation in Healthcare: Why It's Needed and Where It's Going*, HEALTH CATALYST (Dec. 10, 2014), https://www.healthcatalyst.com/innovation-in-healthcare-why-needed-where-going [https://perma.cc/9SHZ-WEQX]. Interestingly, in the healthcare sector, "compelling innovations" are now not from resource-rich, developed countries, but from emerging markets due to the ideas that "necessity breeds innovation" and that entrepreneurs face fewer constraints because of "weaknesses in the infrastructure, institutions, and resources of emerging markets." Tilman Ehrbeck, Nicolaus Henke & Thomas Kibasi, *The Emerging Market in Health Care Innovation*, MCKINSEY & CO. (May 2010), https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/the-emerging-market-in-health-care-innovation [https://perma.cc/7GM3-ZA22].

[74] *See, e.g.*, Pianalto, *supra* note 22 ("[N]early 90 percent of the rise in U.S. prosperity during the first half of the twentieth century came from technological growth, and not, as most economists had assumed, from the mere accumulation of machinery."); Varney, *supra* note 22 ("Invention and innovation are critical in promoting economic growth, creating jobs, and maintaining our competitiveness in the global economy.").

investment. In the innovation space, technological and intangible knowledge is essential and more valuable than ever for businesses to compete.[75] Patented inventions stemming from innovation are protected under the strong patent system as crafted instrumentally by Judge Rich, enhanced by Congress through its creation of the Federal Circuit, and molded daily by the Federal Circuit that cherishes the certainty, predictability, patent inclusion, and incentives for business to innovate.[76]

Indeed, businesses can rely on the patents obtained to enjoy the exclusive rights for twenty years.[77] Their patents are statutorily presumed valid, as the Patent Office has examined all of the patentability requirements. Businesses can rely on the predictability of patent jurisprudence related to infringement, permanent injunctive relief, affirmative defenses, and privilege, among others, as interpreted by the Federal Circuit as the bedrock of certainty.[78] In the end, businesses and their partners and investors can rely on patents as signals of innovation and exclusivity, as they know all too well that investment in new technology will not occur if the patents covering the technology and the patent law are uncertain.[79]

---

[75] Sobel, *supra* note 28, at 1091-92 (describing generally patent system's stimulus of invention); *see also Enterprising States: Executive Summary*, U.S. CHAMBER OF COM. FOUND., https://www.uschamberfoundation.org/enterprisingstates/assets/files/Executive-Summary-OL.pdf [https://perma.cc/78BS-TYWB] (last visited Aug. 22, 2019) (noting that 50% of U.S. annual GDP growth is attributed to increases in innovation and identifying key factors for knowledge and technology-based economy); Pianalto, *supra* note 22 ("While innovation leads to higher growth, higher growth can lead to greater investments in R&D, which will likely lead to more innovation. The forces that drive innovation are not necessarily random events. They are usually driven by the need to be competitive.").

[76] Robert Pitofsky, *Challenges of the New Economy: Issues at the Intersection of Antitrust and Intellectual Property*, 68 ANTITRUST L.J. 913, 923 (2001) (concluding that "Federal Circuit's overall attentiveness to preserving incentives to innovate makes sense, particularly in an economy that depends more and more on innovation to advance consumer welfare"); Sobel, *supra* note 28, at 1092 ("The net effect of the Federal Circuit's work . . . has been to strengthen the incentive to innovate.").

[77] 35 U.S.C. § 154(a)(2) (2012) ("Subject to the payment of fees under this title, such grant shall be for a term beginning on the date on which the patent issues and ending 20 years from the date on which the application for the patent was filed in the United States or, if the application contains a specific reference to an earlier filed application or applications under section 120, 121, or 365(c), from the date on which the earliest such application was filed.").

[78] *See* Hon. Pauline Newman, *The Federal Circuit: Judicial Stability or Judicial Activism?*, 42 AM. U. L. REV. 683, 684-85 (1993) (stating that reason to establish Federal Circuit was "forceful concern of the nation's technological leadership about the effect on industrial innovation of judge-made patent law . . . . The interest of industry was the restoration of the patent system's constitutional and statutory incentive to promote technological progress").

[79] *See, e.g.*, *id.* at 685 ("Patent rights are a factor in much of the research, investment, and commercial risk-taking that comprise industrial innovation . . . .").

As planned by the adoption of the 1952 Patent Code and the creation of the Federal Circuit in 1982 for patent cases, inventors substantially increased patent application filings and received more patents.[80] As noted elsewhere, in the three decades after the creation of the Federal Circuit, patent grants increased four times.[81] The average inventors, from those in computer-related fields to those in biotechnology-related sectors, can obtain patent protection for their innovations. Startups can rely on patent filings and patent grants to seek financing. As a result, Silicon Valley and technology centers across the nation sprouted up.[82]

B. *Direct Funding of Basic and Applied Research*

On December 12, 1980, two years before the creation of the Federal Circuit, Congress passed the Bayh-Dole Act to allow universities the right to own and exploit patents for their innovative research, funded by government grants.[83] The government understood that patents are property and that property should be utilized through commercialization, and not be sitting idly.[84] Congress recognized that universities have ownership of the patents even though the government has provided the funding necessary for the underlying research, instilling its belief that institutions and their researchers, rather than the

[80] LANDES & POSNER, *supra* note 46, at 352 (concluding that "creation of the Federal Circuit appears to have had a positive and significant impact on the number of patent applications, the number of patents issued, the success rate of patent applications, [and] the amount of patent litigation"). Other scholars have also added that efforts from the Patent Office and interest groups lifted the number of patent filings and grants. *See, e.g.*, Clarisa Long, *The PTO and the Market for Influence in Patent Law*, 157 U. PA. L. REV. 1965, 1984-88 (2009).

[81] *See* Gugliuzza, *supra* note 49, at 1803 n.48 ("Over the past thirty years, the number of patents issued annually has increased nearly fourfold, from about 58,000 in 1982 to about 225,000 in 2011."); *U.S. Patent Activity: Calendar Years 1790 to the Present*, U.S. PAT. & TRADEMARK OFF., http://www.uspto.gov/web/offices/ac/ido/oeip/taf/h_counts.htm [https://perma.cc/XLB2-L3AG] (last visited Aug. 22, 2019).

[82] Zorina Khan, *Enterprise and Incentives for Innovation*, NAT'L BUREAU OF ECON. RES. (2017), https://www.nber.org/reporter/2017number1/khan.html [https://perma.cc/M7CN-WFVL] ("One of the fundamental features of the American patent system was its role in facilitating markets in technology and the mobilization of venture capital.").

[83] Universities embraced the landmark Bayh-Dole Act, Pub. L. No. 96-517, 94 Stat. 3015 (1980) (codified as amended at 35 U.S.C. §§ 200-212 (2012)), which has "fundamentally changed the nation's system of technology transfer" and led to the increase in "patenting and licensing groundbreaking discoveries." *Landmark Law Helped Universities Lead the Way*, ASS'N U. TECH. MANAGERS, https://autm.net/about-tech-transfer/advocacy/legislation/bayh-dole-act [https://perma.cc/4UHC-T4JQ] (last visited Aug. 22, 2019). Other countries then followed with similar legislation. *See id.*

[84] Prior to the passage of the Bayh-Dole Act, only 5% of government-owned patents were utilized by industry. WENDY H. SCHACHT, THE BAYH-DOYLE ACT: SELECTED ISSUES IN PATENT POLICY AND THE COMMERCIALIZATION OF TECHNOLOGY 2 (2010).

government, are in a better position to partner with others in industry and maximize the benefits the patents confer.[85] Immediately, universities developed technology transfer offices to work with their researchers; to seek patent protections for new technologies coming out of labs, projects, and classrooms; and to foster the creation of thousands of new companies.[86]

Consequently, universities became centers for basic scientific research and thus expanded their reliance on the government for funding in their pursuit of knowledge. Recognizing the unique role of universities in knowledge creation, Congress continued to provide grants to researchers for fundamental basic and applied research after the Bayh-Dole Act. For example, the National Science Foundation reported that the percentage of basic science research from 1980 to 2001 increased from 66.6% to 74.1%.[87] The grants are crucial for researchers to cover the cost of equipment, materials, supplies, travel to conferences, and payroll for hiring scientists.[88] Researchers enjoyed robust federal funding that

[85] Universities commercialize their patents by entering exclusive licensing deals with firms from different industries. *Id.* at 4. This is very attractive to industry because, before the enactment of the Bayh-Dole Act, government agencies often insisted on nonexclusive patent licenses, which were very unappealing to firms. *Id.* at 2.

[86] David Levenson, *Consequences of the Bayh-Dole Act* 6 (Dec. 12, 2005) (unpublished final paper) (available at http://web.mit.edu/lawclub/www/Bayh-Dole%20Act.pdf [https://perma.cc/T243-FMZB]) (stating that "about thirty billion dollars of economic activity per year and 250,000 jobs can be attributed to technologies born in academic institutions"); Ass'n Univ. Tech. Managers, *Thirty Years After Passage, Bayh-Dole Act Drives the Economy, Protects Public Health*, NEWSWISE (May 3, 2010, 12:00 PM), http://www.newswise.com/articles/thirty-years-after-passage-bayh-dole-act-drives-the-economy-protects-public-health [https://perma.cc/F8G8-JUGP] ("Since the enactment of Bayh-Dole, more than 5,000 new companies have formed around university research.").

[87] Levenson, *supra* note 86.

[88] *See Chapter II - NSF Awards*, NAT'L SCI. FOUND. (July 2005), https://www.nsf.gov/pubs/manuals/gpm05_131/gpm2.jsp [https://perma.cc/N7A6-9LP2] (describing activities and materials funded by National Science Foundation); *Chapter VI - NSF Allowability of Costs*, NAT'L SCI. FOUND. (July 2005), https://www.nsf.gov/pubs/manuals/gpm05_131/gpm6.jsp [https://perma.cc/39KF-CF8U] (describing general applicability of federal cost principles to NSF cost reimbursement grants); Michael Hiltzik, *Reduced Public Funding for Basic Research Leaves U.S. in the Scientific Dust*, L.A. TIMES: BUS. (Apr. 28, 2015, 11:42 AM), http://www.latimes.com/business/hiltzik/la-fi-mh-the-funding-decline-in-basic-research-20150428-column.html [https://perma.cc/F2UZ-PNQZ] (reporting that percentage of science and engineering doctorate holders with full-time faculty appointments was 90% in 1970s); *NIH Grants Policy Statement*, NAT'L INST. HEALTH, https://grants.nih.gov/grants/policy/nihgps/html5/section_7/7.9_allowability_of_costs_activities.htm [https://perma.cc/LAF2-PLVT] (last visited Aug. 22, 2019) (describing National Institute of Health's policies for cost reimbursement through grants).

constituted 2% of the U.S. gross domestic product ("GDP") in the 1970s.[89] In the 1960s and 1970s, the federal government shouldered 70% of the funding for basic research. The government scaled back to 61% as of 2004.[90] And after the financial crisis of 2008, the federal government enhanced federal funding for research to $160 billion in 2010.[91]

Without grant funding, there would be no research for innovation, and there would be no invention for patent filings and, consequently, no patents for licensing.[92] Moreover, in the past, firms like AT&T, DuPont, IBM, Merck, and the like invested in fundamental scientific research.[93] And the stock market then valued corporate fundamental and scientific research by taking the long-term view.[94]

Overall, in past decades the United States has invested three times as much as any other economy in basic research in pursuit of scientific knowledge and applied research to turn discoveries into useful technologies for industry and

[89] Jahne, *supra* note 14 ("Seen from a longer perspective, federal spending on R&D as a share of the gross domestic product has been in a long, slow slide from the 1970s, when it peaked above 2 percent.").

[90] Jeffrey Mervis, *Data Check: U.S. Government Share of Basic Research Funding Falls Below 50%*, SCI. MAG. (Mar. 9, 2017, 1:15 PM), http://www.sciencemag.org/news/2017/03/data-check-us-government-share-basic-research-funding-falls-below-50 [https://perma.cc/M7SC-F2A8]).

[91] Jahne, *supra* note 14 ("According to the American Association for the Advancement of Science (AAAS), the federal government pays almost $140 billion a year for research and development, down from a 2010 peak of about $160 billion, in constant dollars.").

[92] The connection among the Bayh-Dole Act, government funding, and public-private sector R&D reliance allows new businesses to be created from university researchers and patents licensed. *See* Joseph Allen, *Academic Patent Licensing Helps Drive the U.S. Economy*, IPWATCHDOG (June 20, 2017), http://www.ipwatchdog.com/2017/06/20/academic-patent-licensing-helps-drive-u-s-economy/id=84778/ [https://perma.cc/U2GT-YJEL] (describing impact of patent regulation on growing technology transfer in United States).

[93] *See generally* Ashis Arora et al., *The Decline of Research in Corporate R&D*, DUKE U. SCH. L. (Apr. 2, 2017), https://law.duke.edu/sites/default/files/centers/cip/changing-innovation_arora-and-belenzon-final.pdf [https://perma.cc/6BTZ-E4X4] (describing corporate shift from fundamental research to applied research).

[94] *See* Ashish Arora, Sharon Belenzon & Andrea Patacconi, *The Decline of Science in Corporate R&D*, 39 STRATEGIC MGMT. J. 3, 3 (2018) (finding that "value attributable to scientific research has dropped" and that "[l]arge firms still value the golden eggs of science (as reflected in patents) but seem to be increasingly unwilling to invest in the golden goose itself (the internal scientific capabilities)"); Brad Plumer, *American Companies Are Investing Way Less in Science Than They Used To*, VOX, https://www.vox.com/2015/2/4/7965967/corporate-research-basic-science [https://perma.cc/EHJ6-YDY5] (last updated Feb. 4, 2015, 12:30 PM) (describing value placed on patents over applications by corporate America).

society.[95] Still, Europe and China have proved to be formidable competitors, and thus innovation requires constant attention amidst fierce global competition.

C. *Tax Incentives for Innovation*

The government also supports new innovation indirectly through various tax incentives.[96] In theory, tax incentives for innovation can encourage private spending that would not otherwise occur in the private market. This is a good thing because it is generally believed that research produces positive spillover effects, such as attracting high value workers including engineers and scientists, as well as luring capital essential for innovation.

Are special tax incentives for innovation justified? After all, an ideal tax system should be neutral and avoid unnecessarily shaping economic behavior.[97] Over the past half century, however, this neutrality principle has lost ground to what might be termed "social engineering." Today, there are many tax rules in place that deliberately attempt to drive certain economic policies. These rules create what are known as "tax expenditures." In the common vernacular, a tax expenditure might be called a tax break or a tax loophole. Whatever we call it, a tax expenditure occurs when a rule causes the government to collect less revenue than it would collect under a "normal" income tax.[98] Social engineering through tax expenditures is a prominent feature of our current income tax. The federal government maintains what is known as the tax expenditures budget, a compilation of all of the tax expenditures.[99] It is estimated that federal income

[95] Hal Sirkin, Justin Rose & Rahul Choraria, *An Innovation-Led Boost for US Manufacturing*, BOS. CONSULTING GROUP (Apr. 17, 2017), https://www.bcg.com/publications/2017/lean-innovation-led-boost-us-manufacturing.aspx [https://perma.cc/D7CJ-WPRJ].

[96] Some commentators have suggested that special tax incentives are inappropriate. *See, e.g.*, Graetz & Doud, *supra* note 22, at 408 (arguing that "R&D tax incentives are inevitably overbroad, rewarding spending that would have occurred without the tax break, and subsidizing R&D that produces little or no positive spillover"); David Hasen, *Taxation and Innovation—A Sectorial Approach*, 2017 U. ILL. L. REV. 1043, 1043.

[97] An ideal tax system should also embrace principles of fairness and efficiency. *See* JOHN A. MILLER & JEFFREY A. MAINE, THE FUNDAMENTALS OF FEDERAL TAXATION 5 (5th ed. 2018). For an analysis of equity and efficiency in the tax system governing intellectual property, see generally Xuan-Thao Nguyen & Jeffrey A. Maine, *Equity and Efficiency in Intellectual Property Taxation*, 76 BROOK. L. REV. 1 (2010).

[98] This raises the question of what is a normal income tax. There is a great deal of room for debate on this topic but, in general, we can say that a normal income tax would require capitalization and recovery of those costs over the innovation's useful life.

[99] Congressional Budget and Impoundment Control Act of 1974, Pub. L. No. 93-344, 88 Stat. 297 (codified as amended at 2 U.S.C. §§ 601-688 (2012)) (requiring that list of "tax expenditures" be included in budget).

tax revenues are reduced by hundreds of billions of dollars annually as result of tax expenditures.[100]

Historically, some of the biggest tax expenditures have been for special tax rules designed to encourage new innovation.[101] Tax incentives for innovation generally fall within one of two categories: (1) those on the development side of innovation—specifically, a tax deduction and tax credit for qualified research spending; and (2) those on the back end of the innovation cycle—specifically, a low tax rate on gain from the sale of successful innovation. In the United States, *individual* inventors have historically benefited from both categories of tax incentives. For example, an individual inventor could expense 100% of his or her research costs when paid. If the research was successful and the inventor later sold the invention, he or she could enjoy a low tax rate on any gain. In contrast to individual inventors, *corporate* inventors have historically benefitted from front-end tax incentives only (i.e., a tax deduction or credit for qualified research spending). Corporations do not receive special rate treatment on their gains. It is worthy to note that the United States, in contrast to many other nations, has never adopted a reduced tax rate on royalty income from successful innovation. As noted above, only gains from dispositions by individual inventors have been accorded preferential rate treatment.

1. Special Rate Treatment for Innovation Gains

The government began carving out special tax rules for innovation in the mid-twentieth century. The first special rule for innovation (a back-end tax incentive) was enacted in 1950. Prior to 1950, creators of both copyrighted works and patented inventions were treated similarly for tax purposes. So long as their works were not considered inventory (i.e., so long as they weren't professional creators), they would receive preferential capital gains treatment on later dispositions. Capital gains treatment is preferential to ordinary income treatment because capital gains are taxed at lower rates.[102] To receive capital gains treatment, one must sell a so-called "capital asset" held for more than one year.[103]

[100] *See Tax Expenditures 2019*, U.S. DEP'T TREASURY 21-37 (Oct. 16, 2017), https://www.treasury.gov/resource-center/tax-policy/Documents/Tax-Expenditures-FY2019.pdf [https://perma.cc/3XEA-Q5LJ] (listing estimated tax expenditures for years 2017-2027).

[101] *See Tax Expenditures 2018*, U.S. DEP'T TREASURY 22-37 (Sept. 28, 2016), https://www.treasury.gov/resource-center/tax-policy/Documents/Tax-Expenditures-FY2018.pdf [https://perma.cc/6S86-AXL9] (detailing historical figures for expenditures).

[102] Under current law, the maximum rate at which capital gains are taxed is 20% and the maximum rate at which ordinary income is taxed is 37%, a significant rate differential. I.R.C. § 1 (2012). Over the years, as Congress has tinkered with both rate structures, the spread has changed. All references to the Internal Revenue Code ("I.R.C.") are to the I.R.C. of 1986, as amended, unless otherwise noted.

[103] *Id.* § 1222 (explaining differences between short-term and long-term capital gains).

In 1948, President Dwight D. Eisenhower published a book of wartime memoirs, *Crusade in Europe*, and sold it at a substantial gain. With the help of a ruling by the Treasury Department that he was not a professional writer,[104] he was able to enjoy capital gains treatment, saving about $400,000 in taxes.[105] Congress responded by modifying the definition of a "capital asset" (that is an asset eligible for preferential capital gains treatment) in the Revenue Act of 1950. The new definition excluded self-created copyrights; literary, musical, or artistic compositions; and similar property.[106] Under this change, which has been called the "Eisenhower Amendment," when a person sells a book or other artistic work that is the product of his or her personal effort, his or her gain is taxed at the higher rates applicable to ordinary income.[107] The stated policy behind the change was that gains from personal efforts should be taxed as ordinary income just as wages and salaries are taxed as ordinary income.[108]

When Congress adopted this rule in 1950, it also considered treating as ordinary income gains from the sale of an invention or patent by the occasional inventor. Indeed, the House bill included the words "invention," "patent," and "design" in types of self-created property that were excluded from the capital asset definition and, thus, ineligible for preferential capital gains treatment. Ultimately, however, the committee believed "that the desirability of fostering

[104] Inventory is not considered a capital asset and is taxed at ordinary income tax rates. *Id.* § 1221(a)(1).

[105] DAVID PIETRUSZA, 1948: HARRY TRUMAN'S IMPROBABLE VICTORY AND THE YEAR THAT TRANSFORMED AMERICA 201 (2011).

[106] Under prior law, a person in the profession of writing books or creating other artistic works had ordinary income when he or she sold the products of his or her work. I.R.C. § 1221(a)(1) (2012) (excluding inventory from definition of capital asset). The 1950 tax law change had the effect of putting nonprofessional writers, artists, and photographers on parity with professional writers, artists, and photographers who are subject to ordinary rates on sales of their works.

[107] Some uncertainty exists regarding whether the section 1221(a)(3) exclusion applies to nonindividual creators, such as corporations whose employees or independent contractors created the copyrights. The exclusion applies to "a taxpayer whose personal efforts created" the property. *See* Martin Ice Cream Co. v. Comm'r, 110 T.C. 189, 230 (1998) (holding that business records created by corporation's employee did not fall within I.R.C. § 1221(a)(3)).

[108] Over the years, the Treasury Department and courts broadened the scope of the provision to cover not only traditional copyrighted works and property eligible for copyright protection, but also abstract ideas, such as cartoon characters or formats or ideas for television or radio shows, that are not copyrightable per se. *See* Treas. Reg. § 1.1221-1(c)(1) (as amended in 1975) (noting that "similar property" includes "a theatrical production, a radio program, a newspaper cartoon strip, or any other property eligible for copyright protection"); *see also* Cranford v. United States, 338 F.2d 379, 384 (Ct. Cl. 1964) (holding that "format for radio or television program was 'similar property'"); Stern v. United States, 164 F. Supp. 847, 851 (E.D. La. 1958) (addressing whether character "Francis," the talking mule, was "similar property" and therefore within scope of I.R.C. § 1221(a)(3)), *aff'd per curiam*, 262 F.2d 957 (5th Cir. 1959).

the work of such inventors outweigh[ed] the small amount of additional revenue which might be obtained under the House bill."[109] Accordingly, any references to inventions, patents, and designs were eliminated. This was a strong signal that innovation was to be accorded different, and preferential, treatment under the law, at least for amateur inventors.[110]

While the 1950 tax law change signaled preferential treatment for patented inventions, it only applied to amateur inventors, not to those who habitually invented and sold their inventions. It also applied only to amateur inventors who held their inventions sufficiently long enough (one year) before transferring their rights in the invention. There was also some uncertainty as to whether capital gains treatment should be available to non-professional inventors who sold their inventions but who received contingent payments resembling royalties for their inventions. Royalty payments under a license are taxed at ordinary income rates.

Four years later in 1954, Congress confirmed its desire to provide tax relief to inventors by enacting a special rule for all individual inventors—whether amateur or professional.[111] Section 1235 of the Internal Revenue Code ("Code") provides statutory assurance to individual inventors that the sale of their inventions will qualify for reduced capital gains rates, as opposed to ordinary income tax rates. This is true even if the sale involves contingent payments,[112] the transferor is a professional inventor and would otherwise have to report ordinary income under general tax rules,[113] and the invention has been held for less than one year and would otherwise not meet the requisite one-year holding period under the general capital gains provisions.[114] By assuring individual

[109] S. REP. NO. 81-2375, at 44 (1950), *as reprinted in* 1950 U.S.C.C.A.N. 3053, 3098.

[110] Although, "[i]t has been said that if President Eisenhower had realized similar profits from a patented invention, copyrights would still be treated favorably and patents would have been singled out for non-capital gains treatment." JOHN HENRY MERRYMAN & ALBERT E. ELSEN, LAW, ETHICS AND THE VISUAL ARTS 797 (4th ed. 2002).

[111] *See* I.R.C. § 1235 (2012) (guaranteeing capital gains rates, as opposed to higher ordinary income tax rates, for any transfer of all substantial rights to patent (or of undivided interest in all such rights to patent) by certain holders to unrelated parties); S. REP. NO. 83-1622, at 113 (1954), *as reprinted in* 1954 U.S.C.C.A.N. 4621, 4747; H.R. REP. NO. 83-1337, at A280 (1954), *as reprinted in* 1954 U.S.C.C.A.N. 4017, 4422.

[112] *See* I.R.C. § 1235(a) (2012) (providing that section 1235 applies regardless of whether payments received are payable periodically over period generally coterminous with transferee's use of patent or are contingent on productivity, use, or disposition of property transferred).

[113] *See* S. REP. NO. 83-1622, at 113 (1954), *as reprinted in* 1954 U.S.C.C.A.N. 4621, 4747 (stating that section 1235 can provide capital gains treatment to all inventors, whether amateur or professional, regardless of how often they sell their patents); H.R. REP. NO. 83-1337, at A280 (1954), *as reprinted in* 1954 U.S.C.C.A.N. 4017, 4422 (describing only method under then-new Code by which inventor of patent could obtain capital gains on its sale).

[114] *See* I.R.C. § 1223(3) (2012). Under general characterization rules, only long-term capital gains are accorded preferential tax treatment. A long-term capital gain requires a

inventors that sales of their inventions qualify for special tax treatment, section 1235 is designed to encourage R&D that potentially leads to patentable inventions.[115] A stated policy goal underlying section 1235's enactment was "to provide an incentive to inventors to contribute to the welfare of the Nation."[116]

2. Tax Deduction for Qualified Research Spending

At the same time Congress enacted section 1235 as a back-end incentive to stimulate economic growth and technological advancement, it enacted a very important front-end tax incentive for innovation—section 174 of the Code. Section 174 permits inventors to elect to expense immediately 100% of their qualified research and experimental expenditures.[117] The legislative goal was clear—to encourage innovation activities. As noted by Daniel A. Reed, then Chairman of the House Ways and Means Committee: "This provision will greatly stimulate the search for new products and new inventions upon which the future economic and military strength of our Nation depends. It will be particularly valuable to small and growing businesses."[118] Small businesses, in particular, were viewed as potential beneficiaries since section 174 does not require that an inventor has already established himself in a trade or business to

holding period of more than one year. *Id.* Under the special characterization provision of section 1235, however, the actual holding period becomes irrelevant.

[115] It is worth noting that the special characterization safe harbor does not apply to corporate inventors. Perhaps this was deliberate, as corporations do not receive preferential rate treatment on their capital gains; all income (capital and ordinary) are taxed at the same federal corporate income tax rate. I.R.C. § 11 (2012).

[116] S. REP. NO. 83-1622, at 439 (1954), *as reprinted in* 1954 U.S.C.C.A.N. 4621, 5082.

[117] I.R.C. § 174(a) (2012). A taxpayer could also use one of two other methods to account for research and experimental expenditures. In lieu of currently deducting expenditures in the year in which they were paid or incurred, a taxpayer could: (1) elect to treat the expenditures as deferred expenses amortizable over a period of at least sixty months beginning in the month that benefits are first realized from the expenditures; or (2) elect to amortize the expenditures over ten years beginning in the tax year in which they are paid or incurred. *Id.* §§ 174(b), 59(e).

[118] 3 CONG. REC. 3425 (1954) (statement of Chairman Reed); *see also* H.R. REP. NO. 83-1337 (1954), *as reprinted in* 1954 U.S.C.C.A.N. 4017, 4053; Donald C. Alexander, *Research and Experimental Expenditures Under the 1954 Code*, 10 TAX L. REV. 549, 549 (1955) (noting that primary reason for enacting section 174 was to create incentive for new products and inventions through federal subsidy of R&D start-ups); William Natbony, *The Tax Incentives for Research and Development: An Analysis and a Proposal*, 76 GEO. L.J. 347, 349 (1987) (explaining that Congress decided to provide taxpayers with option of immediate deduction in order to encourage new R&D); Richard L. Parker, *The Innocent Civilians in the War Against NOL Trafficking: Section 382 and High-Tech Start-Up Companies*, 9 VA. TAX REV. 625, 694 (1990) ("The deduction election under section 174(a) is intended to encourage research and development activities by allowing the cost of such activities to be used to offset the income earned in the business at the earliest possible date.").

get the deduction. An inventor need only show that he has the intent and capability to enter into business with the resulting technology.[119]

Without this special rule, innovation costs could not be expensed in the same year they are paid. This is because, since the inception of the modern income tax in 1913, the Code has generally precluded a current deduction for so-called "capital expenditures." The term "capital expenditure" is tax jargon for any expenditure that produces an asset lasting beyond the current tax period.[120] Applying the asset capitalization rule to innovation costs can be challenging for a number of reasons. It is often difficult to determine when research activities result in an identifiable asset, the costs of which must be capitalized. Further, because research may span several years with varying degrees of success, it is often difficult to apportion costs if a particular project partly succeeds and partly fails or when different and simultaneous research activities contribute in varying degrees to the development of an asset or assets.[121] By permitting immediate deduction for qualified research spending, section 174 avoided these messy accounting issues.[122] More importantly, as noted above, section 174 was an important incentive for taxpayers to engage in desirable research activities.[123]

---

[119] *See* Snow v. Comm'r, 416 U.S. 500, 502 (1974) (allowing section 174 deduction for petitioner, despite limited partnership and lack of success); Kantor v. Comm'r, 998 F.2d 1514, 1518 (9th Cir. 1993) (construing language of section 174 broadly based on *Snow*).

[120] Revenue Act of 1913, ch. 16, § II(B), 38 Stat. 114, 167 (outlining allowable business expense deductions). For the current disallowance provisions, see 26 U.S.C.A. §§ 263, 263A (Westlaw through Pub. L. No. 116-56).

[121] *See* David S. Hudson, *The Tax Concept of Research or Experimentation*, 45 TAX LAW. 85, 88-89 (1991) (explaining why asset-capitalization rule is difficult to apply to R&D costs); George Mundstock, *Taxation of Business Intangible Capital*, 135 U. PA. L. REV. 1179, 1258-59 (1987).

[122] For a very brief period in tax history, well before the enactment of section 174, the government permitted expensing of certain research costs:

> In 1919, [the Treasury] promulgated a regulation that gave taxpayers the option of either deducting or capitalizing expenses "for designs, drawings, patterns, models, or work of an experimental nature [if] calculated to result in improvement[s] of [taxpayers'] facilities or [taxpayers'] product[s]." Shortly thereafter, however, the Treasury deleted the regulation because it found that certain taxpayers were enjoying double tax benefits from their research—i.e., deducting research expenses when paid, but also capitalizing them in the basis of developed patents thereby reducing gain on later sales.

Xuan-Thao Nguyen & Jeffrey A. Maine, *The History of Intellectual Property Taxation: Promoting Innovation and Other Intellectual Property Goals*, 64 SMU L. REV. 795, 802 & n.20 (2011) (footnotes omitted) (quoting Treas. Reg. 45, art. 168 (1919)). Following withdrawal of the regulation, courts generally adhered to the asset-capitalization principle for research costs. *See generally* Clem v. Comm'r, 10 T.C.M. (CCH) 1248 (1951); Claude Neon Lights, Inc. v. Comm'r, 35 B.T.A. 424 (1937); Hazeltine Corp. v. Comm'r, 32 B.T.A. 110 (1935), *rev'd*, 89 F.2d 513 (3d Cir. 1937).

[123] I.R.C. § 263(a)(1)(B) (2012) (providing that capitalization rules under section 263(a) do not apply to research or experimental expenditures deductible under section 174(a)).

Congress left to the Treasury Department the job of defining which R&D expenditures qualify for expensing. The regulations define qualified costs as all costs incurred in the experimental or laboratory sense related to the development or improvement of a product.[124] In particular, qualifying costs are those incurred for activities intended to discover information that would eliminate *uncertainty* concerning the development or improvement of a product.[125] Examples of qualifying costs include salaries for those engaged in research, amounts incurred to operate and maintain research facilities (such as utilities, depreciation, and rent), and expenditures for materials and supplies used and consumed in the course of research (including amounts incurred in conducting trials).[126]

Over the years, the Treasury Department expanded the scope of research costs that qualified for current deduction under section 174—most recently in 1994[127] and 2014.[128] Perhaps the most significant enhancement of the section 174 deduction was its extension to computer software development costs. In administrative guidance, the IRS concluded that all costs of developing computer software may be deducted currently under section 174.[129] The government adopts a broad definition of "computer software" for deduction purposes. Because of this broad definition, section 174 principles apply not just to software development costs that would otherwise constitute research or experimental expenditures for purposes of section 174, but more importantly to software development costs that do not satisfy the definition of research and experimental expenditures under section 174.[130]

All of the tax incentives for innovation discussed above were enacted in the 1950s. To recap, on the front-end of the innovation cycle, Congress enacted a special deduction permitting 100% expensing of qualified innovation costs.

---

[124] Treas. Reg. § 1.174-2(a)(1) (as amended in 2014) ("The term *research or experimental expenditures*, as used in section 174, means expenditures incurred in connection with the taxpayer's trade or business which represent research and development costs in the experimental or laboratory sense.").

[125] *Id.*

[126] Treas. Reg. § 1.174-4(c) (1960). The definition of research and experimental expenditures also includes costs of obtaining a patent, such as attorney's fees incurred in making and perfecting a patent. Treas. Reg. § 1.174-2(a)(1) (as amended in 2014). For exclusions, see *Id.* § 1.174-2(a)(6).

[127] *See* Research and Experimental Expenditures, 59 Fed. Reg. 50,159, 50,160 (Oct. 3, 1994) (describing intent to clarify definition of "research or experimental expenditures" under section 174).

[128] *See* Research Expenditures, 79 Fed. Reg. 42,193, 42,193 (July 21, 2014) ("This document contains final regulations to amend the definition of research and experimental expenditures under section 174 of the Internal Revenue Code (Code).").

[129] Rev. Proc. 69-21, 1969-2 C.B. 303 (establishing definition and scope of "computer software" for expensing purposes), updated by Rev. Proc. 2000-50, 2000-2 C.B. 601.

[130] *Id.* (expanding definition scope of coverage for "computer software" past that of section 174).

Later, the Treasury and the IRS expanded the types of innovation eligible for expensing, including software development. On the back end of the innovation cycle, Congress enacted rules to ensure individual inventors would receive preferential capital gains rate treatment on the sales of their inventions—first the Eisenhower Amendment to the capital asset definition (in 1950) and later section 1235 (in 1954).[131] Interestingly, these tax policy tools were adopted around the same time as adoption of the Patent Code (1952), a strong signal of government support for innovation.

3. Tax Credit for Increases in Research Spending

Under the tax incentives discussed above, an inventor may deduct research costs and then enjoy a low capital gains tax on the later sale of the resulting innovation. Three decades after Congress created these powerful tax incentives for innovation, it enacted another tax incentive—a special tax credit ("STC") for incremental increases in research and spending. It should be noted that tax credits differ from tax deductions in one important way. Tax deductions reduce income before the tax rate is applied, whereas tax credits reduce tax liability dollar for dollar. Thus, a credit is worth more to a taxpayer since a deduction only reduces tax liability in proportion to the taxpayer's top marginal tax rate. For this reason, the STC was seen as a more powerful tool in incentivizing increased research activity within the United States.

The STC was enacted in 1981.[132] Codified in section 41 of the Code, the STC is incremental: it is equal to a certain percentage (20%) of qualified research spending above a "base amount"—generally, a firm's normal level of investment in R&D.[133] Innovators, therefore, can only benefit from it if they

[131] Other tax benefits for innovation slowly emerged. For example, section 174 deductions, unlike tax depreciation deductions, do not have to be recaptured and reported as ordinary income on later disposition of the property. Rev. Rul. 85-186, 1985-2 C.B. 84. As further example, inventions sold on a deferred payment basis are not subject to interest imputation rules under the Code (assuming section 1235 applies). I.R.C. §§ 483(d)(4), 1274(c)(3)(E) (2012) (outlining effect on disposition of transferring property).

[132] Economic Recovery Tax Act of 1981, Pub. L. No. 97-34, § 221(a), 95 Stat. 172, 241 (establishing original research credit at I.R.C. § 44F (1981)). In its current form, the research credit consists of three components: (1) 20% of the excess of the "qualified research expenses" for the taxable year over a "base amount"; (2) 20% of the "basic research payments" made during the year to universities and other qualified organizations; and (3) 20% of payments made during the year to an energy research consortium for qualified energy research. I.R.C. § 41(a)(1)-(3) (2012). The first component, commonly known as the general research credit or the incremental research credit, is the main focus of this article.

[133] The base amount (i.e., normal level of R&D investment) is a "fixed-base percentage" of the taxpayer's average annual gross receipts for the four preceding tax years. I.R.C. § 41(c)(1)(A)-(B) (2012). For established firms, the fixed-base percentage is generally based on a ratio of the taxpayer's qualified research expenses to its gross receipts for years 1984 to 1988, capped at 16%. *Id.* § 41(c)(3)(B). For start-up firms, the fixed-base percentage is set at

increase their research spending over time.[134] In theory, the STC lowers the cost of research and firms respond to the reduced price by spending more. There is some data and economic research, albeit limited, on the credit's effectiveness in increasing research spending by private businesses in the United States. One study found that for every one dollar of the credit, firms spend an additional one dollar or more on research.[135] This suggests that the credit is as cost effective as a direct federal research grant.The STC's reformulation over the years has limited the types of research for which the credit is available. Today, not all costs that qualify for the section 174 deduction qualify for the STC due to special regulatory requirements and exceptions.[136] In addition to meeting the requirements for deductibility under section 174, two additional requirements must be met. First, the research must be undertaken for the purpose of discovering information that is technological in nature.[137] Second, substantially all of the research activities must constitute elements of a process of experimentation for functional aspects, performance, reliability, or quality of a business component.[138] Both of these requirements have been the source of considerable controversy, in large part due to the regulations under section 41, which have a checkered past.[139] The main controversy over the years has been

3% during the firm's first five tax years with spending on qualified research and gross receipts. *Id.* § 41(c)(3)(B)(ii)(I). In no event shall the base amount be less than 50% of the qualified research expenses for the credit year. *Id.* § 41(c)(2).

[134] It might be possible for research expenses to qualify for both the STC and section 174 tax deduction discussed above. *See supra* notes 116-32 and accompanying text. In such a case, deductions under section 174 must be reduced by the extent to which the STC is taken. I.R.C. § 280C(c)(1) (2012) ("No deduction shall be allowed for that portion of the qualified research expenses (as defined in section 41(b)) or basic research expenses (as defined in section 41(e)(2)) otherwise allowable as a deduction for the taxable year which is equal to the amount of the credit determined for such taxable year under section 41(a).").

[135] *See* GUENTHER, *supra* note 23, at 19 ("[E]conomists have relied on . . . estimating the additional qualified research (if any) stimulated by the regular credit, and comparing the dollar value of that gain with the tax revenue lost because of the credit. Such an approach compares the direct benefits (i.e., added research investment) with the direct costs (revenue loss) of the regular credit. . . . If the ratio of benefits to cost is greater than one, then the credit can be seen as a more cost-effective way to boost research than direct research subsidies; if it is less than one, then funding the research directly would be more cost effective."). A 2000 study by economists Bronwyn Hall and John Van Reenan found that from 1981 to 1991 the U.S. research credit generated an additional dollar in research for every dollar lost in tax revenue. Bronwyn Hall & John Van Reenen, *How Effective Are Fiscal Incentives for R&D? A Review of the Evidence*, 29 RES. POL'Y 449, 466 (2000).

[136] I.R.C. § 41(d)(1) (2012).

[137] *Id.* § 41(d)(1)(B).

[138] *Id.* § 41(d)(1)(C).

[139] In January 2001, the Treasury issued a set of final regulations relating to the computation of the research credit and the definition of qualified research. *See* Credit for Increasing Research Activities, 66 Fed. Reg. 280, 280 (Jan. 3, 2001). Shortly thereafter,

whether these requirements add to the section 174 requirements discussed earlier, or whether they merely restate them.[140] However, these issues have since been largely resolved.[141]

As further limitation, section 41 specifically excludes a long list of research activities from eligibility for the STC.[142] One notable exclusion relates to development of internal-use software. Specifically, computer software developed for internal use by the taxpayer is excluded,[143] unless the internal-use software satisfies a high threshold of innovation test outlined in the regulations.[144]

A major limitation to the STC was its temporary nature. Until recently, the research credit was continually renewed as a temporary provision, which made it very difficult for firms to plan research activities.[145] In 2015, Congress made

however, the Treasury and IRS announced that these final regulations were suspended for further review and comment. *See* I.R.S. Notice 2001-19, 2001-10 I.R.B. 784 ("On January 3, 2001, the Treasury Department published final regulations relating to the computation of the research credit under § 41(c) . . . . The Treasury Department and the Internal Revenue Service will review these final regulations." (citation omitted)). In December 2001, the Treasury issued a new set of proposed regulations. *See* Credit for Increasing Research Activities, 66 Fed. Reg. 66,362, 66,362 (Dec. 26, 2001). Three years later, the Treasury issued final regulations under section 41. *See* Credit for Increasing Research Activities, 69 Fed. Reg. 22, 22 (Jan. 2, 2004).

[140] *See supra* notes 116-32 and accompanying text.

[141] Current regulations put these issues to rest. For example, they clarify that there is no "discovery" requirement in the research credit regulations separate and apart from that already required under section 174. Treas. Reg. § 1.41-4(a)(2) (as amended in 2016) (requiring research to be "treated as expenses under section 174"). Also, they expand on the definition of "technological in nature." *Id.* § 1.41-4(a)(4) ("[I]nformation is technological in nature if the process of experimentation used to discover such information fundamentally relies on principles of the physical or biological sciences, engineering, or computer science.").

[142] *See* I.R.C. § 41(d)(4) (2012).

[143] *Id.* § 41(d)(4)(E) (excluding "computer software which is developed by (or for the benefit of) the taxpayer primarily for internal use by the taxpayer" from the definition of qualified research, except "to the extent provided in regulations").

[144] Treas. Reg. § 1.41-4(c)(6) (as amended in 2016). This exception for internal-use software was the subject of considerable controversy for years. One issue concerned the definition of "internal-use" software. Another issue centered around what types of internal-use software should be considered to satisfy the high threshold of innovation test. It took a while, but regulations were finally issued in 2016 resolving these issues. *See* Credit for Increasing Research Activities, 81 Fed. Reg. 68,299, 68,299 (Oct. 4, 2016) ("This document contains final regulations concerning the application of the credit for increasing research activities.").

[145] *See, e.g.*, I.R.C. § 41(h)(1) (2012) ("This section shall not apply to any amount paid or incurred after June 30, 1995 . . . .").

the STC permanent.[146] This was probably the most significant enhancement to the STC since its adoption in 1981.

The U.S. tax incentives for innovation enacted in the early 1950s and early 1980s clearly reflect a policy decision to incentivize the development of patented inventions.[147] The incentives for patents and patent-like property do not apply to other forms of intellectual property, such as copyrights and trademarks.[148] With respect to copyright development, for example, creation costs must generally be capitalized.[149] And, under the Eisenhower Amendment discussed earlier, when an individual copyright creator disposes of her work, she must pay tax on gain at the higher rates applicable to ordinary income.[150]

Exceptions to these rules are limited. For example, under a special rule enacted in 1988, certain individual copyright creators (freelance writers, photographers, and artists, as defined in the Code) can deduct their "qualified creative expenses" if they are engaged in an active trade or business, but they cannot deduct fees paid to the Copyright Office to obtain copyright protections on the developed product.[151] Another special rule enacted in 2005 permits

[146] Consolidated Appropriations Act of 2016, Pub. L. No. 114-113, div. Q, tit. I, § 121, 129 Stat. 3049-52 ("Section 41 is amended by striking subsection (h).").

[147] Trade secrets and know-how typically fall within the scope of these incentives. S*ee* Treas. Reg. § 1.174-2(a)(1) (as amended in 2014) ("The term [research or experimental expenditures] includes generally all such costs incident to the development of an experimental or pilot model, a plant process, a product, a formula, an invention, or similar property, and the improvement of already existing property of the type mentioned."). Section 1235 regulations provide that no patent or patent application need be currently in existence, suggesting that an inventor can receive capital gain treatment for patentable, or patent-like, property. Treas. Reg. § 1.1235-2(a) (as amended in 1980) ("It is not necessary that the patent or patent application for the invention be in existence if the requirements of section 1235 are otherwise met"); *see also* Gilson v. Comm'r, 48 T.C.M. (CCH) 922, 927 (1984) (allowing patent tax treatment even though only two of eight designs were patented).

[148] *See, e.g.*, Treas. Reg. § 1.174-2(a)(6) (as amended in 2014) (prohibiting deduction of expenditures for "literary, historical, or similar projects"); S. REP. NO. 83-1622, at 439 (1954), *as reprinted in* 1954 U.S.C.C.A.N. 4621, 5082 (noting tax incentive "does not apply to a property right in an invention differing from the monopoly rights evidenced by a patent").

[149] *See* I.R.C. § 263A (2012) (requiring capitalization of expenditures in connection with copyrightable subject matter); Treas. Reg. § 1.263(a)-4(b)(1)(iii) (2004) (requiring capitalization of costs of creating any "separate and distinct intangible asset"); *id.* § 1.263(a)-4(d)(5) (requiring capitalization of costs of obtaining rights from governmental agency).

[150] *See supra* notes 103-108 and accompanying text. An exception exists for sales of musical compositions and copyrights thereon, which are eligible for capital gains rate treatment under a special elective provision. I.R.C. § 1221(b)(3) (2012) ("At the election of the taxpayer, paragraphs (1) and (3) of subsection (a) shall not apply to musical compositions or copyrights in musical works sold or exchanged by a taxpayer described in subsection (a)(3).").

[151] Treas. Reg. § 1.263(a)-4(d)(5)(i) (2004) ("A taxpayer must capitalize amounts paid to a governmental agency to obtain, renew, renegotiate, or upgrade its rights under a

songwriters, but not other copyright creators, to elect to receive capital gains treatment on the sale of their songs.[152] These exceptions, however, were not adopted as tax incentives to encourage copyright creation; they were relief provisions. The special deduction for freelance writers, photographers, and artists was not to promote freelance activities but rather to relieve such individuals from the burden of the capitalization rules, especially when their activities may not generate income for years.[153] The special capital gains provision for songwriters was not adopted to encourage creation of musical compositions, but rather to provide relief to songwriters who, compared to other copyright creators, have quite low income that often comes in spurts.[154]

In contrast to copyright creation, innovation has benefited from a long history of special tax incentives, and based on analysis of tax expenditures, numerous innovators have benefited from these incentives. In fact, the front-end incentives (deduction and credit) represent some of the largest business tax expenditures for the U.S. government. Expensing of research and experimentation expenditures (the front-end incentive affected by recent tax law change) was expected to cost the government $119 billion over a ten-year period from 2018 to 2027.[155] The credit for increasing research activities (the front-end incentive

trademark . . . ."). These rules do not apply to patent inventors. Treas. Reg. § 1.174-2(a)(1) (as amended in 2014) (allowing for current deduction of "costs of obtaining a patent, such as attorneys' fees expended in making and perfecting a patent application").

[152] Tax Increase Prevention and Reconciliation Act of 2005, Pub. L. No. 109-222, § 204(a)(3), 120 Stat. 345, 350 (2006) (codified at I.R.C. § 1221(b)(3) (2012)) (amended 2017).

[153] *See* H.R. REP. NO. 100-1104, at 145 (1988) (Conf. Rep.), *as reprinted in* 1988 U.S.C.C.A.N. 5048, 5205 ("The House bill exempts from the application of the uniform capitalization rules any otherwise deductible expense that is paid or incurred by an individual engaged in the business of being a writer, photographer, or artist.").

[154] *See* Brady Mullins, *Music to Songwriters' Ears: Lower Taxes; Country Artists' Group Presses Lawmakers to Slash the Levy on Lyricists*, WALL STREET J., Nov. 29, 2005, at A4 ("Songwriters . . . must be paid royalties immediately after they are collected. Thus, unlike an author of a novel, who could arrange to spread out his or her payments over a number of years, a songwriter is more vulnerable to fewer, large payouts—and more of a tax hit."). For criticism of this argument and government response, see James Edward Maule, *I Sing a Song of Taxes, a Pocketful of Cries*, MAULEDAGAIN BLOG (Nov. 30, 2005, 10:39 AM), http://mauledagain.blogsport.com/2005_11_01_archive.html [https://perma.cc/A7QX-35KP] ("Apparently song writers think that when they sell a song they should be taxed just as if they sold a stock. The logic fails, however, because the same argument can be made by a book author. Or a furniture maker. Or a person who grows fruits and vegetables and sells them at a truck stop. The fact that the services are embodied in a self-produced item or an item into which a person's services have been injected does not make the sale a sale of an investment.").

[155] JOINT COMM. ON TAXATION, 115TH CONG., JCX-67-17, ESTIMATED BUDGET EFFECTS OF THE CONFERENCE AGREEMENT FOR H.R. 1, THE "TAX CUT AND JOBS ACT," FISCAL YEARS 2018-2027, at 3 (2017); *see also Tax Expenditures 2019*, *supra* note 100, at tbls.1, 3.

unaffected by recent tax law change) was expected to cost the government $163 billion in tax revenues over the same ten-year period.[156]

II. THE ATTACK ON AMERICAN INNOVATION

A. *Weakening of the Patent System Under the Disguise of Innovation*

A new narrative of innovation has overtaken the United States in the past decade. Under this narrative, innovation demands a weaker patent system where patent eligibility would not be available for inventions in business methods, software, medical diagnostics, and personalized medicine. This new narrative dominates the halls of Congress, the Supreme Court,[157] the media, and academic publications and conferences.[158] By weakening the patent system, this attack aims to close the door on patent inclusion.

The disagreement in patent law interpretation between the Supreme Court and Federal Circuit has escalated in this past decade.[159] In the last ten years, the Supreme Court has systematically destroyed the Federal Circuit's inclusion of inventions in new innovative technologies. For example, in 2010, in *Bilski v. Kappos*,[160] the Court overturned the Federal Circuit's "useful, concrete and tangible result" as the sole test for business methods and software inventions, narrowing the door of patentable subject matter.[161] Four years later, in *Alice Corp. v. CLS Bank International*,[162] the Court nailed the coffin shut on patentability for business method and software innovations.[163] As a result, patent

[156] *Tax Expenditures 2019*, *supra* note 100, at tbls.1, 3.

[157] *See, e.g.*, KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 427 (2007) ("[A]s progress beginning from higher levels of achievement is expected in the normal course, the results of ordinary innovation are not the subject of exclusive rights under the patent laws. Were it otherwise patents might stifle, rather than promote, the progress of useful arts.").

[158] Dana Remus Irwin, *Paradise Lost in Patent Law? Changing Visions of Technology in the Subject Matter Inquiry*, 60 FLA. L. REV. 775, 779 n.24 (2008) (listing scholars and their scholarship opposing patent inclusion in name of innovation).

[159] *See generally* J. Jonas Anderson, *Patent Dialogue*, 92 N.C. L. REV. 1049, 1076-83 (2014) ("The unique relationship between the Federal Circuit and the Supreme Court has led to a new, somewhat contentious form of dialogue between the two courts."); Timothy R. Holbrook, *Explaining the Supreme Court's Interest in Patent Law*, 3 IP THEORY 62, 63-64 (2013) ("Starting in around 2000, the Supreme Court became active, if not even hyperactive, in patent law.").

[160] 561 U.S. 593 (2010).

[161] *Id.* at 612 ("Nothing in today's opinion should be read as endorsing the Federal Circuit's past interpretations of § 101.").

[162] 573 U.S. 208 (2014).

[163] *Id.* at 2351-52 (holding that financial risk-management software is "drawn to the abstract idea of intermediated settlement, and that merely requiring generic computer implementation fails to transform that abstract idea into a patent-eligible invention"); s*ee also* Intellectual Ventures I LLC v. Symantec Corp., 838 F.3d 1307, 1325 (Fed. Cir. 2016) (Mayer,

filings in these fields have dropped drastically.[164] Companies owning existing patents in these fields had to write down the value of their portfolios.[165] And the secondary market for software and business method patents diminished for fear of invalidation under *Alice*.[166]

Wielding its enormous power again in interpreting patentability subject matter under Section 101, the Supreme Court in 2012 turned its attention to medical diagnostics and personalized medicine in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*,[167] removing patent eligibility in this economically important sector.[168] A year later, the Court focused on patent

J., concurring) ("*Alice* sounded the death knell for software patents. . . . [A]ll software implemented on a standard computer should be deemed categorically outside the bounds of section 101.").

[164] In one year after the *Alice* decision, members of the patent bar noted drastic changes. *See Where Do We Stand One Year After* Alice*?*, LAW360 (June 17, 2015, 8:27 PM), https://www.law360.com/articles/668773 ("No U.S. Supreme Court patent case has ever had so large an effect in so short a time as Alice Corp. Pty. Ltd. v. CLS Bank Int'l." (quoting Kenneth Adamo, Kirkland & Ellis LLP)); *id.* ("At the USPTO the number of rejections under 35 USC §101 skyrocketed since Alice. The number of business method patents allowed by the USPTO dropped significantly." (quoting Richard Baker, New England Intellectual Property LLC)); *id.* ("[S]tudies have indicated that the number of business method patents issued have declined by greater than 60 percent over similar pre-Alice periods, and the number of issued software patents have declined by approximately 15 percent. In the courts, Alice Section 101 motions are being granted almost 75 percent of the time, and one can extrapolate that the courts will address about 150 Alice motions in the next 12 months." (quoting Garrard R. Beeney, Sullivan & Cromwell LLP)).

[165] *Id.* ("[P]ublic companies with business method or software patents on their books will have to consider writing down the value of their portfolios to Alice. The valuations of companies that copy competitor's software will increase, and the value of, and investment in, first mover companies in the software and business method arts will continue to decrease." (quoting Richard Baker, New England Intellectual Property LLC)).

[166] *Id.* ("The secondary market for software and business method patents dried up in the past year as buyers avoid the risks of ineligibility under §101." (quoting Richard Baker, New England Intellectual Property LLC)).

[167] 566 U.S. 66 (2012).

[168] *Id.* at 72 ("We must determine whether the claimed processes have transformed these unpatentable natural laws into patent-eligible applications of those laws. We conclude that they have not done so and that therefore the processes are not patentable."). Commentators have expressed their extreme frustration. *See, e.g.*, Gene Quinn, *Killing Industry: The Supreme Court Blows* Mayo v. Prometheus, IPWATCHDOG (Mar. 20, 2012), http://www.ipwatchdog.com/2012/03/20/supreme-court-mayo-v-prometheus/id=22920/ [https://perma.cc/E4EX-MUB8] ("Those in the biotech, medical diagnostics, and pharmaceutical industries have just been taken out behind the woodshed and summarily executed by the Supreme Court this morning. An enormous number of patents will now have no enforceable claims. Hundreds of billions of dollars in corporate value has been erased.").

The decision has also been condemned by scholars. *See, e.g.*, Christopher M. Holman, *The* Mayo *Framework Is Bad for Your Health*, 23 GEO. MASON L. REV. 901, 911 (2016) ("Justice

eligibility in life sciences in *Ass'n of Molecular Pathology v. Myriad Genetics*,[169] further eliminating patent protection in the personalized medicine fields.[170] In these two cases, the Court expanded the "judicial exceptions" to patent eligibility, causing the creation of many new innovations without patent protection.[171] The words "anything under the sun that is made by man," once uttered by the Court thirty years ago in reference to the field of life sciences, were turned upside down.[172] The Court's decisions wreaked so much havoc on the patent system that David Kappos, USPTO Director from 2009 to 2013, urged Congress to repeal section 101 of the Patent Act.[173] In fact, the Intellectual

Breyer emphasized the critical role he saw for the patent eligibility doctrine in preventing patents from tying up the fundamental building blocks of science and technological innovation. . . . Unfortunately, as discussed in more detail below, [his] unnecessarily broad language seems to be having exactly the opposite effect, denying patent protection for truly meritorious inventions that might not adequately develop without the patent incentive.").

[169] 569 U.S. 576 (2013).

[170] *Id.* at 580 ("[W]e hold that a naturally occurring DNA segment is a product of nature and not patent eligible merely because it has been isolated . . . ."); *see also* Berand Chao & Amy Mapes, *An Early Look at* Mayo*'s Impact on Personalized Medicine*, 2016 PATENTLY-O PAT. L.J., no. 1, 2016, at 10, 12 ("[Of] the 294 applications, 520 office actions were issued between August 2007 and March 2016 . . . . Of those office actions, 188 were issued pre-*Mayo* and 332 were issued post-*Mayo*. Only 15.9% of the office actions issued pre-Mayo had rejections under section 101 for subject matter eligibility. In contrast, 86.4% of the office actions issued post-Mayo had rejections under section 101 for subject matter eligibility."); Gene Quinn, Mayo v. Prometheus*: A Lawless Decision by an Omnipotent Court Wreaking Havoc on Patents*, IPWATCHDOG (Jan. 23, 2017), http://www.ipwatchdog.com/2017/01/23/mayo-v-prometheus-lawless-decision-wreaking-havoc-patents/id=77438/ [https://perma.cc/R45K-CSJU] ("Only the Supreme Court's decision in *Association of Molecular Pathology v. Myriad Genetics* comes close to *Mayo* in terms of intellectual dishonesty.").

[171] Mark S. Cohen & Jonathan Passner, *Five Years After* Mayo v. Prometheus*: Where Do We Go from Here*, LEXOLOGY (June 19, 2017), https://www.lexology.com/library/detail.aspx?g=d3719a0f-47dd-455c-9579-551c848ea276 [https://perma.cc/6AS5-S7KF] (noting difficulty of obtaining and enforcing patents in natural products and diagnostic methods).

[172] Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting S. REP. NO. 82-1979, at 5 (1952), *as reprinted in* 1952 U.S.C.C.A.N. 2394, 2399).

[173] Ryan Davis, *Kappos Calls for Abolition of Section 101 of Patent Act*, LAW360 (Apr. 12, 2016, 4:32 PM), https://www.law360.com/articles/783604/kappos-calls-for-abolition-of-section-101-of-patent-act ("The former director of the U.S. Patent and Trademark Office on Monday called for the abolition of Section 101 of the Patent Act, which sets limits on patent-eligible subject matter, saying decisions like *Alice* on the issue are a 'real mess' and threaten patent protection for key U.S. industries."); *see also* Cohen & Passner, *supra* note 171 (noting that Court in *Diamond* "observed there that that [sic] Congress intended the statute establishing what can be patented to 'include anything under the sun that is made by man,'" and "that case was the last word from the Supreme Court in the life sciences on the question of what is patent-eligible").

Property Owners Association adopted a resolution to support legislation to reverse the Court's attack on innovation.[174]

In attacking innovation, the Court's decisions have been criticized by many for confusing the idea of patentability,[175] being judicially dishonest,[176] and demonstrating a misunderstanding of patent law.[177] Specifically, the Court erroneously relied on the "inventive concept" standard of section 103 in analyzing section 101, destroying the distinct three doors of patent law that Judge Rich had carefully separated in the 1952 Patent Code.[178] Sadly, Judge Rich years ago predicted this misinterpretation of section 101, an interpretation in direct conflict with the intent of the drafters of the 1952 Patent Code.[179] Additionally, and certainly more critically, the Court's recent line of patent

[174] INTELL. PROP. OWNERS ASS'N , PROPOSED AMENDMENTS TO PATENT ELIGIBLE SUBJECT MATTER UNDER 35 U.S.C. § 101, at 1 (2017), http://www.ipo.org/wp-content/uploads/2017/02/20170207_IPO-101-TF-Proposed-Amendments-and-Report.pdf [https://perma.cc/N4L4-STVG].

[175] Taylor, *supra* note 40, at 159 ("[T]he current approach to determining patent eligibility confuses the relevant policy concerns underlying numerous discrete patent law doctrines.").

[176] Holman, *supra* note 168, at 912 ("The Mayo Framework purports to follow principles set forth in the first wave of patent-eligibility decisions . . . . The Supreme Court has left it to the lower courts to grapple with the critical question of how much 'what else' is 'enough' to cross over the threshold and into the realm of patent eligibility. It has provided little in the way of concrete guidance . . . .").

[177] Greg Reilly, *How Can the Supreme Court Not "Understand" Patent Law?*, 16 CHI.-KENT J. INTELL. PROP. 292, 295-301 (2017) (noting comments relating to Supreme Court's misunderstanding of patent law and responding to criticism).

[178] David K. Mroz & Umber Aggarwal, *Patent Law Could Use Another Judge Rich Right Now*, IP LITIGATOR, Nov./Dec. 2017, at 8, 8 ("[T]he Patent Act of 1952 carefully crafted a balance between Section 101 and Section 103. Section 101 provided a coarse filter that was satisfied as long as the claimed invention was not 'frivolous' or 'worthless,' and Section 103 provided a more stringent test for patentability." (footnote omitted)); *see also* 35 U.S.C. § 101 (2012) ("Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."); *id.* § 103 ("A patent for a claimed invention may not be obtained . . . if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.").

[179] Rich, *supra* note 31, at 63 ("The doctrine of literalness has the weakness of leading to the misinterpretation, if the interpreter assumes a meaning different from that given to a term by the legislative drafter. True interpretation, therefore, requires that words in a statute be taken in the sense which the *writers* attached to them, unless the intent of someone other than the writer is sought."); *see also* Mroz & Aggarwal, *supra* note 178, at 9 ("Judge Rich prophetically warned that something like this could happen if the Patent Act of 1952 was construed out of context with what the drafters intended.").

eligibility cases brings back pre-1952 instability and uncertainty to modern patent law.[180]

Consistent with the new philosophy of patent exclusion, the Supreme Court has flexed its muscles in other areas of patent law, overturning law well established by the Federal Circuit.[181] From injunctive remedy,[182] to patent exhaustion,[183] to divided infringement,[184] to the obviousness test,[185] the Supreme Court has significantly altered the patent landscape.[186] In the obviousness requirement, the Court has made it much more difficult for innovators to pass

[180] Mroz & Aggarwal, *supra* note 178, at 9 ("[T]he Supreme Court has returned the patent system to its pre-1952 state of uncertainty . . . and the patent system has suffered because of it, as patent prosecutors are unsure how to write claims, and litigants are unsure if asserted claims will survive Section 101 challenges in litigation."); Neal Solomon, *The Disintegration of the American Patent System*, IPWATCHDOG (Jan. 26, 2017), http://www.ipwatchdog.com /2017/01/26/disintegration-american-patent-system/id=77594/ [https://perma.cc/NGF7-FEJ5] ("[A]n activist U.S. Supreme Court supplied a series of decisions from 2006 to 2016 that substantially eroded patent rights [that] had a profound adverse effect on the economy.").

[181] *See, e.g.*, KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 419 (2007) (rejecting Federal Circuit's "rigid" teaching, suggestion, and motivation test).

[182] *See* eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388, 390 (2006) ("Ordinarily, a federal court considering whether to award permanent injunctive relief to a prevailing plaintiff applies the four-factor test historically employed by courts of equity. . . . We agree and, accordingly, vacate the judgment of the Court of Appeals.").

[183] Quanta Comput., Inc. v. LG Elecs., Inc., 553 U.S. 617, 621 (2008) ("Because the exhaustion doctrine applies to method patents, and because the license authorizes the sale of components that substantially embody the patents in suit, the sale exhausted the patents.").

[184] Limelight Networks, Inc. v. Akami Techs., Inc., 572 U.S. 915, 917 (2014) ("This case presents the question whether a defendant may be liable for inducing infringement of a patent under 35 U.S.C. § 271(b) when no one has directly infringed the patent under § 271(a) or any other statutory provision. The statutory text and structure and our prior case law require that we answer this question in the negative. We accordingly reverse the Federal Circuit, which reached the opposite conclusion."); *see also* W. Keith Robinson, *Economic Theory, Divided Infringement, and Enforcing Interactive Patents*, 67 FLA. L. REV. 1961, 1971 (2015) (discussing Federal Circuit's approach to divided infringement before Supreme Court rendered approach moot).

[185] *KSR Int'l*, 550 U.S. at 419.

[186] *See generally* Anderson, *supra* note 159, at 1076-83 (describing patent law changes made by Supreme Court since 2000); Holbrook, *supra* note 159, at 63 ("[T]he Supreme Court's intervention is no longer on the periphery of patent law. The cases they have decided go right to the substance of patent law: the doctrine of equivalents and prosecution history estoppel, subject matter eligibility, induced infringement, the statutory experimental use defense, to name but a few." (footnotes omitted)); Steven Seidenberg, *US Perspectives: Troubled Circuit Hobbles US Patent System*, INTELL. PROP. WATCH (July 31, 2017), http://www.ip-watch.org/2017/07/31/troubled-federal-circuit-hobbles-us-patent-system/ [https://perma.cc/9J8V-UX4U].

the obviousness muster,[187] thus increasing the level of unpredictability.[188] The Court announced that "ordinary innovation" has no place in receiving legal protection under the patent system.[189] "Ordinary innovation" losers include independent inventors, research universities, and startups whose most important assets are patents and who often rely on these intangible assets to attract early-stage investors.[190] Because these losers cannot obtain and enforce their patents, they cannot rely on them when seeking funding for further innovation.[191]

As such, these decisions have alarmed members of the investment community.[192] The weakening of the patent system has negatively impacted

[187] Rexford Johnson & Matthew Whipple, KSR *and the Rising Bar of Innovation*, 51 ADVOC., Aug. 2008, at 18, 19 ("[T]he bar of innovation is rising for would-be patentees and patent holders. Overcoming rejections and withstanding invalidity attacks based on obviousness is now, and will likely remain for the foreseeable future, a more challenging issue than it has been in the past."); Jennifer Nock & Sreekar Gadde, *Raising the Bar for Nonobviousness: An Empirical Study of Federal Circuit Case Law Following* KSR, 20 FED. CIR. B.J. 369, 370-71 (2011) (documenting remarkable shift in Federal Circuit's ruling on obviousness after *KSR*).

[188] Jason Rantanen, *The Federal Circuit's New Obviousness Jurisprudence: An Empricial Study*, 16 STAN. TECH. L. REV. 709, 711, 764 (2013) (confirming prediction that "inventions that were nonobvious the day before KSR would suddenly become obvious" with empirical study of Federal Circuit cases after *KSR*); David Tseng, *Not All Patents Are Created Equal: Bias Against Predictable Arts Patents in the Post*-KSR *Landscape*, 13 CHI.-KENT J. INTELL. PROP. 165, 165 (2013).

[189] *KSR Int'l*, 550 U.S. at 427 ("[T]he results of ordinary innovation are not the subject of exclusive rights under the patent laws."); *see also* Mandel, *supra* note 10, at 120 (noting that current obviousness standard is mandated by *KSR* to separate "ordinary innovation" from "real innovation").

[190] R. Keith Sawyer, *Creativity, Innovation, and Obviousness*, 12 LEWIS & CLARK L. REV. 461, 463 (2008) ("Losers, many of whom filed amicus briefs for the respondent, included those who depend on IP protection for income: independent inventors, universities with their technology transfer operations, and small startup businesses, who often depend on proprietary technology to interest venture capital investors."). Ordinary innovations are the reality of improvements. *See* Motion for Leave to File Brief & Brief of Amicus Curiae American Intellectual Property Law Ass'n as Amicus Curiae Supporting Petitioners at 2, Ill. Tool Works Inc. v. Indep. Ink, Inc., 547 U.S. 28 (2006) (No. 04-1329), 2005 WL 1334162, at *2 ("[V]irtually all patents cover improvements to existing products that represent modest incremental advances.").

[191] Robert Sterne, founder of Sterne, Kessler, Goldstein & Fox, expressed his concerns as a panelist at *The Current Patent Landscape in the U.S. and Abroad*: "[T]he positive impact of the U.S. patent system on universities, start-ups, and individual inventors has rapidly declined and no longer, in many respects, provides the engine for funding of this very critical innovation that is done by small and medium-sized companies and universities." Sterne, *supra* note 9, at 5.

[192] *See, e.g.*, *id.*

investment in new drugs and new technologies.[193] Moreover, the jobs relating to invention in the life sciences and many other areas are moving offshore,[194] as investors turn their attention to different sectors[195] or to different jurisdictions that are more willing to extend patent protection for similar inventions.[196]

For example, China is more willing to protect software patents and includes software inventions in the scope of the patent protection and innovation

[193] *See* Paul A. Stone, Gen. Counsel and Chief Operating Officer, 5AM Ventures, Remarks at 12th Annual Advanced Patent Law Institute: The Current Patent Landscape in the U.S. and Abroad 9 (Mar. 9-10, 2017) (transcript available at https://sls.gmu.edu/cpip/wp-content/uploads/sites/31/2017/04/The-Current-Patent-Landscape-in-the-U.S.-and-Abroad-FINAL-TRANSCRIPT.pdf [https://perma.cc/3P8K-UBQF]) ("If we have a strong patent system like we've had historically in the U.S., we will continue to see meaningful investment in new technologies. Contrarily, if we have a weaker patent system, you will see less investment in new technologies."); *see also* Paul Evans, Vice President of Intellectual Prop., Vivint, Inc., Remarks at 12th Annual Advanced Patent Law Institute: The Current Patent Landscape in the U.S. and Abroad 21-23 (Mar. 9-10, 2017) (transcript available at https://sls.gmu.edu/cpip/wp-content/uploads/sites/31/2017/04/The-Current-Patent-Landscape-in-the-U.S.-and-Abroad-FINAL-TRANSCRIPT.pdf [https://perma.cc/3P8K-UBQF]) (providing firsthand account on diminishing investment in small companies due to weak and uncertain patent system).

[194] Stone, *supra* note 193, at 9.

[195] Judge Michel remarked:

> America spent decades off-shoring the vast portion of manufacturing. My concern is we may be moving in the direction of off-shoring invention in a similar fashion. And that would be critically harmful to the country. The Kauffmann Foundation and the Census Bureau, in multiple studies, have documented that most net new jobs come from small start-up companies dependent on technology. So if we're going to create jobs, if we're going to create prosperity, the patent system has to adequately incentivize the investment managers and I think it's failing to do that. . . . [T]here's, I think, a serious danger that the weakened patent system will turn around the investment engine and if we don't watch it, the patent system will reach the point of collapse.

Paul R. Michel, Chief Judge, Retired, U.S. Court of Appeals for the Fed. Circuit, Remarks at 12th Annual Advanced Patent Law Institute: The Current Patent Landscape in the U.S. and Abroad 7-8 (Mar. 9-10, 2017) (transcript available at https://sls.gmu.edu/cpip/wp-content/uploads/sites/31/2017/04/The-Current-Patent-Landscape-in-the-U.S.-and-Abroad-FINAL-TRANSCRIPT.pdf [https://perma.cc/3P8K-UBQF]). Paul Evans stated that investments that occurred in prior years under strong patent protection are not happening today because under the current weak patent system investors assigned "zero value to patents" due to the high risks. Evans, *supra* note 193, at 22.

[196] Robert Sterne further observed:

> The EPO and the European Union have risen in importance as a place to protect and enforce global patent rights—a dramatic change. The Chinese patent system has mimicked the growth and importance of the Chinese economy, with filings of Chinese applications at SIPO exceeding filings at the USPTO and Chinese-originated applications being the fastest growing country group at the USPTO and the EPO.

Sterne, *supra* note 9, at 4.

ecosystem.[197] Under China's strong patent system, injunctive relief is readily available as 90% of patentees secure relief upon a finding of infringement.[198] Plaintiffs, in enforcing their patents against infringers, enjoy a success rate of more than 60%.[199] In other words, China provides a strong and favorable patent system.[200] Consequently, investments in creating and valuing intellectual property have been diverted to or concentrated in Europe and China.[201]

The Supreme Court is not alone in the attack on innovation. The PTAB, which was created amid the narrative of patent troll hysteria, has also played a significant role.[202] Since its inception in 2012, the PTAB has presided over 6,000 proceedings brought to challenge many valuable patents.[203] The PTAB has invalidated almost two-thirds of the patents disputed, and patent owners face seriously low percentages of success for the patents that have just gone through the examinations conducted by the Patent Office.[204] Peculiarly, the guidelines that the Patent Office examiners have applied in examining the patent applications and granting the patents are the same guidelines that the PTAB judges use to immediately invalidate the just-granted patents.[205] In other words, under the current patent system, the presumption of validity seems to no longer exist! The high rate of invalidating patents, one commentator has noted, makes it seem as though the examination has never occurred.[206] That means patent

[197] *See* Stone, *supra* note 193, at 13-14 ("[A]s of April 1st, [2017,] Article 25 of the Chinese Patent Law will actually introduce things like software patents and business method patents. So they'll be getting beyond means plus function. Business models to the extent that they're attendant to a technical feature or some sort of implementation dependency—they will now actually be in scope. . . . [T]he Chinese have learned how powerful intellectual property is. They've wrapped it up as an integral part of their innovation ecosystem.").

[198] Matteo, *supra* note 7, at 14 ("In China, it's upwards of 90 percent of the time that there's a finding of infringement.").

[199] *Id.* ("[I]n China, if you litigate a patent, typically as a plaintiff, you will prevail 60 percent of the time—70 percent of the time if you're a foreign plaintiff against a domestic defendant.").

[200] *See id.*

[201] *Id.* at 12 ("I've seen a lot more interest in Europe and in China as places to put intellectual property or value intellectual property, create intellectual property, than certainly in the United States."); *see also* Detkin, *supra* note 7, at 18-19 (noting that due to recent court rulings and patent legislation that brought an "unhealthy amount of uncertainty to the market[,] . . . investment in the United States is way down and going up—in Europe").

[202] 35 U.S.C. § 6(a) (2012); *see* Sterne, *supra* note 9, at 41 ("There's a lot of misinformation about the patent system these days that is spread using the patent troll narrative. What is being said might have been correct 10 years ago, but it's not correct today.").

[203] Sterne, *supra* note 9, at 5.

[204] *Id.*

[205] *Id.* at 43.

[206] *See id.*

owners face uncertainty in trying to get patent protection and lack the incentive to innovate in the United States.

In summary, although the winners of a weakened patent system continue to spread their patent troll hysteria and misinformation today, they cannot ignore the reality that innovation and investment have increasingly shifted to strong patent jurisdictions.[207] The attack on innovation, vis-à-vis the systematic weakening of the patent system, is real, with serious consequences for investment, job creation, and national security.[208]

B. *Decline in Basic and Late-Stage Research and Development Funding*

The decline in government R&D funding has been occurring for quite some time.[209] The uncertainty of funding became a reality throughout the last two decades.[210] According to the American Association for the Advancement of Science ("AAAS"), federal funding fell from $160 billion in 2010 to $140 billion in 2013, marking the largest decrease in a three-year period since the space race.[211] Federal spending on R&D accounted for more than 2% of the GDP in the 1970s, but in 2014 the spending plunged to 0.78% of the GDP.[212]

With respect to basic scientific research funding, beginning in 2013, the U.S. government decided that it would no longer fund a majority of the basic research conducted across the nation.[213] In the 1960s and 1970s, the federal government shouldered 70% of the funding for basic research.[214] This amount was cut back to 61% as of 2004, and then again to below 50% in 2013.[215] In 2015, the

---

[207] *Promoting Innovation, Investment and Job Growth by Fixing America's Patent System*, INT'L IP COMMERCIALIZATION COUNCIL, http://wwwiipcc.appspot.com/make-patents-great-again.html [https://perma.cc/SSH3-5KC8] (last visited Aug. 22, 2019) ("A decline in the reliability of patents is contributing to a waning of entrepreneurial energy and a decline in the risk tolerance of American investors and entrepreneurs. As a result, investment capital is moving increasingly to products and services with shorter time horizons and lower risk. This shift has profound implications for the long-term U.S. economy, as China, Korea, Germany and other countries expand the role that patents play in their economies with ambitious plans to displace American dominance of technology in the years to come.").

[208] *See* Sterne, *supra* note 9, at 41-42 (discussing how investment will dry up jobs and how loss of jobs becomes national security issue).

[209] Michael Hiltzik, *Does Congress Deserve a Raise?*, L.A. TIMES, Oct. 16, 2013, at B1 (documenting Superconducting Super Collider ("SSC") project, which began in 1980 and was cancelled by Congress in 1993, to demonstrate U.S. shortsightedness in not funding basic science research).

[210] *See, e.g.*, Sterne, *supra* note 9, at 8, 40-42.

[211] Jahne, *supra* note 14.

[212] *Id.*

[213] Mervis, *supra* note 90 ("[T]he federal government no longer funds a majority of the basic research carried out in the United States.").

[214] *Id.*

[215] *Id.*

government provided only 44% of the total amount spent on basic research, or $38 billion.[216] Again in 2017, the number dropped to $34.9 billion.[217] The reality is painfully clear; without government funding, basic scientific research would stop, as industry would not focus on fundamental discoveries.[218] Nearly half of the 11,000 scientists in a study conducted by MIT revealed that they had to abandon projects central to their labs due to economic pressure.[219] The anti-science narrative echoed in the halls of Congress shows that basic science is often misunderstood and ridiculed in order to justify the reduction in funding.[220]

Not only is the government shrinking funding for basic research, but corporate funding on fundamental scientific research is also in decline, as studies show that large firms are investing less in research, the stock market value of research is declining, and established firms today "can no longer emulate firms such as DuPont, AT&T, IBM, or Merck."[221]As of today, basic research is conducted at universities,[222] but the government has also cut back on grants for such research.[223]

Another troublesome area of U.S. funding patterns is the decline in funding, or lack of funding altogether, for late-stage research.[224] There are three forms of R&D: basic, applied, and development. In basic research, the goal is to expand on fundamental knowledge.[225] In applied research, the purpose is to use

[216] *Id.*

[217] Sci. News Staff, *How Science Fares in the U.S. Budget Deal*, SCI. MAG. (May 1, 2017, 11:15 AM), http://www.sciencemag.org/news/2017/05/how-science-fares-us-budget-deal [https://perma.cc/J9EC-27VD].

[218] *See* Myhrvold, *supra* note 16, at 11 ("Without government support, most basic scientific research will never happen."); Jahne, *supra* note 14 (discussing how cuts in federal research threaten scientific progress).

[219] Hiltzik, *supra* note 88 (reporting that nearly half of 11,000 respondents in Chronicle of Higher Education survey reported that they "had been forced by economic pressures to abandon an area of investigation they thought 'central to their lab's mission'").

[220] *See* MIT COMM. TO EVALUATE THE INNOVATION DEFICIT, *supra* note 3, at vi ("Basic research is often misunderstood, because it often seems to have no immediate payoff.").

[221] Arora, *supra* note 93.

[222] Beryl Lieff Benderly, *The Downs and Ups of Corporate Research*, SCI. MAG. (May 3, 2017, 2:30 PM), http://www.sciencemag.org/careers/2017/05/downs-and-ups-corporate-research [https://perma.cc/5Y88-RZ5Q] ("These days, the basic research that fuels breakthrough science and supports important technological innovation mostly happens at universities.").

[223] *See id.*

[224] Sirkin, Rose & Choraria, *supra* note 95 (discussing United States' decline in research spending).

[225] *See* NAT'L SCI. BOARD, SCIENCE AND ENGINEERING INDICATORS 2018, at 105 (2018) (stating that basic research is "[e]xperimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view").

scientific knowledge to solve practical problems and to devise solutions to improve the human condition, diseases, environment, and the like.[226] In development research, the goal is systematic use of knowledge in production to develop useful materials, devices, systems, or methods.[227] The United States does not devote significant funding in development research to yielding commercial products.[228] China is taking the opposite approach and is projected to invest twice as much as the United States in development research.[229] In fact, China is taking the knowledge developed by the United States in the early stage of R&D and then spending significantly on the development research to turn it into new commercial products.[230]

Traditionally, the U.S. government bears the bulk of the cost of the early-stage R&D, and industry incurs the cost of the development research.[231] This division is due to the line that is drawn between academia and private industry.[232] Further, collaboration between and among firms in private industry for development research is rare, leaving public-private research consortia to engage, if at all, in development research.[233] Consequently, there is much friction to innovation, hindering the systematic transformation of the knowledge to late-stage R&D for innovative products.[234] That means that the United States has not been able to translate "technological breakthroughs" into advanced manufacturing domestically.[235] Flat panel displays, lithium ion batteries, digital

[226] *See id.* at 44 (stating that applied research is "[o]riginal investigation undertaken in order to acquire new knowledge; directed primarily, however, toward a specific, practical aim or objective").

[227] *See id.* (stating that experimental development research is "[s]ystematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes").

[228] Sirkin, Rose & Choraria, *supra* note 95.

[229] *Id.* ("In another five years, China will be investing up to twice as much as the US on development research . . . .").

[230] Paul Davidson, *Why China Is Beating the U.S. at Innovation*, USA TODAY (Apr. 17, 2017, 3:32 PM), https://www.usatoday.com/story/money/2017/04/17/why-china-beating-us-innovation/100016138/ (stating that U.S. has been "doing the hard work of inventing new technologies, and China, among other countries, is reaping the benefits by taking those ideas and turning them into commercial products").

[231] *See* Sirkin, Rose & Choraria, *supra* note 95 ("The US remains dominant at the front end of R&D . . . .").

[232] *See id.* ("One source of friction occurs between academia and private industry. The lion's share of basic and applied research is funded by the federal government and conducted at universities, while industry focuses overwhelmingly on development research.").

[233] *See id.* ("Friction among companies, meanwhile, slows innovation on advanced manufacturing processes.").

[234] *See id.* (proposing ways to address problem in U.S. in late-stage R&D funding area).

[235] *Id.*

mobile handsets, notebook computers, and photovoltaic cells are all examples of products based on innovations invented in the United States but manufactured offshore because the United States has been ignoring late-stage development to commercialize and yield new products.[236]

Meanwhile, China has spent more on development research than the United States has, and is projected to continue to spend more to ensure that China is the country that innovates and brings products to the marketplace.[237] Currently, China's development research accounts for 84% of its total R&D spending.[238] In the past decade, China's spending on development research grew 20% per year compared to 5% in the United States.[239]

Overall, the decline in federal government funding for basic research, industries' lack of a long-term view of R&D, and the missing late-stage development focus by industries are plunging the United States to a period of innovation crisis.[240] The crisis will have serious implications for the United States' economic competitiveness, national security, and national global standing.[241]

C. *Weakening Tax System Governing Innovation*

The U.S. tax system governing innovation has recently been transformed by new legislation. On December 20, 2017, Congress passed the Tax Cuts and Jobs Act ("TCJA")[242] with a 51-48 vote in the Senate and a 224-201 vote in the House. The TCJA represents one of the most significant overhauls of the Code in more than three decades. The act made numerous changes to the income tax as it applies to individuals and business.[243] The leading theme of the new law is an across-the-board reduction of rates.[244] Proponents of the TCJA argue that rate

[236] *Id.*

[237] *Id.*

[238] *Id.*

[239] *Id.*

[240] MIT COMM. TO EVALUATE THE INNOVATION DEFICIT, *supra* note 3, at vii (concluding strategic areas of basic research—like supercomputing, cybersecurity, quantum computing, and photonics—that U.S. has allowed to fall behind "ought to be alarming"). Moreover, the decline in government funding can "disrupt research efforts and cause long term damage, especially to the pipeline of scientific talent on which U.S. research leadership ultimately depends." *Id.* at ix.

[241] Hiltzik, *supra* note 88 (discussing decline in U.S. academia); Sirkin, Rose & Choraria, *supra* note 95 (discussing holistically the impact of current U.S. government research).

[242] Tax Cut and Jobs Act of 2017, Pub. L. No. 115-97, 131 Stat. 2054. The TCJA's official purpose was "to provide for reconciliation pursuant to titles II and V of the concurrent resolution on the budget for fiscal year 2018." *Id.* President Trump signed the bill into law on December 22, 2017. *See id.* It is effective for tax years beginning in 2018. *See id.*

[243] *Id.*

[244] *Id.*

reductions will ultimately stimulate the economy in ways that are beneficial to workers as well as businesses.[245]

In addition to lowering tax rates, the TCJA expanded tax incentives for investments in *tangible* property, such as manufacturing equipment and machinery, as businesses are now permitted to fully expense 100% of their purchases of tangible, personal depreciable property.[246] Expanding the expense allowance for acquisition of equipment, machinery, and other tangible property represents a significant tax subsidy for tangible capital investments.[247] Nevertheless, it was viewed as important to incentivize and increase business spending on tangible assets; in theory, it would lower the cost of tangible capital used in an active trade or business, in turn stimulating business investment and the economy.[248] Policymakers had these goals in mind when they enacted special expensing for tangible property.[249] House Ways and Means Committee Chairman Kevin Brady (R-Texas) noted that full and immediate expensing of tangible assets is the best way to expand the economy.[250]

In providing tax rate cuts and enhanced tax breaks for tangible capital investment, the TCJA had to amend or repeal a number of provisions to help

---

[245] *See, e.g.*, Steven T. Mnuchin, *The Tax Cuts and Jobs Act Is Working*, WHITEHOUSE.GOV (Apr. 15, 2019), https://www.whitehouse.gov/articles/tax-cuts-jobs-act-working/ [https://perma.cc/FN9M-H486].

[246] *Id.* The TCJA increased the maximum amount a taxpayer may expense under section 179 to $1,000,000, as well as expanded the types of tangible property eligible for expensing. *Id.* § 13101, 131 Stat. at 2101 (substituting $1,000,000 for $500,000 in regard to rules for expensing depreciable assets). More importantly, the TCJA extended and modified additional first-year depreciation of tangible assets under section 168(k) through 2026. *Id.* § 13201, 131 Stat. at 2105. The former 50% allowance was increased to 100% for property placed in service after September 27, 2017, and before January 1, 2023. *Id.*

[247] Kyle Pomerleau & Scott Greenberg, *Full Expensing Costs Less Than You'd Think*, TAX FOUND. (June 13, 2017), https://taxfoundation.org/full-expensing-costs-less-than-youd-think/ [https://perma.cc/N9F4-BK54] (discussing TJCA's impact on tangible capital investments). On a static basis, expensing of tangible property would cost $2.2 trillion over a decade. *Id.* ("For instance, last June, the Tax Foundation estimated that moving to full expensing would reduce federal revenue by $2.2 trillion over ten years, on a static basis."). But after accounting for economic growth, that number would be reduced to $883 billion over ten years. *Id.*

[248] *See* Tax Cut and Jobs Act of 2017, Pub. L. No. 115-97, 131 Stat. 2054 ("Full expensing of capital investments is probably the single most significant tax change lawmakers could make to encourage economic growth.").

[249] *See* GARY GUENTHER, CONG. RESEARCH SERV., RL31852, SMALL BUSINESS EXPENSING ALLOWANCE: CURRENT STATUS, LEGISLATIVE PROPOSALS, AND ECONOMIC EFFECTS 3-5 (2009) (weighing costs and benefits of expensing for small businesses).

[250] *See* Laura Davison, *Full Expensing: The Next Tax Reform Battle*, BNA (June 21, 2017), https://www.bna.com/full-expensing-next-n73014453642/ [https://perma.cc/HS5P-JSQY]; Jacob Puhl, *Brady Doubles Down on 100 Percent Expensing at Ways and Means Hearing*, DELOITTE (May 19, 2017), http://newsletters.usdbriefs.com/2017/Tax/TNV/170519_1.pdf [https://perma.cc/TNH5-CBSP].

make up tax revenue loss. Unfortunately, two provisions targeted long-standing tax incentives for innovation capital. Specifically, the TCJA eliminated two tax incentives for innovation that have existed in our tax system for over half a century: (1) the current tax deduction for innovation and (2) preferential capital gains rate treatment applicable to dispositions of successful inventions. The TCJA is also notable for what it did not do. Specifically, the TCJA did not, as some had predicted, enhance the research credit, which many viewed as necessary to maximize its effectiveness. In addition, the TCJA did not adopt a U.S. patent box, which many countries have done in recent years to attract valuable innovation activity to their borders. These developments will undoubtedly have a negative impact on American innovation.

A close examination of the TCJA reveals that Congress was more concerned about capturing tax revenue from intellectual property income rather than spurring American innovation. Indeed, some of the more complicated provisions of the TCJA are international tax rules designed to tax foreign income attributable to research conducted here in the United States. Ironically, all of these efforts, including the base erosion measures, may have the effect of moving the United States in the direction of "off-shore invention." Off-shore invention would reflect the worst-case scenario; the United States would lose valuable innovation activity and its positive spillover effects, as well as the income from such activity and tax revenues.

Each of these recent tax policy choices is worthy of consideration.

1. Elimination of 100% Expensing of Innovation Costs

Since 1954, the government has permitted 100% expensing for spending on qualified research, including amounts paid in connection with the development of any computer software.[251] Under the TCJA, this long-standing rule is eliminated after 2021.[252] Instead, amounts paid or incurred for specified research or experimental expenditures after 2021 (including software development costs) generally must be capitalized and amortized ratably over five years.[253] Overnight, the government changed the law from permitting a 100% write-off in the year in which innovation costs were paid or incurred to requiring costs to

[251] *See supra* notes 116-32 and accompanying text (discussing government expenditures on research).

[252] *See* I.R.C. § 174(a) (2012) (as amended by Tax Cuts and Jobs Act of 2017, Pub. L. No. 115-97, 131 Stat. 2054, and as applied to amounts paid or incurred in tax years beginning after December 31, 2021). Similarly, the rule that taxpayers may elect an amortization period of sixty months or greater, beginning when benefits are first realized, is eliminated after 2021. *See id.*

[253] *Id.* Amounts attributable to foreign research must be amortized ratably over fifteen years instead of five years. *Id.* § 174(a)(2). For this purpose, foreign research means any research conducted outside the United States, Puerto Rico, or any United States territory. *Id.* (indicating that section 174(d)(4)(F)'s definition of foreign research applies).

be spread out over a five-year period.[254] Unfortunately, there is nothing in the legislative history explaining why the government eliminated 100% expensing, which has been a feature of our tax system for some time.[255]

There is nothing in the legislative history to explain why the government chose a write-off period of *five years*.[256] Will a five-year write-off adequately incentivize desirable innovation activity? Does grouping all innovations in a five-year write-off category measure income with sufficient accuracy (i.e., is there some correlation between five years and the actual economic useful lives of inventions)? What are the anticipated compliance and administrative costs under a five-year rule?[257] Unfortunately, the five-year period was chosen without consideration of these questions.[258] Most likely, five years was chosen because it is the period the government has historically used as the "baseline" to measure the tax expenditure cost of immediate expensing of research and experimentation.[259]

If the government was intent on requiring the capitalization and amortization of innovation costs, a shorter write-off period should have been considered. Compared to other investments, innovation is risky, and therefore, innovation risks, such as retirement risk and revenue risk, should be relevant in the design of an ideal cost-recovery rule.[260] As some economists have argued, cost recovery "schedules for relatively risky assets should be accelerated to compensate the

[254] *See id.* § 174(a)(1)-(2).

[255] *See* Calvin H. Johnson, *Capitalize Costs of Software Development*, 124 TAX NOTES 603, 612 (2009) (discussing other reasons for elimination of 100% expensing). Some have argued that expensing represents bad tax policy. Professor Calvin Johnson, for instance, has argued that expensing of software development costs provides too much subsidy for investments that have no special merit and give no external value to the public; for example, expensing encourages a waste of capital because the investments would not be made in the absence of the tax breaks and should not be made because the real pretax demand does not justify the real pretax costs. *Id.*

[256] *See generally* H.R. REP. NO. 115-97 (2017).

[257] Businesses spend over 448 million hours annually complying with depreciation and amortization regimes. Office of Info. & Regulatory Affairs, *View ICR—OIRA Conclusion*, REGINFO.GOV, https://www.reginfo.gov/public/do/PRAViewICR?ref_nbr=201312-1545-029 [https://perma.cc/X92Q-VKEP] (last visited Aug. 22, 2019).

[258] *See generally* H.R. REP. NO. 115-97.

[259] *See Tax Expenditures 2019*, *supra* note 100, at 4 ("The baseline assumed for the normal tax method is that all R&E expenditures are successful and have an expected life of five years."). A normal income tax could require taxpayers to capitalize and write off the costs associated with investments over time to better match the streams of income and associated costs. Expensing is thus viewed as a tax expenditure. The "baseline" assumed for the normal tax is that all research is successful and has an expected life of five years. *Id.*

[260] *See* Jeff Strnad, *Tax Depreciation and Risk*, 52 SMU L. REV. 547, 548 (1999) ("[R]etirement risk *must* be taken into account in designing an accelerated schedule that does not favor some assets over others").

owners of such assets for bearing a disproportionably large share of the capital price risk."[261] It is often difficult to determine whether innovation will produce benefits and, if so, how long those benefits will last. For example, an inventor cannot be certain about whether all of his or her patent applications will mature to patents. In addition, even if a patent is obtained, there is always a fear that the patents may be subsequently invalidated by a third party. These concerns were likely behind the government's 1993 creation of a three-year write-off period (as opposed to five-year write-off period) for computer software acquisitions.[262]

One might accept that a longer recovery period, such as the five-year period under the new law, is justified as long as there are ex post adjustments (tax deductions for unamortized costs) available to inventors upon later sale or retirement of their inventions; however, the new tax law does not permit such tax loss deductions on either the sale or the retirement of innovations.[263] Under the new law, an inventor must continue to amortize research costs over five years even if the property with respect to which the costs were paid or incurred is disposed of or abandoned during the five-year amortization period.[264] In other words, no current deduction of the unamortized portion of the expenditure is allowed.[265] This approach—ex ante slow cost recovery schedule of five years without any ex post adjustments—combines the worst of both worlds.[266]

No doubt the elimination of 100% expensing will impact a large number of taxpayers. As noted earlier, the government anticipates saving $119 billion over the next ten years as a result of the elimination (8% of the projected $1.5 trillion cost of the entire tax legislation).[267] That figure reflects the magnitude of projected research spending that will be ineligible for the tax incentive beginning in 2022.[268] The change, once effective, will have the effect of increasing the cost of private research by these firms. The change may induce firms to make

[261] Ethan Yale, *When Are Capitalization Exceptions Justified?*, 57 TAX L. REV. 549, 572 (2004).

[262] *See* I.R.C. § 167(f) (2012) (noting three-year period for computer software acquisition costs).

[263] *Id.* § 174(d) (noting that there are no ex post adjustments on sale or retirement of innovations). Under prior law, the deductible amount on sale was the excess of the adjusted basis in the innovation over the amount realized in the trade. *Id.* § 1001. The deductible amount on retirement or obsolescence was the unrecovered adjusted basis in the innovation. *Id.* § 165.

[264] *Id.* § 174(d) (indicating treatment upon disposition, retirement, or abandonment of innovations).

[265] *See id.*

[266] As noted by one commentator, an "accelerated depreciation system . . . reduces strategic loss-taking. Under an accelerated schedule adjusted basis is lower at any given point in time. It is less likely that adjusted basis will ever exceed market value by enough to make strategic loss-taking profitable net of trading costs." Strnad, *supra* note 260, at 597.

[267] *See supra* note 159 and accompanying text.

[268] *Id.*

distorted and inefficient business decisions. Firms likely to invest in innovation may be more inclined to invest in tangible equipment instead; for example, we may see a shift in investments from intangible capital to tangible capital. Perhaps this was the desire all along, especially in light of the fact that Congress just enhanced the tax write-offs for equipment and machine—a trade-off of sorts with increased tax breaks for equipment paid for by the elimination of the R&D deduction. Interestingly, the projected revenue losses from the increased deductions for equipment total $112 billion over the next ten years, which is very close to the projected revenue gain from elimination of the R&D deduction.[269]

One might argue that elimination of expensing is of little significance since the research tax credit is still available for these firms, as Congress did leave intact the section 41 research credit as a front-end tax incentive for innovation.[270] The problem is that the research tax credit is not available for many individual and corporate innovators that previously benefited from the deduction.[271] The credit's reformulation over the years has limited the types of research for which it is available.[272] Not all expenditures that qualify for the research deduction under section 174 qualify for the research credit under section 41 due to special regulatory requirements and exceptions.[273] In addition, the incremental nature of the credit prevents many individual and small business innovators who heretofore utilized the deduction from using the credit.[274] As currently formulated, the credit is not available if a taxpayer's gross sales have grown faster than the taxpayer's qualified research expenditures; this might explain why many start-ups do not benefit from the credit and why only the largest businesses do.[275] According to the Joint Committee on Taxation, firms with assets of $1 million or more account for over 77% of all corporations claiming a credit and represent more than 98% of the credits claimed.[276] Firms with assets

[269] JOINT COMM. ON TAXATION, 115TH CONG., *supra* note 155, at 17 (indicating projected revenue losses).

[270] *See* I.R.C. § 41 (2012).

[271] *See id.*

[272] *See id.*

[273] *See id.*

[274] Taxpayers may, at their election, compute the research credit under another alternative—the alternative simplified credit method—in lieu of the regular credit. The alternative simplified credit is an amount equal to 14% of the amount by which the qualified research expenses exceed 50% of the average qualified research expenses for the three preceding tax years. *Id.* § 41(c)(5) (indicating option for election of alternative simplified credit).

[275] *See* JOINT COMM. ON TAXATION, 112TH CONG., JCX45-11, TAX INCENTIVES FOR RESEARCH, EXPERIMENTATION, AND INNOVATION 11 (2011) (noting that firms with assets of $50 million or more account for 18% of all corporations claiming credit but represent more than 85% of credits claimed).

[276] *See id.* at 13.

under $100,000 represent only 1.2% of the credits claimed.[277] The largest sector claiming research credits is manufacturing (69% of credits).[278] Historically, individual and small business innovators and start-ups, as well as those not engaged in big manufacturing, have not been the primary beneficiaries, and it does not seem likely they will suddenly qualify because the only other front-end incentive (the tax deduction) has been eliminated.[279] The delayed effective date (the requirement that all specified research expenditures must be amortized starting in 2022) may signal that the law change is more about meeting the revenue goals of the TCJA rather than a permanent move from expensing to amortization of innovation costs. Regardless of whether Congress intended this to become permanent legislation, there are no guarantees for reversal in the near future. Unfortunately, this uncertainty will only further reduce innovative activity, as a recent report of the Organisation for Economic Co-operation and Development ("OECD") and International Monetary Fund ("IMF") identified frequent tax changes as the greatest factor in business uncertainty affecting investment and growth.[280]

2. Elimination of Capital Gain Treatment for Innovation Dispositions

In addition to eliminating an important front-end incentive for innovation (starting in 2022), the TCJA eliminated an important back-end incentive by changing the capital gains rules for innovation dispositions (starting in 2018).[281] Gains realized from dispositions of property are taxed at lower capital gains rates if such gains are characterized as capital gains.[282] One such requirement is that the property disposed of be a so-called "capital asset."[283] In 2017, the TCJA excluded from the capital asset definition self-created patents, inventions, designs, and secret formulas; instead, under the act, a patent, invention, model or design (patented or not), or secret formula or process is not a capital asset in

[277] *See id.*

[278] *See id.* at 12.

[279] *See* I.R.C. § 41(h) (2012) (noting that, in recognition of fact that some start-up companies and small business were not benefiting from credit, Congress expanded credit in 2015 so that those entities could use it to offset payroll taxes or alternative minimum tax).

[280] *See* INT'L MONETARY FUND & ORG. FOR ECON. CO-OPERATION & DEV., TAX CERTAINTY: IMF/OECD REPORT FOR THE G20 FINANCE MINISTERS 11 (2017), https://www.oecd.org/tax/tax-policy/tax-certainty-report-oecd-imf-report-g20-finance-ministers-march-2017.pdf [https://perma.cc/E7ZE-STST] (discussing nature and impact of tax uncertainty).

[281] *See* I.R.C. § 1221(a)(3) (2012).

[282] *See id.* § 1221 (indicating preferential treatment for capital gains). A long term capital gain is defined as a gain from the sale or exchange of a capital asset held for more than one year. *Id.*

[283] *Id.*

the hands of the taxpayer whose personal efforts created the property.[284] Thus, under general characterization principles, gains from the sale of a patent, invention, model or design, or secret formula that is held by the creator will no longer be eligible for preferential capital gains treatment.[285]

The legislative history behind the TCJA of 2017 explains why self-created patents and similar property were targeted for ordinary tax rate treatment: "Since the intent of Congress is that profits and losses arising from everyday business operations be characterized as ordinary income and loss, the general definition of capital asset is narrowly applied and the categories of exclusions are broadly interpreted."[286] The legislative history behind the original 1950 provision (which excluded only self-created copyrights and similar property) similarly noted that gains from personal efforts (income from a book or other artistic work) should be treated as ordinary income regardless of whether the taxpayer was in the profession of writing books or creating other artistic works or was an amateur. However, the legislative history behind the 1950 law made it very clear why self-created patents and similar property were not targeted for ordinary income treatment: "[T]he desirability of fostering the work of such inventors outweighs the small amount of additional revenue which might be obtained" by including inventions, patents, and designs.[287]

The revenue impact of removing self-created patents and inventions from capital asset characterization is expected to be minimal.[288] This might be due to the fact that much innovation comes from corporations (whose employees invent), and the tax law change does not impact works for hire. This might also be due to the fact that Congress failed to repeal section 1235 for patents created by individuals. Regardless, treating as ordinary income the gains from the sale of an invention or patent by the amateur or occasional inventor is a complete shift in innovation tax policy—and runs counter to America's desire to foster the work of such individuals.

It is worthy to note that Congress failed to repeal section 1235. Recall from Part I that section 1235 was enacted in 1954 as a tax incentive for innovation.[289] It acts like a safe-harbor for certain patent dispositions by individuals. When it applies, it provides statutory assurance to certain inventors that the sale of their

[284] *See id.* § 1221(a)(3) (noting that exception also applies to taxpayer with substitute or transferred basis from taxpayer whose personal efforts created property).

[285] *Id.* These types of self-created property also do not qualify for special treatment of the quasi-capital asset rules of section 1231. *Id.* § 1231(b)(1)(C).

[286] H.R. REP. NO. 115-466, at 414 (2017) (Conf. Rep.).

[287] S. REP. NO. 81-2375, at 44 (1950), *as reprinted in* 1950 U.S.C.C.A.N. 3053, 3098; *see supra* Section I.C.1 (discussing history of special rate treatment for innovation gains).

[288] JOINT COMM. ON TAXATION, 112TH CONG., *supra* note 275, at 5 (estimating that impact on revenue of removing self-created patents and inventions from capital asset characterization is about half billion dollars over ten years).

[289] *See supra* Section I.C.1.

inventions will qualify for reduced capital gains rates as opposed to ordinary income tax rates, even if the sale involves contingent payments, the transferor is a professional inventor, and the invention has been held for less than one year.[290] The House bill proposed repealing section 1235, which would have completely eliminated any chance innovation gains would be taxed at the lower capital gain rate.[291] The Senate version, however, kept it, and the Conference Committee agreed with the Senate.[292]

It would be a mistake, however, to conclude that the special characterization rule of section 1235 saved the day. While it does remain on the books as the only back-end tax incentive for innovation, it is of limited application. For example, section 1235 applies only to a "patent," a term defined in the regulations.[293] In addition, section 1235 applies only if there is a transfer of "all substantial rights" to a patent, which does not include transfers that are limited geographically within the country of issuance or transfers that are limited to fields of use within trades or industries.[294] Finally, section 1235's favorable capital gains treatment applies only if the transferor is a statutorily defined "holder" of the patent, defined as any individual whose personal efforts created the patent property and who would qualify as the "original and first" inventor under the patent laws;[295] therefore, section 1235 is unavailable to the more common startup companies and small research entities whose employees conduct their research.[296]

Given the TCJA's changes to long-standing general characterization principles and the limited application of section 1235, the tax law governing patents has moved closer to the tax law governing other forms of intellectual property such as copyrights and trademarks. While there may be efficiency arguments for treating all forms of intellectual property the same for tax purposes, there are strong arguments for treating patents differently. For example, unlike copyrights and many artworks, the creation of patentable property may entail a capital investment. Indeed, in industries like medical devices, pharma, biotechnology, and genetic engineering, intensive capital

[290] *See supra* notes 112-17 and accompanying text.

[291] An Act to Provide for Reconciliation Pursuant to Titles II and V of the Concurrent Resolution on the Budget for Fiscal Year 2018, H.R. 1, 115th Cong. § 3312 (2017).

[292] S. Res. 1, 115th Cong. (2017) (indicating Senate's stance on certain self-created property not treated as capital asset).

[293] Treas. Reg. § 1.1235-2(a) (as amended in 1980) (defining patent).

[294] *Id.* § 1.1235-2(b)(1) (defining all substantial rights to patent).

[295] I.R.C. § 1235(b)(1) (2012) (defining holder as "any individual whose efforts created such property"); Treas. Reg. § 1.1235-2(d)(1)(i) (as amended in 1980) (defining holder).

[296] This is irrelevant for tax rate purposes, as corporate income (both ordinary income and capital gain income) is taxed at the same rate. I.R.C. § 11 (2012). Nevertheless, capital gain treatment is often sought by companies because their capital losses are deductible in any given year only to the extent they have capital gains. *Id.* § 1211. In other words, to the extent income is characterized as capital gain income, that income can be used to absorb any capital losses the company might have.

investment is necessary in order to obtain the right technology suitable for scalability and market competition. Furthermore, patents contribute significantly to the strength or welfare of the nation in a very tangible way. This is illustrated by how new sectors of the economy develop when new technologies become patent-eligible. For example, the biotech revolution occurred after the Supreme Court upheld patent eligibility for living matter created by man.[297] Since this landmark decision, the biotech industry "has improved and saved lives around the world through breakthrough medical therapies, increased crop yields, and renewable fuels," and the industry supports "more than 7.5 million jobs" in the United States.[298]

3. Failure to Enhance the Research Credit to Maximize Its Effectiveness

To its credit, Congress has made some limited enhancements to the research credit in recent years. As noted earlier, Congress made the credit permanent in 2015. This was perhaps the most significant enhancement to the credit since its enactment. Congress also recently expanded the credit for start-ups and small businesses. Starting in 2016, some start-ups and small businesses can use the credit to offset payroll taxes or the alternative minimum tax.

Further reforms, however, could have been considered to enhance the credit's effectiveness. President Obama pushed for such reforms. His administration would have simplified the credit by repealing the outdated formula and enhancing the credit for pass-through businesses.[299] Before President Trump's tax plan, the TCJA, was passed, House Republicans had their own tax reform blueprint, which promised to make the research tax credit "more effective and efficient."[300] Despite calls for further enhancements,[301] the TCJA made no changes to the credit.

---

[297] *See* Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) ("Judged in this light, respondent's micro-organism plainly qualifies as patentable subject matter.").

[298] *BIO Celebrates 30th Anniversary of* Diamond v. Chakrabarty *Decision*, BIOTECH. INNOVATION ORG. (June 16, 2010), https://www.bio.org/media/press-release/bio-celebrates-30th-anniversary-diamond-v-chakrabarty-decision [http://perma.cc/GZ2Q-MG9N].

[299] WHITE HOUSE & U.S. DEP'T OF TREASURY, THE PRESIDENT'S FRAMEWORK FOR BUSINESS TAX REFORM 21 (2016) [hereinafter THE PRESIDENT'S FRAMEWORK] ("The President's Framework would simplify the credit by repealing the outdated formula, increase the credit rate from 14 to 18 percent, and enhance the credit for pass-through businesses.").

[300] *See* GOP, A BETTER WAY: OUR VISION FOR A CONFIDENT AMERICA 27 (2016), https://www.novoco.com/sites/default/files/atoms/files/ryan_a_better_way_policy_paper_062416.pdf [https://perma.cc/ZAY6-MUQH] ("The Blueprint will include an R&D credit in similar form so that America will continue to be an attractive place to conduct research. The Committee on Ways and Means will evaluate options for making the R&D credit more effective and efficient.").

[301] *See* GUENTHER, *supra* note 23, at 18 ("The main concern of critics is that the credit has not been as effective as it should have because of what they say are certain problems with its design. In their view, the credit can yield its intended benefits only if it is altered to remedy

Congress could have increased the credit to greater than 20%, in line with what some other nations offer. The credit in Spain and Ireland, for example, is 25%.[302] It is 30% in France. Interestingly, the U.S. research credit was 25% (not 20%) when first created in 1981. Five year years later, however, Congress reduced it to 20% to help pay for lower income tax rates as part of the Tax Reform Act of 1986.

Congress could have expanded the types of expenditures that qualify for the credit. The current restrictive definition of "qualified research" prevents many research dollars from qualifying. In fact, expenses excluded from the credit account for 27% to 50% of business R&D spending.[303] A more complete and less ambiguous definition of qualified research would also eliminate many disputes between the IRS and taxpayers.[304]

Congress could have changed the nature of the credit from one that is incremental (applicable only if the firm increases research spending over time) to one that is volume-based (applicable simply on the volume or amount of qualified research spending). As currently designed, the credit is not available if a taxpayer's gross receipts increase significantly as compared to qualified research spending. In many countries, like the United Kingdom, the research credit is volume-based. Indeed, some countries have recently moved from a purely incremental credit to one that is volume-based in order to make their credit more attractive to multinational companies with large research activities.[305]

---

five problems in particular: (1) the credit is not a permanent provision of the IRC; (2) it still has weak and uneven incentive effects; (3) it is not refundable; (4) the definition of qualified research remains incomplete and ambiguous, and thus a major source of disputes between the IRS and taxpayers; and (5) the credit is not targeted at investments that are likely to generate relatively large economic benefits.").

[302] *See, e.g.*, Louise Kelly, *Looking to the Future: Life After the 'Double Irish*,*'* INT'L TAX REV. (Feb. 24, 2015), www.internationaltaxreview.com/Article/3430276/Looking-to-the-future-Life-after-the-Double-Irish.html [https://perma.cc/C3XD-X94T] ("Before January 1 2015, the R&D tax credit regime [in Ireland] offered a credit of 25% on qualifying expenditure . . . .").

[303] GUENTHER, *supra* note 23, at 4 ("According to some estimates, the excluded expenses account for 27% to 50% of business R&D spending.").

[304] See *id.* at 18 ("[T]he definition of qualified research remains incomplete and ambiguous, and thus [is] a major source of disputes between the IRS and taxpayers . . . .").

[305] *See, e.g.*, *Tax Reform Options: Incentives for Innovation: Hearing Before the S. Comm. on Fin.*, 112th Cong. 12 (2011) (statement of Dirk Pilat, Head, Structural Policy Division, Organization for Economic Co-operation and Development Directorate for Science, Technology, and Industry) ("A general trend among many OECD countries has been to make their R&D tax incentives more generous. Another has been to increase the availability and simplicity of the use of these systems, with many countries moving towards volume-based credits."); PATRICK EPARVIER, THE "POLICY MIX" PROJECT: COUNTRY REVIEW FRANCE 19 (2007), http://ec.europa.eu/invest-in-research/pdf/download_en/france.pdf [https://perma.cc/46Y5-NG8M] ("In order to increase companies' expenditures devoted to R&D, the

Finally, Congress could have made the credit refundable, as it is in some other countries. Currently, the credit is non-refundable, which means that only firms with sufficient income tax liabilities can benefit from the full amount of the credit claimed in any year. This can pose a problem for small, research-intensive firms that spend substantial sums on research in early years while operating with a stream of net-operating losses. In the view of some critics, the non-refundable credit is "likely to reduce the typical small, research-intensive start-up firm's prospects of survival and growth, as the firm cannot count on having access to the credit when the need for it is greatest."[306]

4. Failure to Enact a U.S. Patent Box

While Congress failed to enhance the only front-end tax incentive left for innovation (the incremental research credit), it also failed to consider adoption of a patent box as a new back-end incentive. Many European countries in recent years have enacted so-called "innovation boxes" or "patent boxes" to encourage multinational companies to move their intellectual property and innovation activities within their borders.[307] Patent boxes provide a reduced effective tax

Government has reformed the Research Tax Credit in 2004. The most important change is the introduction of a volume-based scheme along the incremental-based scheme (that started in the 1980s)."); ORG. FOR ECON. CO-OPERATION & DEV., R&D TAX INCENTIVES: FRANCE, 2018, at 1 (2019), https://www.oecd.org/sti/rd-tax-stats-france.pdf [https://perma.cc/HHD4-3DC7] (noting that France utilizes volume-based research tax credit); PRICEWATERHOUSECOOPERS, GLOBAL RESEARCH & DEVELOPMENT INCENTIVES GROUP 19 (2012), www.pwc.com/gx/en/tax/assets/pwc-global-research-development-incentives-group-november-2012-pdf.pdf [https://perma.cc/V69D-SRZ6] (charting countries with incremental- or volume-based credits); Kelly, *supra* note 302 ("The availability of grant aid for certain R&D projects, in addition to the R&D tax credit, has led to a significant increase in the number of R&D centres in Ireland in recent years.").

[306] GUENTHER, *supra* note 23, at 19.

[307] *See* Jason M. Brown, Note, *Patent Box Taxation: A Comparison of Four Recent European Patent Box Tax Regimes and an Analytical Consideration of If and How the United States Should Implement Its Own Patent Box*, 46 INT'L LAW. 913, 914 (2012) ("Since 2007, several European and Asian governments, including Belgium, China, France, Luxembourg, the Netherlands, and Spain, have added some form of patent box taxation to their corporate tax systems.").

rate on income associated with eligible intellectual property.[308] China has also recently jumped on the patent-box bandwagon.[309]

Countries adopt patent box regimes for various reasons. Some use them to try to lure companies to relocate their existing mobile intellectual property and to capture additional tax revenues.[310] Some wish to improve the competitiveness of their own tax systems and discourage shifting intellectual property income abroad.[311] And some adopt them to attract research activities, along with all the positive spillover benefits, within their borders.[312]

Despite widespread adoption of patent boxes in Europe and China, the United States has failed to take the initiative to create its own. There have been calls for a patent box. In 2011, for example, David Camp, then-Chairman of the House Committee on Ways and Means, proposed a 15% rate on certain intellectual property income.[313] In 2015, Representatives Charles Boustany and Richard

[308] Some patent box regimes exempt income (royalty income, and, in some cases, gains from disposal) from qualifying intellectual property, which has the effect of reducing the effective corporate tax rate on that intellectual property. In contrast, some patent box regimes allow certain income from qualifying intellectual property to be taxed at reduced rates. *See id.* at 916 (comparing four patent box regimes); *see also* NICK PANTALEO, FINN POSCHMANN & SCOTT WILKIE, C.D. HOWE INST., COMMENTARY NO. 379: IMPROVING THE TAX TREATMENT OF INTELLECTUAL PROPERTY INCOME IN CANADA 11 (2013), https://www.cdhowe.org/sites/default/files/attachments/research_papers/mixed/Commentary_379_0.pdf [https://perma.cc/CX7R-7GBT] (proposing patent box regime in Canada).

[309] *See* W. Wesley Hill & J. Sims Rhyne, III, *Opening Pandora's Patent Box: Global Intellectual Property Tax Incentives and Their Implications for the United States*, 53 IDEA 371, 384 (2013) ("In addition to these incentives, China adopted a patent box regime in 2008.").

[310] Graetz & Doud, *supra* note 22, at 405 ("Patent boxes are of more recent vintage and not only take international developments into account, but seem to have been enacted by various European nations in an effort to capture a share of mobile innovative activity or at least some revenue from such especially mobile income.").

[311] The United Kingdom noted that "some patent-rich UK businesses face a higher overall effective tax rate than their foreign competitors," and the patent box is explicitly intended to "improve the competitiveness of the UK corporate tax regime . . . ." HM TREASURY, CORPORATE TAX REFORM: DELIVERING A MORE COMPETITIVE SYSTEM 51 (2010), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/81303/corporate_tax_reform_complete_document.pdf [https://perma.cc/8SYP-BVX5]. The UK patent box also appears to be at least partially a response to the plans of some prominent multinational entities to move to Ireland. *See* Lee A. Sheppard, *What Hath Britain Wrought?*, 61 TAX NOTES INT'L 7, 7-8 (2011).

[312] *See, e.g.*, Finance Act 2012, c. 14, sch. 2 (Eng.), www.legislation.gov.uk/ukpga/2012/14/contents/enacted [https://perma.cc/9NTK-MUJZ] (providing reduced corporation tax rate for profits from patents).

[313] *See* H. COMM. ON WAYS & MEANS, TECHNICAL EXPLANATIONS OF THE WAYS AND MEANS DISCUSSION DRAFT PROVISIONS TO ESTABLISH A PARTICIPATION EXEMPTION SYSTEM FOR THE TAXATION OF FOREIGN INCOME 34 (2011).

Neal offered a patent box proposal that allowed (by means of a 71.4% deduction) a 10% U.S. tax rate for certain intellectual property income that has a U.S. link.[314] But none of these calls have been answered with new legislation.

There are several reasons why the United States resists adopting a patent box. First, patent boxes provide tax benefits for intellectual property already in existence, and research suggests they are less effective than R&D credits in encouraging new innovation.[315] R&D deductions and credits do a better job of encouraging new research, which results in positive spillover effects like attracting high value workers as well as luring capital essential for intellectual property.[316] Second, patent boxes are costly.[317] The United Kingdom, for example, saw a reduction in corporate revenues with its patent box even though additional innovation was reported.[318] If the United States adopted a patent box, the large size of its market could constitute a significant loss of revenue.[319] Third, patent boxes require new rules and compliance checks that would only further complicate the tax system.[320] And finally, patent boxes can result in a

[314] *See* Peter R. Merrill et al., *Is It Time for the United States to Consider the Patent Box?*, 134 TAX NOTES 1665, 1665 (2012) ("Given the tax benefits provided in some EU countries for holding IP, the question arises whether the United States should adopt similar incentives and, if so, how they should be designed."); Martin A. Sullivan, *Economic Analysis: Time for a U.S. Patent Box?*, 133 TAX NOTES 1304, 1307 (2011) ("If the United States wants to further promote private domestic research, it would be far simpler and more cost-effective to expand the research credit than to add a patent box to the code."); ERNST & YOUNG, US REPRESENTATIVES BOUSTANY AND NEIL RELEASE INNOVATION BOX DRAFT AS PART OF INTERNATIONAL TAX REFORM DELIBERATIONS 1 (2015), http://www.ey.com/Publication/vwLUAssets/US_Representatives_Boustany_and_Neal_release_innovation_box_draft_as_part_of_international_tax_reform_deliberations/$FILE/2015G_CM5649_US%20Reps%20Boustany%20and%20Neal%20release%20innovation%20box%20draft%20as%20part%20of%20intl%20tax%20reform%20delibs.pdf [https://perma.cc/Y95Y-56AK] ("On 29 July 2015, US Senior House Ways and Means Committee members Charles Boustany and Richard Neal released an 'innovation box' discussion draft that proposes a 10.15% effective rate of corporate tax on a portion of US corporate profits derived from qualifying intellectual property . . . .").

[315] THE PRESIDENT'S FRAMEWORK, *supra* note 299, at 22.

[316] *See* Graetz & Doud, *supra* note 22, at 374-75 (summarizing data on benefits of R&D tax incentives); *see also* THE PRESIDENT'S FRAMEWORK, *supra* note 299, at 22 ("Compared to the R&E credit, an innovation box is less effective in encouraging innovation.").

[317] THE PRESIDENT'S FRAMEWORK, *supra* note 299, at 22.

[318] Rachel Griffith, Helen Miller & Martin O'Connell, *Ownership of Intellectual Property and Corporate Taxation*, 112 J. PUB. ECON. 12, 21 (2014).

[319] A way to make up the tax revenue loss would have to be considered. *See* Luca Gattoni-Celli, *News and Analysis: Ryan Eyeing Research Cost Recovery to Pay for Innovation Box*, 148 TAX NOTES 824, 824 (2015) (describing House Ways and Means Committee Chair Paul Ryan's proposal of five-year amortization of R&D costs).

[320] THE PRESIDENT'S FRAMEWORK, *supra* note 299, at 22 ("Innovation boxes also work against the broadly shared goal of simplifying the tax system. New tax rules and compliance

"race to the bottom" wherein countries compete to have the lowest rate on intellectual property income.[321] This could have a negative impact on overall government funding and provision of various goods and services.

Despite these plausible reasons for failing to adopt a patent box, the United States cannot ignore the fact that competitor countries are utilizing them as tools to compete for global innovation. Belgium (6.8%), Cyprus (2.5%), Ireland (6.25%), Liechtenstein (2.5%), Luxembourg (5.76%), Malta (0%), and the Netherlands (5%) are just a few of the countries offering very low effective rates on income from innovation.[322] Even in China, the applicable tax rate on qualifying profits ranges from 0 to 12.5%.[323]

5. Base Erosion Measures in Response to Intellectual Property Income Shifting

We have explored several recent deliberate domestic tax changes that impact innovation, namely the choice to (1) repeal expensing for R&D, (2) repeal capital gains treatment for certain innovators, (3) not enhance the research tax credit, and (4) not adopt a U.S. patent box. It is worthy to note that Congress made other changes to the Code that may have unintended consequences for innovation. For example, the TCJA enacted an excise tax on the net investment income of certain private colleges and universities.[324] The tax applies not only to interest and dividends, but also to royalties.[325] The new tax may have the effect of reducing the value of endowments and redirecting money that could be used for basic research from those institutions to the federal government.

Perhaps the most significant changes made by the TCJA were to U.S. international tax rules. For years, Congress has explored ways to ensure its fair share of tax revenues from innovation conducted in the United States but exploited abroad. While many U.S. multinational entities presently conduct a vast amount of research in the United States and claim credits for R&D spending, the vast amount of worldwide profits attributable to that research is

checks would be needed to determine precisely how much income was associated with particular innovations.").

[321] *Id.* ("In essence, an innovation box is just another variation on a 'race to the bottom' in the taxation of multinational firms, where countries compete to have the lowest tax rate on certain corporate activities, without concern for the funding of necessary public goods and services.").

[322] JEFFREY A. MAINE & XUAN-THAO NGUYEN, THE INTELLECTUAL PROPERTY HOLDING COMPANY: TAX USE AND ABUSE FROM VICTORIA'S SECRET TO APPLE 173 (2017); *see also* PANTALEO, POSCHMANN & WILKIE, *supra* note 308, at 9-11; Merrill et al., *supra* note 314; Brown, *supra* note 307, at 927.

[323] Hill & Rhyne, *supra* note 309, at 385.

[324] I.R.C. § 4968 (2012) (imposing tax on applicable educational institutions).

[325] *See id.* § 4940(c) (defining net investment income).

not taxed in the United States.[326] As an example, Microsoft spent over $7.8 billion (out of a total R&D budget of $9.1 billion) on R&D in the United States and received $200 million in U.S. tax credits. Much of their profit attributable to the research conducted in the United States, however, was located in low-tax foreign countries.[327]

The TCJA made several changes to U.S. international income taxation intended to encourage U.S. businesses to report and pay income taxes in the United States rather than use foreign subsidiaries to lodge their earnings elsewhere. The problem with some of these anti-base erosion measures is that, while designed to capture more tax revenues, they may actually encourage the movement of R&D (and related income) offshore.[328]

As one example, the TCJA adopted a minimum tax on global intangible low-taxed income ("GILTI").[329] This subjects a new, very broad class of foreign intellectual property income, GILTI, to immediate taxation, albeit at a reduced rate. The computation of the new tax is complicated, but essentially it is imposed on the excess of a controlled foreign corporation's net income over a deemed return on the controlled foreign corporation's tangible assets (10% of depreciated tax basis). According to some analysts, firms will have an incentive to move tangible assets (such as R&D facilities and operations) abroad in order to reduce GILTI.[330]

As a complement to the new minimum tax regime on excess returns earned by a controlled foreign corporation, the TCJA provides a low effective tax rate on excess returns earned directly by a U.S. company from foreign sales (including licenses from intangibles in the United States).[331] The preferential rate on foreign-derived intangible income ("FDII") was designed to encourage companies to locate their intangibles in the United States. According to some analysts, however, "FDII is not likely to encourage firms to move their

[326] *See, e.g.*, MAINE & NGUYEN, *supra* note 322, at 3 ("This book closely examines these tax minimization strategies—specifically the use of *domestic* and *foreign* IP Holding Companies.").

[327] *See Offshore Profit Shifting and the U.S. Tax Code—Part I (Microsoft and Hewlett-Packard): Hearing Before the Permanent Subcomm. on Investigations of the S. Comm. on Homeland Sec. and Governmental Affairs*, 112th Cong. 20 (2012) (discussing Microsoft's activities in low-tax jurisdictions).

[328] For instance, the TCJA reduced the corporate tax rate from 35% to 21% and moved the United States closer to a territorial tax regime. While the rate reduction may reduce incentives for multinationals to shift profits outside the United States, the shift to a territorial system could actually exacerbate those incentives because any profits shifted offshore would be permanently exempt from U.S. tax.

[329] I.R.C. § 951A (2012) (adopting tax on GILTI).

[330] *See* Alexander Lewis, *TCJA's Effect on Income Shifting to Be Determined, Economists Say*, 89 TAX NOTES INT'L 665, 665 (2018).

[331] I.R.C. § 250 (2012) (addressing FDII and GILTI).

intangible assets back to the United States because of the uncertainty surrounding the validity of the regime under international trade rules."[332]

Base erosion due to intellectual property income shifting has not been merely a U.S. concern. Statistical and anecdotal evidence suggests that foreign-based multinationals engage in the same income-shifting strategies as U.S.-based multinationals.[333] In 2015, the OECD delivered a number of concrete recommendations to help nations address the problems of offshore income shifting, including recommendations involving intellectual property.[334] The so-called Base Erosion and Profit Shifting ("BEPS") Project consists of fifteen actions that provide principles (minimum standards) for appropriate taxation of multinational companies that attempt to tax profits where value is added (and to promote greater tax transparency with increased information exchange between tax authorities).[335] Most importantly, many of the actions attempt to tax income in the source country as opposed to the country of residence.[336] Action 5 targets patent box regimes. Because patent boxes can "unfairly erode the tax bases of other countries, potentially distorting the location of capital and services,"[337] especially when they are offered to entities that engage in no substantial activity, Action 5 requires "substantial activity" by a multinational company in order for the multinational to benefit from the patent box's lower rate on intellectual

[332] *See* Lewis, *supra* note 330, at 665.

[333] ROSANNE ALTSHULER, STEPHEN SHAY & ERIC TODER, LESSONS THE UNITED STATES CAN LEARN FROM OTHER COUNTRIES' TERRITORIAL SYSTEMS FOR TAXING INCOME OF MULTINATIONAL CORPORATIONS 36 (2015), https://www.taxpolicycenter.org/publications/lessons-united-states-can-learn-other-countries-territorial-systems-taxing-income/full [https://perma.cc/77AJ-MTU8] ("Anecdotal evidence suggests that foreign-based multinationals may be engaging in similar transactions and perhaps even to a greater degree.").

[334] *See generally* ORG. FOR ECON. CO-OPERATION & DEV., OECD/G20 BASE EROSION AND PROFIT SHIFTING PROJECT: EXPLANATORY STATEMENT (2015), http://www.oecd.org/ctp/beps-explanatory-statement-2015.pdf [https://perma.cc/7PXB-8BGY] (providing action items for tax reform).

[335] *The U.S. Tax Code: Love It, Leave It, or Reform It: Hearing Before the S. Comm. on Fin.*, 113th Cong. 97 (2014) (testimony of Robert B. Stack, Deputy Assistant Secretary (International Tax Affairs), United States Department of the Treasury) ("The principal target of the BEPS project is so-called 'stateless income,' basically very low- or non-taxed income within a multinational group.").

[336] *See* H. David Rosenbloom & Joseph P. Brothers, *Reflections on the Intersection of U.S. Tax Treaty Policy, U.S. Tax Reform, and BEPS*, 78 TAX NOTES INT'L 759, 764 (2015) ("[M]any of the [BEPS] actions point clearly in the direction of greater source-basis taxation.").

[337] ORG. FOR ECON. CO-OPERATION & DEV., COUNTERING HARMFUL TAX PRACTICES MORE EFFECTIVELY, TAKING INTO ACCOUNT TRANSPARENCY AND SUBSTANCE 13 (2014), https://www.oecd-ilibrary.org/docserver/9789264218970-en.pdf [https://perma.cc/TSN6-UFYP].

property income.[338] It uses R&D expenditures as a proxy for substantial activity. Thus, there must be a link or appropriate nexus between a multinational company's research expenditures and the intellectual property income receiving the low rate. If a multinational incurred 100% of the costs to develop an intellectual property asset in a country with a patent box regime, then 100% of the overall income from the intellectual property asset would be eligible for the regime's preferential rate. However, if the multinational outsourced all R&D to related parties, then none of the income from the intellectual property asset would receive tax benefits.

The point to take from all of this is that many countries have revised their patent boxes to meet the nexus requirement.[339] These BEPS-compliant measures by nations with a patent box may have negative implications for the United States, as there will now be an incentive for firms to move their research activities offshore in order to take advantage of the lower patent box tax rates. There are other examples of OECD initiatives that will have an indirect effect on the design and implementation of nations' R&D incentives, which, in turn, may result in multinationals relocating their R&D functions to low-tax countries to which they attribute profits.[340]

III. IMPLICATIONS

Startups, typically defined as companies less than ten years old, are critical to economic growth in the United States, as they constitute 51% of firms engaged in innovation.[341] Technology-based startups are particularly important, as they account for more than 70% of business R&D investment and nearly 60% of R&D jobs in the United States.[342] Technology-based startups focus on innovation development with competitive market advantages and have high

[338] *Id.* at 9.

[339] *See, e.g.*, NGUYEN & MAINE, *supra* note 322, at 278 & n.184 (noting that "[m]embers' countries will have to revise their patent boxes to meet the nexus requirement, which can limit the objectives they were designed to achieve").

[340] A prime example is the OECD's guidance with respect to transfer pricing rules. Under the OECD's revised transfer pricing guidelines, a controlled foreign subsidiary must perform actual functions and assume risks related to the development, maintenance, and exploitation of intangibles in order to be entitled to a return (allocated more global profits) taxed at the country's low rate. *See* ORG. FOR ECON. COOPERATION & DEV., OECD/G20 BASE EROSION AND PROFIT SHIFTING PROJECT: 2015 FINAL REPORTS: EXECUTIVE SUMMARIES 28-29 (2015), www.oecd.org/ctp/beps-reports-2015-executive-summaries.pdf [https://perma.cc/VL57-BA9V] (discussing risks and intangibles).

[341] *See* J. JOHN WU & ROBERT D. ATKINSON, INFO. TECH. & INNOVATION FOUND., HOW TECHNOLOGY-BASED START-UPS SUPPORT U.S. ECONOMIC GROWTH 5-12 (2017), http://www2.itif.org/2017-technology-based-start-ups.pdf?_ga [https://perma.cc/D6G2-QXLH].

[342] *See id.* at 6 (focusing on ten technology-based industries in manufacturing and services).

growth potential compared to other types of startups.[343] When the tech startups succeed, their innovations and business model translate to an increase in employment and revenue.[344] Employment growth rates at tech startups enjoy twice as many net jobs as all startups generally.[345] Workers in tech startups earn twice the national average compensation and almost three times more than other types of startups.[346] Moreover, technology-based startups create jobs in other economic sectors, such as jobs in firms that are conducting business with the tech startups.[347] Further, for every job created directly by technology-based startups, five additional jobs are created in other sectors—the highest employment multiplier.[348] Clearly, startups bring significant changes in many industries and impact society. The number of new startups in the United States, however, has been declining rapidly in recent years—a drop by 30% over the past ten years.[349]

We have offered several reasons to explain this downward trend for technology-based startups. By closing the patent protection doors on inventions in fields dominated by startups—like software, business methods, medical

[343] *Id.* at 7 ("[Tech start-ups] often experience accounting losses for several years because they undertake heavy initial R&D and prototyping and testing investments, often many years before developing a significant revenue stream. Many fail somewhere along this process, but if their technology and business models succeed, they often experience robust growth rates, hiring skilled and semi-skilled workers and paying well above the median wage. This contrasts with the typical new business in other industries, such as a restaurant or local service firm, which does not invest in R&D, has little intention to grow, creates a small number of jobs often at low wages, and usually goes out of business in under 10 years." (footnote omitted)).

[344] *Id.*

[345] *See generally* IAN HATHAWAY, EWING MARION KAUFFMAN FOUND., TECH STARTS: HIGH-TECHNOLOGY BUSINESS FORMATION AND JOB CREATION IN THE UNITED STATES (2013), https://www.kauffman.org/-/media/kauffman_org/research-reports-and-covers/2013/08/bdstechstartsreport.pdf [https://perma.cc/D3QN-QZSB].

[346] *See* WU & ATKINSON, *supra* note 341, at 10 ("[T]echnology-based start-ups pay an average of $102,000, more than double the U.S. average wage of $48,000.").

[347] These related jobs include "manufacturing jobs in production supply chains, laboratory technicians in third-party laboratories, hospital workers where biotech firms conduct trails [sic], and lawyers and accountants that help firms." *Id.* at 10. Likewise, indirectly induced jobs include jobs in groceries, financial services, and entertainment that the tech employees frequent. *Id.*

[348] *See, e.g.*, MASS. BIOTECH. COUNCIL, PRESIDENT OBAMA, THE 111TH CONGRESS, AND BIOTECHNOLOGY: WORKING TOGETHER TODAY TO ENSURE A HEALTHY TOMORROW 16 (2009) ("For every biopharmaceutical manufacturing job created, 5 additional supporting jobs are created in other industries."); ENRICO MORETTI, THE NEW GEOGRAPHY OF JOBS 13 (2012) ("Indeed, my research shows that for each new high-tech job in a city, five additional jobs are ultimately created outside of the high-tech sector in that city, both in skilled occupations (lawyers, teachers, nurses) and in unskilled ones (waiters, hairdressers, carpenters).").

[349] *See supra* note 1 and accompanying text.

diagnostics, and personalized medicine—the United States has been heading into unknown territory. Because Europe and China recognize the importance of innovations in these fields and allow them patent eligibility, companies seek patent protection there.[350] This results in Europe and China enjoying increased financing and employment in those sectors. Likewise, the decline in U.S. government funding for basic research deprives the United States of scientific breakthroughs, decimates the number of researchers, and discourages young people from entering STEM fields. Stronger patent protection in Europe and China coupled with the lack of U.S. government funding for research will force innovation to leave the United States for other locations. The offshore movement of talent and investments will have devastating consequences in the long run.

U.S. tax policy has also played a major factor in the decline of American innovation. The U.S. tax policy tools used to incentivize innovation (for example, a tax deduction and credit for R&D and capital gains treatment upon innovation dispositions) have remained largely constant until recently with the TCJA; if anything, their design changes over the years have weakened their incentive effects. Meanwhile, other countries have enhanced their tax incentives for innovation over time. Tax considerations can be important when firms are setting their annual research budgets, deciding what research projects to undertake, and determining where to undertake them. Many countries understand this and have adopted very attractive tax incentives for innovation. And some, even shortly after adopting tax incentives, have modified them to make them more attractive. The United Kingdom, for example, started with a super deduction for small companies. It later created a super deduction for larger companies and then increased the super deduction for both small and large companies, resulting in several increases to tax deductions for innovation.[351] Some countries have enhanced their tax credits for innovation. Ireland did so from 20% to 25%. France's change from an incremental credit to a volume-based credit is another example.[352] Further, many countries, including China, have enacted patent boxes or innovation boxes.

---

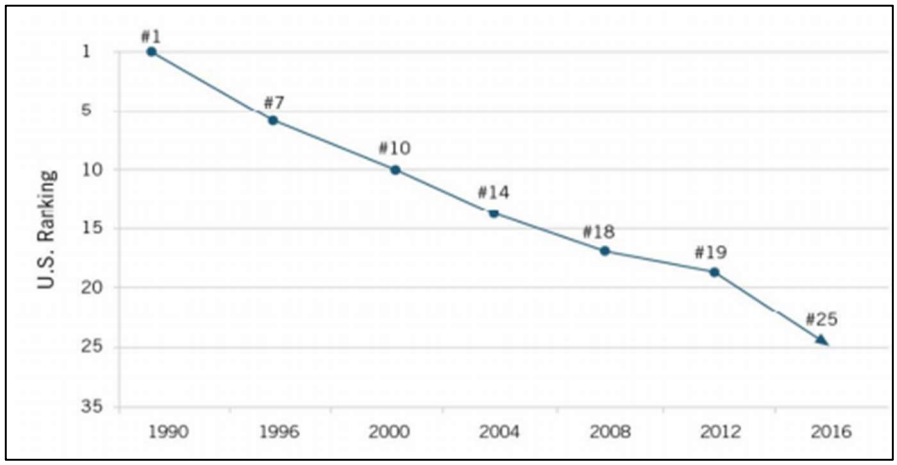
[350] Madigan & Mossoff, *supra* note 13, at 941 ("Other jurisdictions, such as in Europe and China, are now granting patents for the same or related inventions and discoveries that are being rejected in the U.S. as ineligible for patent protection."); Gabriela I. Coman, *Procuring Personalized Medicine Patents in US vs. Europe*, LAW360 (July 20, 2015, 9:56 AM), https://www.law360.com/articles/677723/procuring-personalized-medicine-patents-in-us-vs-europe ("[C]urrent U.S. and European patent laws do not provide a uniform platform when addressing personalized medicine claims. In the United States, many patent claims related to personalized medicine are being challenged based on patentable subject matter, whereas in Europe, most claims are questioned based on novelty and inventive step.").

[351] *See* PRICEWATERHOUSECOOPERS, *supra* note 305, at 23 (describing United Kingdom's "super deduction").

[352] *See* ORG. FOR ECON. CO-OPERATION & DEV., *supra* note 305, at 1; PRICEWATERHOUSECOOPERS, *supra* note 305, at 13 (describing French system as credit on volume).

As a result of other nations enhancing their R&D tax incentives, the United States has dropped significantly in its ranking among nations in terms of innovation tax incentives. The OECD monitors tax support for R&D and innovation among member countries. As the following chart shows, in terms of R&D tax incentive generosity, the United States dropped from number one in 1990 to number twenty-five in 2016.[353]

Figure 1. U.S. Ranking in OECD on R&D Tax Incentive Generosity for Large Firms.



In light of this trend, one might have expected the United States to adopt in the TCJA of 2017 new tax policy approaches to spur innovation, including measures adopted by other nations. Instead of enhancing incentives for

[353] *See* LUKE A. STEWART, JACEK WARDA & ROBERT D. ATKINSON, WE'RE #27!: THE UNITED STATES LAGS FAR BEHIND IN R&D TAX INCENTIVE GENEROSITY 1 (2012), http://www2.itif.org/2012-were-27-b-index-tax.pdf?_ga [https://perma.cc/S2XW-AG8E] ("In 2012, the United States ranks just 27th out of 42 countries studied in terms of R&D tax incentive generosity, down from 23rd just five years ago."); Jacek Warda, *Measuring the Value of R&D Tax Treatment in OECD Countries*, 2000 SCI. TECH. & INDUSTRY REV., no. 2, 2002, at 185, 199 (listing United States as moderate incentive provider in 1999-2000); Jacek Warda, *Tax Treatment of Business Investments in Intellectual Assets: An International Comparison* 27 (OECD Sci., Tech. and Indus., Working Paper No. 2006/04, 2006), https://www.oecd-ilibrary.org/docserver/672304513676.pdf [https://perma.cc/K2SQ-ZN5T] (comparing corporate income tax rates); *Measuring Tax Support for R&D and Innovation*, OECD, http://www.oecd.org/sti/rd-tax-stats.htm [https://perma.cc/ESD4-Z2CF] (last visited Aug. 22, 2019) (charting direct government funding and tax support for business R&D by country). In certain years, values were not conducted for some OECD countries. For example, in 2012, Estonia and Latvia were omitted, and the 2016 estimates did not calculate values for Estonia and Israel.

innovation, however, the TCJA actually scaled back incentives for innovation while providing enhanced tax breaks for machinery and enacting anti-base erosion measures to capture revenue from foreign intangible income.

Because the TCJA is the most recent attack on innovation, we give it a little more attention in our final observations.

First, the U.S. government did not have any quantitative sense of the real effects of some of these tax changes before adopting them. We have seen this before in the United States. The initial research tax credit in 1981 was 25% (not 20%). However, "[t]here is no evidence that the rate was chosen on the basis of a rigorous assessment of the gap between the private and social returns to research investment, or the sensitivity of research expenditures to declines in their after-tax cost."[354] In 1986, the credit was reduced to 20%. Again, this change was not based on an analysis of the credit's effectiveness in the first five years, but rather seemed to stem from the overriding goals of the Tax Reform Act of 1986, which were to lower tax rates and broaden the income tax base. History seems to repeat itself. The TCJA eliminated expensing and capital gains treatment for innovation not based on an analysis of these incentives' effectiveness, but rather based on the overriding goals of the TCJA—reducing tax rates and broadening the income tax base. This is not the best way to set innovation tax policy.[355]

Second, the TCJA's reliance on tax incentives for tangible asset purchases (machinery and equipment) to boost the economy is short-sighted. Despite the political mantra that full and immediate expensing of tangible assets is the best way to expand the economy, econometric analysis reveals only a short-term increase in private investment in tangible property in response to these incentives.[356] Firms may accelerate their investments, but they do not change their aggregate investment in tangible assets over time.[357] A more long-term

[354] GUENTHER, *supra* note 23, at 11.

[355] But we have seen it in the United States and in other countries as well. As a prime example, many countries have adopted patent boxes in the absence of convincing evidence of their effectiveness. One would think that nations would want some quantitative sense of a patent box's effects before adopting one. But that has not been the case. The data is too limited to adequately assess the effectiveness of patent boxes. Nevertheless, many countries have rapidly adopted them, and many have expanded and enhanced them soon after adoption without evidence of their effectiveness.

[356] Kevin A. Hassett & R. Glenn Hubbard, *Tax Policy and Business Investment*, 3 HANDBOOK PUB. ECON. 1293, 1338 (2002); *see generally* Kevin A. Hassett & Kathryn Newmark, *Taxation and Business Behavior: A Review of the Recent Literature*, *in* FUNDAMENTAL TAX REFORM 1294 (John W. Diamond & George R. Zodrow eds., 2008).

[357] *See generally* Eric Zwick & James Mahon, Do Financial Frictions Amplify Fiscal Policy? Evidence from Business Investment Stimulus (June 30, 2014) (unpublished manuscript) (available at https://www.irs.gov/pub/irs-soi/businessinveststimmahonzwick.pdf [https://perma.cc/B5QE-LPLX]). The evidence on whether expensing results in permanent increases in aggregate investment is more mixed. *See, e.g.*, James R. Hines, Jr. & Jongsang

focus on economic expansion would focus more on innovation and intangible capital investments rather than on tangible capital investments.

Third, and most significantly, the recent tax changes will encourage firms to move their R&D offshore. The research credit, untouched by the recent TCJA, is now the U.S. government's main tax policy tool to spur innovation. However, relying on the current, unenhanced research credit as the main tax policy tool for innovation does not place the United States in a competitive posture vis-à-vis other nations. The result is a risk of losing American innovation to other countries, including China. Research and development have become more global over the past two decades as more countries have developed the technical talent to conduct research and as firms operate in more markets around the world. Studies show that innovation tax incentives clearly affect the location of research activities and not just the amount.[358]

The offshoring of innovation is already happening. A review of seven industrial groups in twelve countries concluded that U.S. technological dominance is eroding at a rapid pace and that foreign affiliates of U.S. firms conducted more research in countries with research tax incentives. In 2007, U.S. foreign affiliate R&D was $17.2 billion, or equivalent to 11% of the U.S. business total; just ten years later, in 2017, it was $41 billion, or equivalent to 15% of the U.S. total.[359] This trajectory of foreign affiliate research performed outside the United States is getting worse and will likely only continue to worsen in the aftermath of Congress's recent tax law changes.

CONCLUSION

Innovation helps firms in the United States stay ahead of their international competitors, producing higher market shares and more revenues with which to hire more workers. A strong patent system and strong tax incentives can affect where a firm places its highest-value production activities. Innovation expansion domestically has carry-over effects because innovations lower costs and increase competitiveness in other industries. Advances in information technology, for

Park, *Investment Ramifications of Distortionary Tax Subsidies*, 172 J. PUB. ECON 36, 48 (2019) (concluding that evidence of positive impact of any tax incentives on aggregate investment is relatively weak).

[358] JOE KENNEDY & ROBERT D. ATKINSON, INFO. TECH. & INNOVATION FOUND., WHY EXPANDING THE R&D TAX CREDIT IS KEY TO SUCCESSFUL CORPORATE TAX REFORM 4 (2017), http://www2.itif.org/2017-rd-tax-credit.pdf [https://perma.cc/N68Z-N85N] ("A multi-country study showed that R&D in one country responds to changes in the price of R&D in other countries, suggesting that innovation policies could play an important role in determining where research is located globally." (citing Nicholas Bloom & Rachel Griffith, *The Internationalisation of UK R&D*, 22 FISCAL STUD. 337, 350 (2001))).

[359] *Research and Development: U.S. Trends and International Comparisons*, NAT'L SCI. BOARD, https://www.nsf.gov/statistics/2018/nsb20181/report/sections/research-and-development-u-s-trends-and-international-comparisons/u-s-business-r-d#r-d-by-multinational-enterprises [https://perma.cc/3LQM-TAMC] (last visited Aug. 22, 2019).

instance, can affect productivity throughout the traded sector. The higher wages and lower prices that eventually result from higher productivity create a new source of demand across the economy.

Until now, the United States has been the largest research performer ($457 billion in 2013), accounting for 27% of the global total. But China is not far behind. China was the second largest performer ($336 billion in 2013), accounting for 20% of the global total.[360] China and other developing countries have vigorously pursued national innovation policies. The United States can no longer afford to take an "exceptionalism" approach to patent law and tax policy and ignore the policies of other nations.

[360] Japan is third at 10% ($160 billion); Germany is fourth at 6% ($101 billion). *Id.* France ($55 billion), India ($36 billion), Russia ($41 billion), South Korea ($69 billion), and the United Kingdom ($40 billion) make up a third tier of performers, each accounting for 2% to 4% of the global total. *Id.* Australia, Brazil, Canada, Italy, Spain, and Taiwan make up a fourth tier, with annual R&D expenditures ranging from $19 billion to $31 billion; each accounting for 1% to 2% of the global total. *Id.*