ECONOMIC GROWTH AND PROSPERITY STEM FROM EFFECTIVE INTELLECTUAL PROPERTY RIGHTS

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INTRODUCTION

This essay sets out to examine, through the lens of economics and growth, the ways in which intellectual property ("IP") rights benefit individuals. The interrelated nature of intellectual property, innovation, and jobs is essential to economic prosperity, and this piece seeks to establish the importance of these relationships.

Determining the role of IP in innovation, and the economic benefits that flow from innovation, is inherently challenging. Given that it is very difficult to prove why something does not happen, establishing the value of intellectual property rights protections is most easily approached by examining where innovation happens and drawing a correlation to the corresponding strength of intellectual property protection environments. This essay seeks to show that the below concepts substantiate the importance of effective intellectual property rights to innovation and economic growth:

*The economic fundamentals of production characterized by high fixed costs and low marginal costs;

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*The development and launch of new therapies and cures in the pharmaceutical industry;

*An examination of where innovation happens, in nations with strong IP environments;

*The value of IP ownership to securing venture capital investments; and

*Job creation that is fostered by strong IP protections.

I. THE ECONOMIC FUNDAMENTALS

A growing body of empirical evidence demonstrates that stronger intellectual property protections, in combination with other policies, increase economic development, foreign direct investment, and innovation.[1] Intellectual property rights incentivize innovation through a well-known static/dynamic tradeoff.[2] In exchange for market exclusivity that gives firms the incentives to invest in the difficult and expensive research and development necessary for biopharmaceutical advances, firms share their innovations in disclosures in their patent applications.[3] In exchange for twenty years of market exclusivity—a static loss—new knowledge is forever brought into the public domain—a dynamic gain.[4]

Industries characterized by high fixed costs of development and low marginal costs of production suffer from a market failure that intellectual property protection corrects. Without patent rights and other forms of IP protection, firms in these industries have no incentive to invest, and innovation

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1 *See* MEIR PEREZ PUGATCH, ET AL., TAKING STOCK: HOW GLOBAL BIOTECHNOLOGY BENEFITS FROM INTELLECTUAL PROPERTY RIGHTS 56 (2012). Their study documents the findings of more than 40 studies which demonstrate the positive correlation between intellectual property rights, foreign direct investment, trade and economic development. These studies examine both industrialized and developing nations from all regions of the globe. *See generally id.* at 10–27.

2 *See* WILLIAM D. NORDHAUS, INVENTION, GROWTH, AND WELFARE: A THEORETICAL TREATMENT OF TECHNOLOGICAL CHANGE 76 (1969) (discussing the tradeoff in the context of patent lives).

3 *See* Gregory J. Glover, *The Influence of Market Exclusivity on Drug Availability and Medical Innovation*, 9 AM. ASSOC. PHARM. SCIENTISTS J. 312, 312–13 (2007).

4 Kristin Lybecker, *The Biologics Revolution in the Production of Drugs*, *in* INTELLECTUAL PROPERTY RIGHTS AND THE PROMOTION OF BIOLOGICS, MEDICAL DEVICES AND TRADE IN PHARMACEUTICALS 18, 21 (Steven Globerman ed., 2016). "The temporary static inefficiency results from the loss of consumer welfare due to higher prices that result from market exclusivity. In contrast, the permanent dynamic gains result from the incentives patents provide to develop new products and the knowledge that is thereby provided to society." *Id*. at 21 n.7.

evaporates. Innovations that require significant investments in the development process may be produced (or replicated) at minimal cost, and there is no incentive to innovate.

The pharmaceutical industry exemplifies this situation. The cost of researching and developing a new pharmaceutical therapy, an expenditure that is considered a fixed cost, is extraordinarily high.[5] The estimated cost of developing a new medicine is $2.6 billion.[6] Though an admittedly controversial figure, the estimate drives home the fact that bringing a drug from bench to bedside is exceedingly expensive. At the same time, after the innovative firm bears the costs of development, the marginal cost of production—the cost of producing one additional dose/pill/tablet—is relatively modest. Moreover, the final product is easily replicated.

This is evidenced by the fact that the financial cost borne by innovation-based companies is more than 200 times that of generic companies in the development of a particular drug.[7] The investment of time is also significantly greater for the innovative pharmaceutical industry. Table 1, below, describes the differences in the drug development processes of innovative and generic companies, illustrating the importance of strong IP protection for a healthy domestic industry. While the investment of time, resources, and financial support by research-based companies is far greater than that by generic firms, assuring that these investments continue is dependent upon strong intellectual property protection and the innovative firms' ability to recoup their investments.

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[5] *See* WAYNE WINEGARDEN, THE ECONOMICS OF PHARMACEUTICAL PRICING 8 (2014). *See also* Kristina Lybecker, *IP Protection Incentivizes Innovation and Creates Jobs: A Message Worth Repeating*, IP WATCHDOG (June 8, 2015), http://www.ipwatchdog.com/2015/06/08/ip-protection-incentivizes-innovation-and-creates-jobs-a-message-worth-repeating/id=58443 ("The R&D costs are considered a fixed cost. In economic terms, this is a cost that a firm is unable to recover and one that [is] independent of the quantity produced. That is, the $2 billion required to develop a new therapy does not change, regardless of the number of doses produced (1 or 1,000 or 1,000,000). In contrast, [t]he cost of producing one additional dose is the marginal cost of production, a cost that we would expect to be relatively low once the development process is complete.").

[6] *See* Joseph A. DiMasi, et al., *Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs*, 47 J. HEALTH ECON. 20, 31 (2016). It is important to note how DiMasi's estimates were calculated. Capitalizing out-of-pocket costs to the point of marketing approval at a real discount rate of 10.5% yields a total pre-approval cost estimate of $2558 million (2013 dollars). Adding an estimate of post-approval R&D costs increases the cost estimate to $2870 million (2013 dollars). *Id.* at 20.

[7] CAN. INTELLECTUAL PROP. COUNCIL, THE CAN. CHAMBER OF COMMERCE, INNOVATION FOR A BETTER TOMORROW: CLOSING CANADA'S INTELLECTUAL PROPERTY GAP IN THE PHARMACEUTICAL SECTOR 10 (2011).

Drug Development Process and Comparisons

Drug Development Phases	Innovative Companies	Generic Companies
Research and Development	2-6.5 years (early stage development)	6 months-1 year (secure active ingredient and formulation)
Tests and Trials	7 years for 60% of total costs	3-6 months for $1 million
Time from Laboratory to Market	11-13 years	2.25-6.5 years
Estimated Total Costs	$897 million	$4 million
Time to Recoup Investments	7-9 years	No time limit

Table 1[8]

As a result, no firm has an incentive to spend the billions of dollars needed for development without an assurance that they will be able to capture the returns to their investment. Rather, every firm is incentivized to let another firm bear the cost, while they wait to merely copy the drug once it has been developed. Without patent protection, and other forms of intellectual property rights to protect an innovator's investment, pharmaceutical drug development will not take place.

Fundamentally, patents and intellectual property rights promote disclosure. Otherwise, trade secrecy would be used to protect innovation, and secrecy would replace disclosure. Over the past five decades, a multitude of scholars have demonstrated that patents foster *ex ante* innovation, motivating the investment of time and talent because of the prospect of financial gain from those endeavors.[9]

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[8] *Id.* at 9.

[9] *See* Marshall Phelps, *Do Patents Really Promote Innovation? A Response to The Economist*, FORBES (Sep. 16, 2015), https://www.forbes.com/sites/marshallphelps/2015/09/16/do-patents-really-promote-innovation-a-response-to-the-economist/#1921f381921f (citing JACOB SCHMOOKLER, INVENTION AND ECONOMIC GROWTH (1966); Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, *in* THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609–26 (1962); Nancy T. Gallini, *The Economics of Patents: Lessons from Recent U.S. Patent Reform*, 16 J. ECON. PERSPS. 131 (2002); Richard Gilbert & Carl Shapiro, *Optimal Patent Length and Breadth*, 21 RAND J. ECON. 106 (1990); Zvi Griliches, *The Sources of Measured Productivity Growth: United States Agriculture, 1940-60*, 71 J. POL. ECON. 331 (1963); Gene M. Grossman & Elhanan Helpman, *Quality Ladders in the Theory of Growth*, 58 REV. ECON. STUD. 43 (1991); Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977); Paul Klemperer, *How Broad Should the Scope of Patent Protection Be?*, 21 RAND J. ECON. 113 (1990); Jennifer F. Reinganum, *Technology Adoption Under Imperfect Information*, 14 BELL J. ECON. 57 (1983); Paul M. Romer, *Endogenous Technological Change*, 98 J. POL. ECON. 71 (1990); Suzanne Scotchmer, *On the Optimality of the Patent Renewal System*, 30 RAND J. ECON. 181 (1999)).

The strength of a national intellectual property environment is a critical factor in determining a product's launch speed in a particular country. Jean Lanjouw first showed that stronger product and process IP protections correspond to faster launch times for new drugs.[10] Table 2, below, shows that this correlation continues to hold for available targeted cancer therapies.

Correlation Between Available Drugs and IP Protection

	Available Targeted Cancer Therapies (of 27 possible)	GIPC Overall Score 2015
India	4	7.23
Brazil	6	10.86
China	8	12.40
Russia	9	13.54
Mexico	13	14.55

Table 2[11]

Lanjouw writes:

> Less than one-half of the new pharmaceutical molecules that are marketed worldwide are sold in any given country, and those that are sold are often available to consumers in one country only six or seven years after those in another. Both price regulation and intellectual property rights influence these outcomes.[12]

Clearly sufficient intellectual property rights protection drives the launch of new treatments and cures. Where IP rights are secure, innovation is embraced and available, and the public health benefits are realized.

The benefits of a vibrant innovative pharmaceutical industry translate into treatments that enhance and extend life. Over the past several decades, new medicines have increased longevity, accounting for 40 percent of the two-year increase in life expectancy achieved in fifty-two countries between

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10 *See* Jean O. Lanjouw, *Patents, Price Controls and Access to New Drugs: How Policy Affects Global Market Entry* 24–25 (Ctr. for Glob. Dev., Working Paper No. 61, 2005).

11 *See* GLOB. INTEL. PROP. CTR., U.S. CHAMBER OF COMMERCE, GIPC INTERNATIONAL IP INDEX 5 (3d ed., 2015); Donna Young, *Cancer Drug Reaches $100bn; Access Varies Widely*, SCRIP INTELLIGENCE (May 5, 2015), https://scrip.pharmamedtechbi.com/SC028613/Cancer-drug-spending-reaches-100bn-access-varies-widely.

12 Lanjouw, *supra* note 10, at 1. These findings are echoed in a report by Walter G. Park and Douglas C. Lippoldt. Walter G. Park & Douglas C. Lippoldt, *Technology Transfer and the Economic Implications of the Strengthening of Intellectual Property Rights in Developing Countries* 5 (Org. for Econ. Cooperation and Dev., Working Paper No. 62, 2008) ("Focusing on technology transfer to developing countries, the study finds that stronger levels of patent protection are positively and significantly associated with the inflows of *high-tech* products, like pharmaceutical goods, chemicals, aerospace, computer services, information, and office and telecom equipment.").

1986 and 2000.[13] Other examples include the treatment of HIV/AIDS and cancer.[14] Since the mid-1990s and the development of a new wave of medicines to treat HIV/AIDS, the U.S. death rate from AIDS has dropped about 70 percent.[15] In addition, in the years since 1971, our arsenal of cancer medicines has tripled. These new treatments account for 50-60 percent of the increase in six-year cancer survival rates since 1975.[16] In 2003, the total number of people who died of cancer went down for the first time in more than 70 years.[17]

In contrast, inadequate intellectual property protection results in a loss of welfare for patients as well as firms. A leading example is Pfizer, which originally developed Viagra to treat high blood pressure and cardiovascular disease, due to the drug's ability to enlarge blood vessels and increase blood flow.[18] Although initial studies demonstrated that the drug had minimal effects on critical cardiovascular parameters, the drug was approved in 1998 to treat erectile dysfunction.[19] Almost two decades later, a new study now suggests that Viagra (and other PDE-5 inhibitors) may also have cardioprotective effects.[20] Specifically, "continuous use of Viagra improves cardiac performance in patients, cardiac hypertrophy, and heart failure, conditions where the cardiac pump function is compromised."[21]

While this could be wonderful news for patients with cardiovascular disease, it is highly likely that the potential of PDE-5 inhibitors will never be realized. Demonstrating that Viagra and other PDE-5 inhibitors are a safe and effective treatment for cardiovascular disease would require a lengthy clinical trial program with a large number of patients who would be monitored over many years.[22] Given that such a study would likely cost hundreds of millions of dollars and Viagra will soon be off-patent, it is unlikely that Pfizer would be willing to invest the necessary funds to conduct the clinical trials even with this evidence of effectiveness.

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13 Frank R. Lichtenberg, *The Impact of New Drug Launches on Longevity: Evidence from Longitudinal, Disease-Level Data from 52 Countries, 1982-2001* 19 (Nat'l Bureau of Econ. Research, Working Paper No. 9754, 2003).

14 *See* Frank R. Lichtenberg, *The Expanding Pharmaceutical Arsenal in the War on Cancer* 2 (Nat'l Bureau of Econ. Research, Working Paper No. 10328, 2004); K. Porter et al., *Determinants of Survival Following HIV-1 Seroconversion After the Introduction of HAART*, 362 THE LANCET 1267, 1267 (2003).

15 *See* Porter, *supra* note 14, at 1269.

16 Lichtenberg, *supra* note 14, at 26–27.

17 *See* Donna L. Hoyert, et al., NAT'L CTR. FOR HEALTH STATS., CTRS. FOR DISEASE CONTROL AND PREVENTION, DEATHS: FINAL DATA FOR 2003 (2006), https://www.cdc.gov/nchs/data/hestat/finaldeaths03/finaldeaths03.htm.

18 John LaMattina, *Viagra Protects the Heart—Now What?*, FORBES (Oct. 21, 2014), https://www.forbes.com/sites/johnlamattina/2014/10/21/viagra-protects-the-heart-now-what/#d947c22d 55d5.

19 *Id.*

20 *Id.*

21 *Id.*

22 *Id.*

In this case, the stumbling block is an issue of incremental innovation. Pfizer wishes to further develop an existing innovation, but would have to do so without the IP protections that would enable a return on the investment needed to do so. Research demonstrates that "close to one-quarter of the therapeutic indications described are treated by drugs initially indicated to treat a different disease or condition[;] [t]he value of such innovation is best measured through the improved health outcomes for patients."[23] The evidence suggests that PDE-5 inhibitors hold great promise in this regard.[24] Unfortunately, without the ability to recoup its investment, Pfizer will not perform the necessary research to bring these benefits to market.[25] All innovation is valuable to the economy and to patients, whether breakthrough medical discoveries or incremental innovations. The IP system could do a better job recognizing this reality.

Moreover, "[t]he patent system allows for the production of generic copies of the initial innovation, even while the improved innovation is protected."[26] Importantly, incremental innovations are usually launched at a discount, and the resulting competition across drugs in a therapeutic class results in lower prices. In a 2000 study, Joseph A. DiMasi examined twenty new drugs, accounting for half of U.S. sales, launched between 1995 and 1999.[27] The study showed that all but one of the follow-on drugs were discounted and sold at prices up to 70 percent lower than the pioneer drug.[28] Incremental innovation does not stymie competition; instead, it has the potential to enhance it. In that context, it is important to recognize that improvement innovations may emerge from the original innovator, competing firms, or generic producers.

From a public health perspective, incremental innovation ensures a variety of drugs are available within a therapeutic class. This variety enables physicians to treat individual needs of diverse patients with precision. For patients, the benefits to incremental innovation are tremendous. Innovative improvements have the potential to increase the number of available dosing options, uncover new physiological interactions of known medicines, allow for reformulations to encourage children's compliance, increase the shelf life

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23 Kristina Lybecker, *Incremental Innovation Delivers Choice and Cost-Savings*, WARD HEALTH (July 19, 2014), http://www.wardhealth.com/incremental-innovation-delivers-choice-and-cost-savings.

24 *See* LaMattina, *supra* note 18.

25 *See id.*

26 Kristina Lybecker, *The Importance of Protecting Incremental, Improvement Innovation*, IPWATCHDOG (Oct. 17, 2013), http://www.ipwatchdog.com/2013/10/17/the-importance-of-protecting-incremental-improvement-innovation/id=45725/. *See* INT'L FED'N OF PHARM. MFRS. & ASS'NS., INCREMENTAL INNOVATION: ADAPTING TO PATIENT NEEDS 16–17 (2013) [hereinafter IFPMA, ADAPTING TO PATIENT NEEDS].

27 Joseph A. DiMasi, *Price Trends for Prescription Pharmaceuticals: 1995-1999*, Report to Dept. of Health & Human Servs. Conference on Pham. Pricing Practices, Utilization, & Costs, 4, 9 (Aug. 8, 2000).

28 *See id.* at 7–8.

or heat stability of a given medicine to secure effectiveness in diverse environments, eliminate treatment-limiting drug reactions or side effects, enhance patient administration, and improve patient compliance.[29] Drugs within a single therapeutic class "differ in their therapeutic profile, metabolism, adverse effects, dosing schedules, delivery systems, and other features."[30] These differences increase a patient's probability of finding a treatment that is both effective and tolerated. Moreover, multiple therapies ensure an uninterrupted supply and availability of vital medications if the initial drug fails in the development stage or in the market, or suffers from manufacturing interruptions.[31]

Incremental innovation provides both follow-on medicines and new uses for existing therapies. Since first-in-class drugs are rarely optimal, improvement innovations may become best-in-class and first-line therapies. A recent study by Joshua P. Cohen and Kenneth I. Kaitin found that 63 percent of the drugs on the World Health Organization's Essential Drug Lists are follow-on drugs.[32] While abstract explanations of the value of improvement innovation are helpful, specific examples are more illustrative. Importantly, several of these examples describe treatments for neglected diseases and maladies of the developing world:

> *AIDS: Atripla, the first-ever single-pill AIDS treatment regimen combining three drugs into one pill, simplified the dosing regimen and increased patient compliance.[33]
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> *Diabetes: Inhaled insulin administered through an inhaler has been shown to have a more rapid onset of action than injected insulin.[34]
>
> *Congestive Heart Failure: Captopril was the first ACE (angiotensin converting enzyme) inhibitor. Unpleasant side effects led to additional research efforts that yielded a completely new understanding of the enzyme linked to congestive heart failure.[35]
>
> *Hepatitis C Virus: A modified formulation of interferon alfa (IFNα) improved the positive response rate of patients receiving treatment from 38-43 percent to 54-56 percent and drastically simplified dosing regimens.[36]

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29 IFPMA, ADAPTING TO PATIENT NEEDS, *supra* note 26, at 5.

30 Albert Wertheimer, et al., *Too Many Drugs? The Clinical and Economic Value of Incremental Innovations*, *in* INVESTING IN HEALTH: THE SOCIAL AND ECONOMIC BENEFITS OF HEALTH CARE INNOVATION 77, 77 (2001).

31 *Id.*

32 Joshua Cohen & Kenneth Kaitin, *Follow-On Drugs and Indications: The Importance of Incremental Innovation to Medical Practice*, 15 AM. J. THERAPEUTICS 89, 90 (2008).

33 *Id.*

34 *Id.*

35 IFPMA, ADAPTING TO PATIENT NEEDS, *supra* note 26, at 10.

36 *Id.* at 12.

> *Malaria: Improvement innovation led to the development of a new formulation of two anti-malarial drugs, artesunate and amodiaquine, reducing dosing regimens from eight tablets a day to two.[37]
>
> *Type 2 Diabetes: The combination of two treatments, metformin and saxagliptin, allowed for a single dosage form, a much simpler drug therapy regimen.[38]
>
> *Chagas Disease: Clinical trials are underway to explore the effects of the antifungal medicine ravuconazole against the pathogen that causes Chagas disease, a neglected tropical disease affecting nearly ten million people.[39]

Admittedly, innovation happens for many reasons, including necessity. Among the top reasons, we can include "happy accidents," as was the case of Viagra.[40] That said, to incentivize innovation, intellectual property rights are essential. If we are content to let things happen accidentally and by happenstance, we don't need intellectual property rights; but most businesses and national economic advisers aren't willing to leave profits and prosperity to chance. In today's economy, innovation is expensive and requires hard-sought investment and deliberate planning. These investments of time, talent, and financial resources only take place when incentivized by the potential returns that IP protection provides.

II. WHERE INNOVATION HAPPENS

Innovation happens most frequently in places with strong protection of intellectual property rights. Recent studies demonstrate the link between international competitiveness and the extent of intellectual property protection.[41] Economies with weak IP protection are less innovative and correspondingly less competitive in the global economy.[42] The United States exemplifies this trend. Recent data indicates that U.S.-IP is worth upwards of $6 trillion, accounting for more than the nominal Gross Domestic Product ("GDP") of any other nation, and that IP-intensive industries generate more than two-thirds of U.S. GDP and close to three-quarters of all U.S. exports.[43]

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37 *Id.*

38 *Id.* at 13.

39 *DNDi Chagas R&D Collaboration*, INT'L FED. PHARM. MFGS. ASSOC. (last visited Aug. 3, 2017), http://partnerships.ifpma.org/partnership/dndi-chagas-r-d-collaboration.

40 *See* Jacque Wilson, *Viagra: The Little Blue Pill that Could*, CNN (Mar. 27, 2013), http://www.cnn.com/2013/03/27/health/viagra-anniversary-timeline/.

41 *See, e.g.*, JAMES A. LEWIS, INTELLECTUAL PROPERTY PROTECTION: PROMOTING INNOVATION IN A GLOBAL INFORMATION ECONOMY 38 (2008); AUGUSTO LOPEZ-CLAROS ET AL., THE GLOBAL COMPETITIVENESS REPORT 2005-2006 21–22 (2005); EDWIN MANSFIELD, INTELLECTUAL PROPERTY PROTECTION, FOREIGN DIRECT INVESTMENT, AND TECHNOLOGY TRANSFER 20–21 (1994).

42 LEWIS, *supra* note 41, at 4–5.

43 *Why is IP Important?*, GLOB. INTELLECTUAL PROP. CTR. (last visited Mar. 24, 2017), http://www.theglobalipcenter.com/resources/why-is-ip-important/.

Innovation is a notoriously difficult process, one that is impacted by a host of factors. While strong intellectual property rights alone are insufficient to produce innovation, there is a clear correlation between strong IP protection and innovative economies. The explanation for this correlation is more difficult to pin down. A nation's intellectual property architecture is but one piece of the rules, laws, and norms that contribute to an economy's productivity.[44]

The Global Intellectual Property Center ("GIPC") recently began an annual evaluation of the strength of intellectual property protection by country.[45] Evaluating IP protection across thirty indicators, the GIPC index evaluates the intellectual property environments of thirty nations. These countries comprise close to 80 percent of the global economy as measured by GDP.[46] The GIPC's ranking of overall IP scores is shown in Figure 1 below.

Overall IP Scores by Country

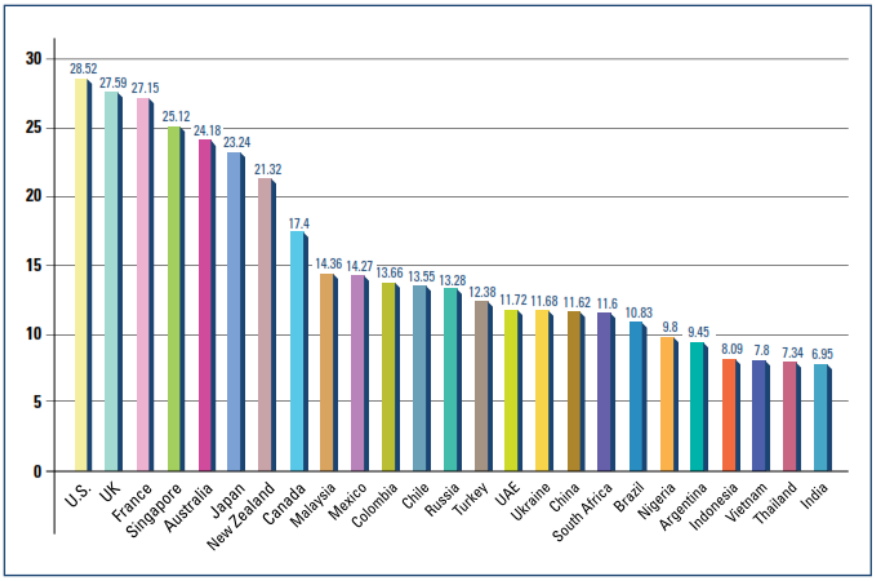

Figure 1[47]

The information in Figure 1 is most useful when placed in perspective with innovative activity. According to Bloomberg, the ten most innovative

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44 *See* LEWIS, *supra* note 41, at 31.

45 MEIR PUGATCH, ET AL., CHARTING THE COURSE: GLOB. INTEL. PROP. CTR. INTERNATIONAL IP INDEX 7 (2d ed. 2014) [hereinafter GIPC INT'L IP INDEX 2014].

46 MEIR PUGATCH, ET AL., CHARTING THE COURSE: GLOB. IINTEL. PROP. CTR. INTERNATIONAL IP INDEX 4 (3d ed. 2015) [hereinafter GIPC INT'L IP INDEX 2015].

47 GIPC INT'L IP INDEX 2014, *supra* note 45, at 28.

nations (in rank order) are: South Korea, Germany, Sweden, Japan, Switzerland, Singapore, Finland, the United States, Denmark, and France.[48] Table 3, below, combines the information from the GIPC on IP protection with information on innovation from Bloomberg.

IP Protection and Innovation

	GIPC	Innovation Rank		GIPC	Innovation Rank
U.S.	95.37	8	South Korea	77.73	1
UK	91.77	17	Germany	91.20	2
Germany	91.20	2	Sweden	90.40	3
France	90.73	10	Japan	77.73	4
Sweden	90.40	3	Switzerland	83.00	5
Singapore	85.43	6	Singapore	85.43	6
Switzerland	83.00	5	U.S.	95.37	8
Australia	82.63	20	France	90.73	10
Japan	77.73	4	Israel	66.87	11
South Korea	77.73	n/a	Russia	43.53	12
Italy	75.63	26	UK	91.77	17
New Zealand	71.27	22	Canada	60.57	19
Israel	66.87	11	Australia	82.63	20
Poland	62.50	23	China	42.13	21
Canada	60.57	19	New Zealand	71.27	22
Malaysia	49.27	25	Poland	62.50	23
Mexico	46.10	n/a	Malaysia	49.27	25
Colombia	45.90	n/a	Italy	75.63	26
Russia	43.53	12	Turkey	39.57	36
Chile	43.50	n/a	Ukraine	38.50	41
China	42.13	21	India	23.50	45
UAE	41.43	n/a	Thailand	24.67	47
Peru	41.00	n/a	Argentina	29.70	49
Turkey	39.57	36	South Africa	39.13	n/a
South Africa	39.13	1	Algeria	28.47	n/a
Ukraine	38.50	41	Brazil	34.70	n/a
Brazil	34.70	n/a	Chile	43.50	n/a
Nigeria	31.40	n/a	Colombia	45.90	n/a
Argentina	29.70	49	Ecuador	28.73	n/a
Ecuador	28.73	n/a	Indonesia	28.63	n/a
Indonesia	28.63	n/a	Mexico	46.10	n/a

48 Michelle Jamrisko & Wei Lu, *These Are the World's Most Innovative Economies*, BLOOMBERG (Jan. 19, 2016), https://www.bloomberg.com/news/articles/2016-01-19/these-are-the-world-s-most-innovative-economies.

	GIPC	Innovation Rank		GIPC	Innovation Rank
Algeria	28.47	n/a	Nigeria	31.40	n/a
Vietnam	26.10	n/a	Peru	41.00	n/a
Thailand	24.67	47	UAE	41.43	n/a
India	23.50	45	Venezuela	21.40	n/a
Venezuela	21.40	n/a	Vietnam	26.10	n/a

Table 3[49]

Table 3 reveals a clear correlation between the proliferation of innovation and the protection of intellectual property rights. The correlation between the two series is 0.73, establishing an undeniable relationship between IP protection and incentivizing innovation.

III. VENTURE CAPITAL INVESTMENTS

Intellectual property rights, especially patents, not only safeguard a firm's innovation. They also foster venture capital ("VC") financing. In a 2009 study investigating how patent applications and grants held by new firms impact their ability to attract VC financing, the authors found that investors rely on patents as signals to overcome the tremendous uncertainty involved in assessing the prospects of potential portfolio companies.[50]

The study found that in the presence of patent applications, VC financing occurs earlier. Confirming the findings of earlier work, this study further establishes that for startup firms the patenting process generates valuable quality signals that assist them in obtaining funding.[51] Patents are believed to reduce information asymmetries between financiers and innovators, thus spurring market entry by startups.[52] Fundamentally, patents facilitate access to VC financing, market entry, and job creation. Without patents and an effective IP environment, the process stalls, and, in some cases, firms may never emerge.

Admittedly it is difficult to find evidence of what might have been. However, there are some striking examples of firms unable to secure a patent that lost their VC funding and disappeared. Case in point: Innate Immune. Stanford immunologist Sam Strober developed a new treatment for Lupus

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49 MEIR PUGATCH, ET AL.,INFINITE POSSIBILITIES: U.S. CHAMBER INTERNATIONAL IP INDEX 24 (4th ed. 2016); Jamrisko & Lu, *supra* note 48.

50 Caroline Haeussler, et al., *To Be Financed or Not: The Role of Patents for Venture Capital Financing* 5 (Ctr. for Eur. Econ. Res., Discussion Paper 09-003, 2009).

51 *See* Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995*, 32 RAND J. ECON. 101, 120 (2001).

52 Haeussler, et al. *supra* note 50, at 23.

and founded the startup Innate Immune.[53] After recruiting Dr. Andrew Pearlman as CEO, the former director of clinical research at Genentech, Innate Immune lined up venture capitalists ready to commit $30 million to develop the drug.[54] Unfortunately, the firm was unable to secure a patent due to the slow pace of approvals at the underfunded and overburdened U.S. Patent Office.[55] The venture capitalists withdrew their funding, and the firm, the drug, and the jobs never materialized.[56] The 2008 Berkeley Patent Survey of Entrepreneurs found that 76 percent of venture-backed entrepreneurs and 67 percent of all entrepreneurs believe that patents are absolutely essential to obtaining funding.[57]

IV. JOB CREATION

Beyond the benefits discussed above, innovation creates sustained economic growth, which, in turn, creates jobs. Accordingly, any commitment to job creation must start with a commitment to effective IP rights. Consider the counterfactual. International evidence demonstrates that insufficient IP protection harms jobs. According to a 2014 study by Robert J. Shapiro and Aparna Mathur, if India improved intellectual property protection to match that of China, annual foreign direct investment inflows would increase by 33 percent annually.[58] The study goes on to claim that in the pharmaceutical industry alone, the increased investment would generate 18,000 new jobs.[59] Further, if India achieved levels of intellectual property protection equivalent to the United States, the benefits would be greater still, increasing foreign direct investment by as much as 83 percent annually by 2020.[60] Again, in the pharmaceutical industry alone, this would result in the creation of 44,000 new jobs.[61]

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53 Henry R. Nothhaft, *Start-Up Reality: No Patent= No Funding, No Business, No Jobs*, IP WATCHDOG (Jan. 27, 2011), http://www.ipwatchdog.com/2011/01/27/start-up-reality-no-patent-no-funding-no-business-no-jobs/id=14659/.

54 *Id.*

55 *Id.*

56 *Id.*

57 Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1304, 1307 (2009).

58 Robert J. Shapiro & Aparna Mathur, *How India Can Attract More Foreign Direct Investment, Create Jobs, and Increase GDP: The Benefits of Respecting the Intellectual Property Rights of Foreign Pharmaceutical Producers,* at 3,(2014) available at http://ssrn.com/abstract=2540591.

59 *Id.* at 4.

60 *Id.* at 3.

61 *Id.* at 4.

Conventional wisdom holds that small businesses create most jobs in the United States.[62] It is a widespread popular perception, but perhaps an inaccurate one. According to a 2013 study, startups are the lifeblood of job creation.[63] While the study found some evidence in support of the belief that small businesses create most jobs, the authors' most striking finding was that although startup firms account for a mere 3 percent of U.S. employment, they are responsible for almost 20 percent of gross job creation.[64] Moreover, the authors hypothesize that "the volatility and apparent experimentation of young businesses . . . [is] critical for the development of new products and processes that are in turn used by (and perhaps acquired by) the large and mature businesses that account for most economic activity" in the United States.[65]

Job creation must also be examined through the lens of "what kind of jobs?" While all job creation is valuable to continued economic growth and development, high-skilled, well-paying jobs are the most impactful for sustained economic progress.[66] Evidence suggests that IP-intensive industries are critical to economic growth and vital to national well-being and global competitiveness.[67]

Nam D. Pham analyzed the role of innovation and the impact of intellectual property rights on U.S. productivity, competitiveness, jobs, wages, and exports.[68] His results clearly point to the importance of IP-intensive industries to economic prosperity. As described in Pham's study, IP-intensive industries sustain greater long-term economic growth, generate trade surpluses, and pay both highly skilled and low-skilled employees at higher rates than non-IP-intensive industries.[69] This should not be news to anyone. More than fifty years ago, Nobel laureate Robert Solow's analysis[70] demonstrated that more than 80 percent of the growth in U.S. output per worker historically came from technological innovation.[71] Previously, economists believed that capital and labor were the primary drivers of economic growth. Solow's

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62 *See* John Haltiwanger et. al., *Who Creates Jobs? Small Versus Large Versus Young*, 95 REV. ECON. & STAT. 347, 347 (2013).

63 *See id.* at 348.

64 *Id.* at 360.

65 *Id.* at 361.

66 *See* NAM D. PHAM, THE IMPACT OF INNOVATION AND THE ROLE OF INTELLECTUAL PROPERTY RIGHTS ON U.S. PRODUCTIVITY, COMPETITIVENESS, JOBS, WAGES AND EXPORTS 32 (2010).

67 *Id.* at 52.

68 *Id.* at 52–53.

69 *Id.*

70 Robert M. Solow, *Technical Change and the Aggregate Production Function*, 39 REV. OF ECON. & STAT. 312 (1957).

71 *Id.* at 320.

sources-of-growth accounting continues to be used to estimate the separate effects of labor, capital, and technological progress on economic growth.[72]

Admittedly, it is important to acknowledge the process of "creative destruction," as Joseph Schumpeter described it:

> The opening up of new markets, foreign or domestic, and the organizational development from the craft shop and factory to such concerns as U.S. Steel illustrate the same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism.[73]

While some jobs are lost, innovation creates new industries. One of the best examples is the mechanization of U.S. agricultural production. Jobs were lost when agriculture became mechanized, but the industrial revolution created far more, and expanded the set of available opportunities to absorb the workers who were displaced.[74] The share of Americans directly employed in agriculture has shifted from 70–80 percent of the population in 1870 to less than two percent of the population in 2008.[75]

Job creation is both direct and indirect. Including both direct and indirect job creation, the number of IP-related jobs is tremendous. Figure 2, below, maps the distribution of IP jobs by state, across the United States, as calculated by GIPC.

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72 *See* Gary D. Hansen & Edward C. Prescott, *Malthus to Solow*, 92 AM. ECON. REV. 1205, 1213 (2002).

73 JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY 83 (3rd ed. 2008) (footnote omitted).

74 John Majewski, *The Industrial Revolution: Working Class Poverty or Prosperity?*, FOUND. ECON. EDUC. (July 1, 1986), https://fee.org/articles/the-industrial-revolution-working-class-poverty-or-prosperity/.

75 Louis D. Johnston, *History Lessons: Understanding the Decline in Manufacturing*, MINNPOST (Feb. 22, 2012), https://www.minnpost.com/macro-micro-minnesota/2012/02/history-lessons-understanding-decline-manufacturing.

Map of IP Jobs by State

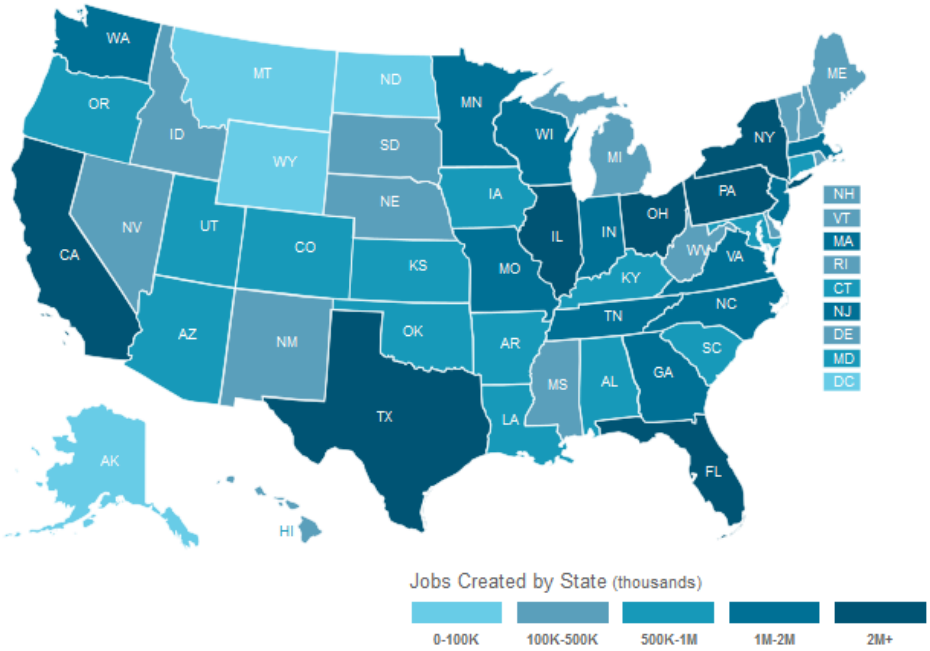

Figure 2[76]

Strong, effective intellectual property rights foster innovation. Innovation creates sustained economic growth. Economic growth creates jobs. Without adequate IP protection, innovators are unable to attract investments, business creation is slowed, and jobs are lost. Evidence suggests that this same story plays out, albeit with differing dynamics, across all sorts of firms, all industries, and all nations. Economic prosperity relies on job growth, and it is clear that strong, effective IP rights have a role to play in creating both.

CONCLUSION

In the long term, economic evidence conclusively finds that patents are strongly correlated with increased innovation, knowledge diffusion, and economic development and growth. As described by B. Zorina Khan,

> The empirical evidence on the early patent system in the United States suggests that patents and their effective legal enforcement played a substantial role in influencing the rate and direction of inventive activity in a country that would become the

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76 U.S. Chamber of Commerce, *Employing Innovation Across America*, GLOB. INTEL. PROP. CTR. (Nov., 2012), http://www.theglobalipcenter.com/ip-employs-innovation/.

> world's leading industrial nation. Patent institutions were not perfect, but as Demsetz points out, their imperfections did not necessarily imply the superiority of any other system.[77]

Patents have long played a key role in incentivizing the investments of time, talent, and financial resources required for innovative activity. Their importance is clearly reflected in the academic literature and the abundant number of studies that document their impact.

Our nation's Founding Fathers believed these fundamental property rights to be so important that they were enshrined in the Constitution, Article 1, Section 8.[78] The Founders understood the role that IP rights play in fostering innovation, inspiring creative endeavors, and nurturing entrepreneurship.[79] IP rights today are as important as they were in the time of our Founding, if not more so. They continue to propel innovation, investment, and job creation. They are at the heart of our most vital industries and provide the primary incentive for economic growth and prosperity.

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77 B. Zorina Khan, *Inventing Prizes: A Historical Perspective on Innovation Awards and Technology Policy*, 89 BUS. HIST. REV. 656, 659 (2015) (footnote omitted).

78 U.S. CONST. art I, § 8, cl. 8.

79 *See* James Rogan, *Reaffirming Intellectual Property in an Information Age*, HERITAGE FOUNDATION (Nov. 5, 2002), http://www.heritage.org/technology/report/reaffirming-intellectual-property-information-age.