

THE CASE AGAINST TAX SUBSIDIES IN INNOVATION POLICY

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ABSTRACT

Until recently, intellectual property (IP) scholars agreed that patents were the prime innovation tool to aggregate decentralized information. This case for the property approach, which argues patents are appropriate when information about possible inventions and the social value of inventions are hidden, is now also under pressure in the literature. IP scholars argue that tax subsidies for firms that invest in research and development (R&D) replicate many of the merits of the patent system under conditions of asymmetric information.

Based on developments in institutional economics, this Article shows that tax subsidies are not market-set incentives and are not optimal tools for aggregating decentralized information. Tax subsidies target specific investments ex ante in relation to the market process when there is little information on the costs of specific projects or their social value. Governments lack the knowledge required to decide which projects to support and to calibrate the subsidies according to their social value. Comparatively, a patent system is better equipped for the decentralized nature of information. Moreover, it relies on entrepreneurs and inventors to decide which new projects to pursue and on consumers within the marketplace to evaluate the value of these innovations. Based on public choice theory, the Article also argues tax subsidies for innovation are particularly vulnerable to rent-seeking, leading tax dollars to be captured by the politically powerful—not by disruptive newcomers. From an institutional perspective, a more sensible innovation policy lies in simplifying, stabilizing, and generalizing the rules of property and contract that set the market process in motion.

This is therefore the first article, amid growing scholarly consensus concerning subsidies as the new innovation tool, to present both a full-blown critique and a radical alternative. In contrast to contemporary innovation scholarship, which is often animated by presumptions of

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perfect information and benevolent policymakers, this Article demonstrates the superiority of the property approach under imperfect conditions.

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INTRODUCTION

“[I]nnovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.”¹ It is a phenomenon whereby products, services, means of production, marketing strategies, delivery methods, and business structures do not take fixed

1. OSLO MANUAL: GUIDELINES FOR COLLECTING AND INTERPRETING INNOVATION DATA 46 (3rd ed. 2005); see also David A. Harper, *Innovation and Institutions from the Bottom Up: An Introduction*, 14 J. INSTITUTIONAL ECON. 975, 976 (2018) (“In general terms, innovation is the economic actualization of a new idea, such as a new good or service, a new production method, a new routine, a new rule system (i.e. institution), a new market or a new network.”).

forms but rather are subject to change, either incremental or radical.² This Article concerns innovation policy and what governments ought to do to secure the process by which companies inject novelty into the market. This Article opposes the growing support for stimulating innovation through tax subsidies. It argues that the proposal to subsidize specific activities *ex ante* (that is, at the time of investment) is subject to overwhelming information problems and significant rent-seeking issues.

Until recently, one was right to argue that “discussion of R&D tax incentives is largely left to tax law academics, practitioners and nonlawyers,”³ or, to paraphrase Robert Merges, “[t]axation is of course external to IP law.”⁴ For most of the twentieth century, legal scholars saw patents as “our primary policy tool to promote innovation,” but recently we have witnessed a growing opposition to the property approach.⁵ Continuous attacks on applying property rights to inventions, for instance through the work of Rochelle Dreyfuss, Steven Shavell, Tanguy van Ypersele, Petra Moser, Michael Kremer, and Tom Nicholas, have created scholarly enthusiasm for government-directed innovation.⁶ In consequence, prizes—payments funded with general revenues and made to researchers on the condition that they deliver a

2. See Paul Lewis, *The Innovation Systems Approach*, 34 REV. AUSTRIAN ECON. 97, 98-102 (2021), <https://link.springer.com/article/10.1007/s11138-020-00507-8> [<https://perma.cc/S2BZ-5JUL>].

3. Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEXAS L. REV. 303, 306 (2013).

4. ROBERT P. MERGES, JUSTIFYING INTELLECTUAL PROPERTY 132 (2011); see also the landmark article by Dan Burk and Mark Lemley that gives an overview of all policy levers yet omits tax subsidies, Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575 (2003).

5. Burk & Lemley, *supra* note 4, at 1576 (“Patent law is our primary policy tool to promote innovation.”). On the dominance of IP for innovation, see generally Nancy Gallini & Suzanne Scotchmer, *Intellectual Property: When Is It the Best Incentive System?*, in 2 INNOVATION POL’Y & ECON. 51 (Adam B. Jaffe, Josh Lerner & Scott Stern eds. 2002); Brian D. Wright, *The Economics of Invention Incentives: Patents, Prizes, and Research Contracts*, 73 AM. ECON. REV. 691 (1983).

6. Various innovation scholars have abandoned patents as the prime innovation instrument and sometimes as a tool that should be used at all. See Rochelle Cooper Dreyfuss, *Does IP Need IP? Accommodating Intellectual Production Outside the Intellectual Property Paradigm*, 31 CARDOZO L. REV. 1437, 1447-60 (2010) (exploring the possibility of intellectual production without IP rights); Michael Kremer, *Patent Buyouts: A Mechanism for Encouraging Innovation*, 113 Q.J. ECON. 1137, 1146-48 (1998) (describing how governments can move away from the patent system by purchasing patent rights from a patent holder and then placing the patent in the public domain); Petra Moser, *How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World’s Fairs*, 95 AM. ECON. REV. 1214, 1233 (2005) (arguing against introducing patent laws into developing countries as doing so will slow economic growth); Petra Moser & Tom Nicholas, *Prizes, Publicity and Patents: Non-Monetary Awards as a Mechanism to Encourage Innovation*, 61 J. INDUS. ECON. 763, 767 (2013) (arguing that financial rewards may not be necessary at all, as publicity for inventors is an incentive in itself); Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525, 534-39 (2001) (arguing that the property approach should be replaced by an optional system in which investors can choose a reward system and the government selects and appropriately calibrates the reward).

specified invention—have been gaining scholarly support.⁷ The (once very strong) scholarly support for patents now persists only in circumstances in which information costs are high and the government cannot foresee all potential inventions or evaluate their costs and benefits.⁸

This reduced and minimal support for the property approach recently came under even more pressure. The primary belief driving this further erosion of support for the property approach is that “tax expenditures can replicate many of the merits of a patent system under conditions of asymmetric information.”⁹ Animated by an influential article by Daniel Hemel and Lisa Larrimore Ouellette, innovation scholars now celebrate tax expenditures as “market-set” tools for innovation.¹⁰ Under a policy of tax subsidies, the government decreases the costs of innovation at the time of investment, after which decentralized knowledge will be aggregated, as goods will be sold in a competitive market based on consumer demand.¹¹ Hence, according to

7. Michael Abramowicz, *Perfecting Patent Prizes*, 115 VAND. L. REV. 115, 211-34 (2003); Shavell & van Ypersele, *supra* note 6; Joseph E. Stiglitz, *Economic Foundations of Intellectual Property Rights*, 57 DUKE L.J. 1693, 1719-21 (2008); Benjamin N. Roin, *Intellectual Property Versus Prizes: Reframing the Debate*, 81 U. CHI. L. REV. 999, 1025-27 (2014).

8. Gallini & Scotchmer, *supra* note 5, at 70; Richard A. Posner, *Intellectual Property: The Law and Economics Approach*, 19 J. ECON. PERSP. 57, 58-59 (2005).

9. Hemel & Ouellette, *supra* note 3, at 328.

10. *Id.* at 347, 348. Only five years after its publication, this article has been cited in 121 other articles. As a result, an increasing number of IP scholars are embracing tax subsidies as the new innovation tool. For specific influences, see Sarah Burstein, *Moving Beyond the Standard Criticism of Design Patents*, 37 STAN. TECH. L. REV. 305, 338-39 (2013) (raising tax credits as an alternative way to recognize designers); Lisa Larrimore Ouellette, *Patent Experimentalism*, 101 VA. L. REV. 65, 127-28 (2015) (expressing doubts about whether patents should be protected at all, and discussing the efficiency of tax subsidies in cases where governments have the knowledge); Roin, *supra* note 7, at 1065-66 (arguing that innovation tools can be replaced by a tax and subsidy transfer scheme); Ted Sichelman, *Patents, Prizes and Property*, 30 HARV. J.L. & TECH. 279, 285-90 (2017) (welcoming the tax system as a complement to but not a replacement of the patent system). See generally Mark A. Lemley, Lisa Larrimore Ouellette & Rachel E. Sachs, *The Medicare Innovation Subsidy*, 95 N.Y.U. L. REV. 75 (2020) (underscoring that subsidies are one of the most important innovation tools, and exploring their expansion in the domain of health care). See also Zachary Liscow & Quentin Karpilow, *Innovation Snowballing and Climate Law*, 95 WASH. U.L. REV. 387, 436-40 (2017) (arguing for tax subsidies as an innovation tool superior to patents when it comes to new technologies to alleviate the effects of climate change).

11. Tax subsidies are also popular amongst tax scholars. See Robert D. Atkinson, *Expanding the R&E Tax Credit to Drive Innovation, Competitiveness and Prosperity*, 32 J. TECH. TRANSFER 617, 623-26 (2007) (arguing in favor of doubling the current value of the credit); Calvin Johnson, *Capitalize Costs of Software Development*, 124 TAX NOTES 603, 609-12 (2009) (proposing to capitalize the costs of development of computer software under section 263A of the code instead of rendering them eligible for the research credit); Shaun Mahaffy, *The Case for Tax: A Comparative Approach to Innovation Policy*, 123 YALE L.J. 530, 859-60 (2013) (arguing in favor more narrowly targeting tax incentives to those domains where tax is most effective); William Natbony, *Tax Incentives for Research and Development: An Analysis and a Proposal*, 76 GEO. L.J. 347, 407-416 (1987) (making a case for broader and simpler tax incentives); Jennifer L. Venghaus, *Tax Incentives: A Means of Encouraging Research and Development for Homeland Security*, 37 U. RICH. L. REV., 1213, 1230-33 (2003) (discussing legal reform tax incentives to stimulate research and development for homeland security); Evan Wamsley, *The Definition of Qualified Research Under the*

this viewpoint, “the ‘special advantage’ and ‘obvious virtue’ of patents can be reproduced through the use of R&D credits.”¹² In the wake of the patents-versus-prizes debate, the dominant view is now that tax and nontax incentives should be “mixed and matched” and that tax subsidies can replace property rights in cases of asymmetric information.¹³

This Article joins the debate on instrument choice in innovation policy, with a focus on tax subsidies. While sympathetic to the general endeavor to create a legal framework oriented toward innovation, the legal literature is flawed with respect to innovation and tax subsidies. Economic policies are a function of the economic model employed and the assumptions underlying them. Innovation scholarship is mainly fueled by standard economics and equilibrium analysis.¹⁴ On this basis, recent contributions assume that tax subsidies replicate the knowledge-generating character of property rights while avoiding

Section 41 Research and Development Tax Credit: Its Impact on the Credit's Effectiveness, 87 VA. L. REV. 165, 190-95 (2001) (discussing how to improve the effectiveness of the credit by targeting the definition of qualified research).

12. Hemel & Ouellette, *supra* note 3, at 328. This approach has generated support within legal scholarship. See, e.g., Ted Sichelman, *Decoupling Intellectual Property's Incentive and Allocation Functions*, JOTWELL (Sept. 3, 2018), <https://ip.jotwell.com/decoupling-intellectual-property-s-incentive-and-allocation-functions/> [<https://perma.cc/5VYT-9NY7>] (“Besides explaining the importance of considering the full panoply of tools to incentivize innovation—such as patents, prizes, grants, and tax credits—Hemel and Ouellette showed that these tools could be decoupled and refashioned to create effectively new, mutant-like rights with potentially superior effects than their ‘pure’ form.”). In earlier work, Hemel and Ouellette established a three-part framework for characterizing innovation subsidies: who decides the size of the reward, when the reward will be provided, and who pays for the reward. See generally Hemel & Ouellette, *supra* note 3, at 303-82 (This piece contains a nuanced defense of tax incentives; although the authors prefer a mix, they point to their advantages when compared to patents.).

13. In their insightful follow-up 2019 article, Hemel and Ouellette argue that various instruments can actually be mixed and matched. They introduce the distinction between an “incentive” function—the payoff structure required to make innovators produce an innovation—and an “allocation” function—the terms under which individuals and firms can have access to the knowledge goods and thus the distribution of costs over users (and non-users) in an economy. Since each innovation tool serves not one but *both* of these goals, a more sophisticated policy can engage in a mixing and matching of IP and non-IP tools to optimize the outcome with respect to both functions. When it comes to the optimal mixing and matching of all tools, the best innovation policy needs to be calibrated on a case-by-case basis, taking into account the specific economic context wherein research and development take place and the nature of the goods and services. See generally Daniel J. Hemel & Lisa Larrimore Ouellette, *Innovation Policy Pluralism*, 128 YALE L.J. 544 (2019).

14. Governmental support for R&D is an application of market failure theory. Knowledge from research and development creates positive spillover effects, and private returns from R&D investment will be less than public benefits. 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, 618 (U.-Nat'l Bureau Comm. for Econ. Research, Comm. on Econ. Growth of the Soc. Sci. Research Council ed., 1962), <https://www.nber.org/chapters/c2144.pdf> [<https://perma.cc/K222-Q35P>] (“Thus basic research, the output of which is only used as an informational input into other inventive activities, is especially unlikely to be rewarded.”); Richard R. Nelson, *The Simple Economics of Basic Scientific Research*, 67 J. POL. ECON. 297, 304-06 (1959); see also Gallini & Scotchmer, *supra* note 5 at 53; Venghaus, *supra* note 11, at 1240-41. See generally WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW (2003).

some of its problems.¹⁵ However, recent tax scholarship has highlighted the information problems that arise when governments execute these models,¹⁶ and other sources reveal that the main recipients of R&D subsidies are large companies.¹⁷ The empirical literature reports that evidence of the effectiveness of tax subsidies is altogether lacking.¹⁸

15. Hemel & Ouellette, *supra* note 3, at 328.

16. Jordan M. Barry, *Taxation and Innovation: The Sharing Economy as a Case Study* 7 (U. San Diego Sch. L. Legal Stud. Res. Paper Series., Res. Paper No. 18-319, 2018), <http://ssrn.com/abstract=3091380> [<https://perma.cc/25UH-6WKH>] (“Taxpayers’ ingenuity, and the government’s knowledge that it cannot predict how that ingenuity will manifest itself, favors caution when crafting special dispensations and tax benefits.”); David M Schizer, *Limiting Tax Expenditures*, 68 TAX L. REV. 275, 293-94 (2015) (“The government is not well positioned to determine which technologies are most promising. Instead, the R&D credit uses expansive criteria, such as requiring projects to be ‘technological in nature,’ and ‘useful in the development of a new or improved business component.’”); Stephen E. Shay, J. Clifton Fleming, Jr. & Robert J. Peroni, *R&D Tax Incentives: Growth Panacea or Budget Trojan Horse?*, 69 TAX L. REV. 419, 423 (2016) (“This assumption highlights an initial problem: It is difficult to identify research for innovative knowledge that would not be undertaken by companies without the marginal tax incentive.”). See generally Noam Noked, *Designing R&D Incentives in Hong Kong*, 14 U. PA. ASIAN L. REV. 41 (2019).

17. In 2012, approximately 84% of corporate R&D credit amounts were claimed by corporations with receipts over \$250 million. See *SOI Tax Stats—Corporation Research Credit, Fig. C: Totals of Research Credit Amounts, by Size of Business Receipts for Tax Years 1990–2013*, IRS, <https://www.irs.gov/uac/SOI-Tax-Stats-Corporation-Research-Credit> [<https://perma.cc/R267-RDXV>] (last updated Nov. 29, 2019) [hereinafter *SOI Tax Stats*]; see also Eurry Kim, *The Credit for Increasing Research Activities: Statistics from Tax Years 2004–2005*, 28 STAT. INCOME BULL. 182, 183 (2008) (stating that 80% of R&D credits were distributed to corporations with over \$250 million of business receipts in 2001–2005). Various legal scholars report that tax incentives do not benefit start-up companies. See Susan C. Morse & Eric J. Allen, *Innovation and Taxation at Start-up Firms*, 69 TAX L. REV. 357, 357-58 (2016); see also Barry, *supra* note 16, at 11-12; Hemel & Ouellette, *supra* note 4, at 337.

18. See ORG. FOR ECON. CO-OPERATION AND DEV. (OECD), *THE SOURCES OF ECONOMIC GROWTH IN OECD COUNTRIES* 64, 84 (2003), https://www.oecd-ilibrary.org/economics/the-sources-of-economic-growth-in-oecd-countries_9789264199460-en [<https://perma.cc/6H6K-J5VW>] (stating that government funding of R&D had no or even negative impact on economic growth); Paul A. David, Bronwyn H. Hall & Andrew A. Toole, *Is Public R&D a Complement or Substitute for Private R&D? A Review of the Econometric Evidence*, 29 RES. POL’Y 497, 502 (2000) (stating that tax incentives lead to replacing R&D and to altering its composition in such a way that firms will favor projects that will generate profits in the short run); Terence Kealey & Omar Al-Ubaydli, *A Critique of Science and R&D-Based Models of Endogenous Growth*, 13 KNOWLEDGE, TECH. & POL’Y 37, 41-43 (2001) (observing that the United Kingdom and United States witnessed an explosion of innovation, not in the era of government-sponsored R&D, but before that during the nineteenth and early twentieth centuries); Shay, Fleming Jr. & Peroni, *supra* note 16, at 424; Daniel J. Wilson, *Beggar Thy Neighbor? The In-State, Out-of-State, and Aggregate Effects of R&D Tax Credits*, 91 REV. ECON. & STAT. 431, 436 (2009) (stating that R&D tax incentives motivate companies to shift the location of R&D activities rather than to innovate); Antoine Dechezleprêtre et al., *Do Tax Incentives for Research Increase Firm Innovation? An RD Design for R&D* (Nat’l Bureau of Econ. Research, Working Paper No. 22405, 2016) (stating that private R&D has a substantial and significant effect on productivity growth but public R&D appears to have a much weaker if not insignificant direct effect), <http://www.nber.org/papers/w22405.pdf> [<https://perma.cc/6WVM-4772>]; Christian Köhler, Philippe Laredo & Christian Rammer, *The Impact and Effectiveness of Fiscal Incentives for R&D* (Nat’l Endowment for Sci., Tech. & the Arts, Working Paper No. 12/01, 2012) (stating that while many studies can measure the effect of tax expenditures on R&D inputs when it comes to the effects on innovation output and growth more generally, very little can be said with certainty),

This Article employs enhanced economic models to understand the failures that occur when governments steer innovation via specific fiscal interventions. It uses institutional economics to model the *knowledge problem* that hinders the operationalization of subsidies for innovation. The Article uses public choice theory to underline the problems of *rent-seeking* that undermine the feasibility of stimulating innovation through the tax code. Along with critically assessing the operationalization of subsidies for innovation, it proposes an alternative innovation policy. Given the challenges of imperfect information and rent-seeking, secure and stable (intellectual) property rights are a comparatively better innovation policy.

The perspective of this Article on tax subsidies, and innovation policy more broadly, is new, inasmuch as most contributions in the field are animated by assumptions of full information and benevolent governments. Since subsidies are widely discussed in tax scholarship, this paper also contributes to the fiscal literature.

First, the Article replaces equilibrium-based models with insights from institutional economics. Innovation is part of a discovery process whereby profit-seeking entrepreneurs compete for consumers by modifying products in a world with imperfect knowledge. After presenting a realistic picture of entrepreneurial behavior and the market process, the Article evaluates tax subsidies for innovation in terms of the informational challenges that this policy faces. It argues that legislative authorities do not have the economic knowledge necessary to decide which projects should receive subsidies, or the amount of support that should be transferred. As their operationalization is grounded in a questionable conception of economic information, tax benefits will often *not* be directed toward genuine innovators. Using a more realistic model, the Article contends that innovation can be promoted by securing the *underlying institutions* that set the market process in motion. It identifies property rights, which follow the precepts of generality, stability, and simplicity, as a more feasible innovation policy alternative.

In a second treatment, the Article uses public choice economics to enrich the recent debate on tax subsidies. Rules that leave much room for political discretion will, under specific conditions, be captured by industries and voters and shaped according to their interests. Given the self-interested pressures from various agents surrounding the lawmaking process, tax benefits often are *not* directed to actual innovators but rather to large-scale market agents with political influence. While overprotection and patent-trolling in IP policy are real issues, the problems of rent-seeking here are less harmful;

therefore, the property approach deals comparatively better with political opportunism than the subsidy-approach.

This Article proceeds as follows. Part I summarizes the literature in IP and innovation policy, notably the emergent support for tax subsidies. Part II uses enriched models of innovation to illustrate that governments do not possess the requisite *knowledge* to operationalize tax subsidies for innovation. Secure and stable (intellectual) property rights are better instruments for the production and dissemination of knowledge. Part III illustrates the vulnerability of tax subsidies to being captured by opportunistic political strategies. While also imperfect, the property approach deals comparatively better with problems of rent-seeking. Finally, the analysis concludes.

I. THE FISCAL TURN IN IP SCHOLARSHIP

A. *Innovation: The Property Rights Approach*

Innovation scholarship is heavily influenced by the Arrow-Nelson model and its famous prediction of underproduction of novelty: “We expect a free enterprise economy to underinvest in invention and research (as compared with an ideal), because it is risky, because the product can be appropriated only to a limited extent, and because of increasing returns in use.”¹⁹ Rational and risk-averse individuals will not inject novelty into the economy, and without external impetus we are facing an endless and unchanging round of activity.²⁰ So, innovative knowledge, through research and development as the source of innovation, is not something we can expect to emerge

19. Arrow, *supra* note 14, at 619; Nelson, *supra* note 14, at 298 (“But when the marginal value of a ‘good’ to society exceeds the marginal value of the good to the individual who pays for it, the allocation of resources that maximizes private profits will not be optimal. For in these cases private-profit opportunities do not adequately reflect social benefit, and, in the absence of positive public policy, the competitive economy will tend to spend less on that good ‘than it should.’”); *see, e.g.*, Herbert Hovenkamp, *Restraints on Innovation*, 29 CARDOZO L. REV. 247, 253 (stating that “[t]he neoclassical models typically assumed that products were static and competition meant a state of affairs where prices are as close as possible to cost”); Michael J. Graetz & Rachael Doud, *Technological Innovation, International Competition, and the Challenges of International Income Taxation*, 113 COLUM. L. REV. 347, 349 (2013); *see also* LANDES & POSNER, *supra* note 14, at 304.

20. *See* Gallini & Scotchmer, *supra* note 5, at 53 (observing that “[a]n invention such as a wireless palmtop is a combination of tangible embodiments and an intangible idea, as well as information about how to manufacture it. Typically, both the information and the tangible embodiments are costly to the inventor, but only the tangible components are costly to a rival. Without some sort of protection or reward, the inventor will therefore be at a market disadvantage relative to rivals, and may be dissuaded from investing.”). This standard model can generally be found in LÉON WALRAS, *ELEMENTS OF PURE ECONOMICS* (Routledge 2003) (1954); ALFRED MARSHALL, *PRINCIPLES OF ECONOMICS* (1920); Kenneth J. Arrow & Gerard Debreu, *Existence of an Equilibrium for a Competitive Economy*, 22 *ECONOMETRICA* 265 (1954); JOHN R. HICKS, *VALUE AND CAPITAL: AN INQUIRY INTO SOME FUNDAMENTAL PRINCIPLES OF ECONOMIC THEORY* (2nd ed., 2001). The work of Noble Laureate Elinor Ostrom criticized this. *See generally* ELINOR OSTROM, *GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION* (1990).

spontaneously from within a market.²¹ Just as with negative externalities, when it comes to knowledge goods, private returns do not match social benefits.²² Absent any specific intervention, an expected equilibrium will fail to properly value creative knowledge and the development of novelty, and consumers will be stuck with the same products and services.²³ Against the backdrop of this Arrow-Nelson thesis and the predicted underdevelopment of innovation in free markets, law scholarship has been researching the question of what the proper tools to incentivize innovation in the economy are.²⁴

For most of the twentieth century, “innovation scholarship” was “IP”; with legal scholars seeing patents as “our primary policy tool to promote innovation.”²⁵ A patent is an exclusive right to market an invention for a fixed time period.²⁶ The standard argument is that a patent system maximizes the use of private information about which endeavors to pursue and concerning the relative value of new inventions.²⁷ As Hemel and Ouellette admit, under a patent system

21. See Arrow, *supra* note 14, at 619 (“To sum up, we expect a free enterprise economy to underinvest in invention and research (as compared with an *ideal*.)”) (emphasis added). See generally Robert M. Solow, *A Contribution to the Theory of Economic Growth*, 70 Q.J. ECON. 65 (1956); Robert M. Solow, *Technical Change and the Aggregate Production Function*, 39 REV. ECON. & STAT. 312 (1957).

22. Markets will often produce negative externalities, where costs cannot be properly priced as part of the costs of production. Tax scholars, in the tradition of the influential A.C. Pigou, have thus proposed discriminatory rate structures to correct for the externality problem posed within a standard market situation. Carbon taxes are intended to make taxpayers internalize the negative externalities that such emissions exert on society. See generally A.C. PIGOU, *THE ECONOMICS OF WELFARE* (4th ed. 1932); William J. Baumol, *On Taxation and the Control of Externalities*, 62 AM. ECON. REV. 307, 307-08 (1972).

23. The production of innovative knowledge is traditionally conceptualized as a positive externality—a good that produces benefits that cannot be charged directly to consumers. See SUZANNE SCOTCHMER, *INNOVATION AND INCENTIVES* 35 (2004) (“However, the efficient competitive price, zero, will not cover the costs of developing the software and therefore the market will not work.”); see also Arrow, *supra* note 14, at 618 (“Thus basic research, the output of which is only used as an informational input into other inventive activities, is especially unlikely to be rewarded.”)

24. See SCOTCHMER, *supra* note 23, at 259 (“We have taken on faith that incentives will lead to R&D, that R&D will lead to innovations, and that innovations will lead to improvements in consumer welfare or economic growth.”); see also Mark A. Lemley, *Ex Ante Versus Ex Post Justifications for Intellectual Property*, 71 U. CHI. L. REV. 129, 129 (2004) (“The traditional economic justification for intellectual property is well known. Ideas are public goods: they can be copied freely and used by anyone who is aware of them without depriving others of their use.”).

25. Burk & Lemley, *supra* note 4, at 1576.

26. Gallini & Scotchmer, *supra* note 5, at 53.

27. The residual case for patents is that they work well in a world where information is hidden. See *id.* at 54 (“When both the costs and values of innovations are publicly observable to both firms and a public sponsor, IP is not the best incentive scheme.”). See also Wright, *supra* note 5, at 703 (“The special advantage of patents arises only from ex ante researcher information relating to the value of the invention.”); Gallini & Scotchmer, *supra* note 5, at 54-55 (stating that “if the costs and benefits of R&D investments are known only to firms, and not to government sponsors, firms will use their superior knowledge to screen investments.”). Hemel and Ouellette also refer to the power of markets to aggregate initially dispersed information concerning consumer preferences. See Hemel & Ouellette *supra* note 13, at 555 (“Markets, by contrast, aggregate widely dispersed information regarding consumers’ willingness to pay for new knowledge goods.”).

“the government merely sets the ground rules (in terms of patentable subject matter, patent term, etc.), and the reward size is then based on the forces of supply and demand.”²⁸ The government does not have to decide “whether more resources should be directed toward, say, nanotechnology or turbulence research”; under some general conditions of patentability, it is primarily individuals who must take the initiative regarding which projects to pursue.²⁹ Since patents fit well with the decentralized nature of knowledge in a market, Ouellette states that “the government is not omniscient; patents themselves represent a somewhat Hayekian recognition of the distribution of knowledge.”³⁰

B. *The Rise of Government-Instructed Innovation*

For two decades, distrust of the bottom-up game created by profit-seeking entrepreneurs and consumers that assign dollars and cents has been increasing. Markets are not perfect—certainly not when founded by patent rights. Under the patent system, reward size is determined by monopolistic pricing, which tends to cause deadweight loss.³¹ The property approach will also fail when consumers’ willingness to pay does not fully appreciate social value (for example, of low-emission vehicles or smoking-cessation technologies).³² Additionally, in the last two decades, a remarkable number of scholars have simply questioned whether privatizing information is efficient as such. The message of the day leans toward the opposite. Since patents limit accessibility of information, they can stifle competition.³³ Additionally, there is the distributional argument: Under the property approach, the

28. Hemel & Ouellette, *supra* note 3, at 327.

29. *Id.* at 328. The idea that the informational input for innovation is not “readily accessible” but scattered and hidden over society was earlier argued for by Gallini & Scotchmer, *supra* note 5, at 54-55 (“Most importantly, if the costs and benefits of R&D investments are known only to firms, and not to government sponsors, firms will use their superior knowledge to screen investments.”).

30. Ouellette, *supra* note 10, at 127. F.A. Hayek is a Noble Laureate in economics whose work revolved around the decentralized and often tacit nature of knowledge. This Article will employ his thoughts later.

31. Self-interested inventors want to maximize their revenue and charge consumers prices that exceed marginal cost, creating under-consumption. Prizes can ensure that the reward for inventors is closer to the marginal costs, and thus avoid some consumers being pushed out of the market. See Amy Kapczynski, *The Cost of Price: Why and How to Get Beyond Intellectual Property Internalism*, 59 UCLA L. REV. 970, 982-89 (2012); Roin, *supra* note 7, at 1023; Shavell & van Ypersele, *supra* note 7 at 525-26.

32. Roin, *supra* note 7, at 1027-29 (“There have always been flaws in the incentives that result from linking the reward for innovation to consumers’ willingness to pay. Many prize advocates have begun to argue that these flaws run so deep that a prize system would offer superior incentives for innovation.”); see also Hemel & Ouellette, *supra* note 13, at 555-57; Cass R. Sunstein, *Willingness to Pay vs. Welfare*, 1 HARV. L. & POL’Y REV. 303, 305 (2007) (“[P]eople are often willing to pay a great deal for goods whose acquisition does not improve their welfare.”).

33. See Stiglitz, *supra* note 7, at 1720; Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV., 989, 996-98 (1997); see also STEVEN SHAVELL, FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW 161-64 (2004).

costs of innovation are concentrated with end users. Egalitarian considerations make a case for a finance system that spreads costs over all taxpayers.³⁴

Hence, various innovation scholars have abandoned patents as the prime innovation instrument, and sometimes have advocated not using them at all. Seminal work by Shavell and van Ypersele argues that the property approach should be replaced by an optional system whereby investors can choose a reward system in which the government selects and appropriately calibrates the reward.³⁵ Michael Kremer's influential article describes how governments can move away from the patent system by purchasing patent rights from a patent holder and then placing the patent in the public domain.³⁶ After the patent buyout, whereby the government pays a price that equals or exceeds the net present value of future patent rents, the goods become open access in order to avoid monopoly pricing.³⁷ Petra Moser argues against any introduction of patent laws in developing countries on the ground that they will slow economic growth.³⁸ This skepticism of the property-approach was reinforced recently when Moser and Nicholas argued that financial rewards may not be necessary because publicity is an incentive to inventors.³⁹

In the wake of this anti-patent movement in the literature, prizes have been gaining remarkable support.⁴⁰ A prize is a payment funded out of general revenues and made to a researcher on the condition of delivering a specified invention.⁴¹ Scholars assume that prizes enable the government to correct the problems that occur under the property rights approach.⁴² First, prizes could solve the problem of deadweight loss, as government officials can *decrease* the reward size for inventors and ensure that the benefit approximates what is necessary to achieve the desired incentive effect.⁴³ Prizes are also a means for the government to *increase* the reward when consumers' willingness to pay does not fully appreciate the social value of the good or service, and thus to incentivize the development of specific products or services

34. Stiglitz sees patents as a "benefit tax system" under which only those who benefit pay the costs. See Stiglitz, *supra* note 7, at 1713-14.

35. See Shavell & van Ypersele, *supra* note 7, at 525, 534-39.

36. See generally Kremer, *supra* note 6.

37. See Kremer, *supra* note 6, at 1146-48.

38. Moser, *supra* note 6, at 1233.

39. See Moser & Nicholas, *supra* note 6, at 781-84.

40. For an overview of the standard arguments for prizes over patents see Roin, *supra* note 7, at 1023-27. See generally Abramowicz, *supra* note 7 (investigating how to overcome the weaknesses of prizes); Shavell & van Ypersele, *supra* note 6 (arguing that the property approach should be replaced by an optional system whereby investors can choose a reward system in which the government selects and appropriately calibrates the reward).

41. Gallini & Scotchmer, *supra* note 5, at 53.

42. *Id.* at 54-55. When both the costs and values of innovations are publicly observable to both firms and a public sponsor, IP is not the best incentive scheme.

43. Hemel & Ouellette, *supra* note 13, at 556-57; Gallini & Scotchmer, *supra* note 5, at 62; see also Stiglitz, *supra* note 7, at 1719-21.

under-rewarded by the market.⁴⁴ Prizes constitute a reward to inventive entrepreneurs; the privatization of the invention itself is not required. Since the knowledge remains in the public domain, some scholars argue that prizes can boost innovation by other players.⁴⁵

Furthermore, prizes can be funded through cross-subsidization, which means that the costs of innovation are not concentrated on users but diffused to all taxpayers.⁴⁶

However, it is accepted that prizes are vulnerable to information problems because governments can neither reasonably foresee all potential inventions nor evaluate their costs and benefits.⁴⁷ So *in cases* where the nature of future inventions is hard to predict or information about costs and consumer demand is hard to estimate, we must rely on the market to gather widely dispersed information and the case for the property approach therefore prevails.⁴⁸

C. *The Fiscal Turn in IP Scholarship*

This *residual case* for the property approach, which argues for patents when information about the nature of the social value of inventions is hidden, is now also under pressure in the literature. In the wake of the patents-versus-prizes debate, a number of innovation scholars are arguing that tax expenditures can be used in contexts traditionally for the preservation of patents, namely when the information about the value of specific innovations is unknown.⁴⁹ Tax subsidies reward innovators by making favorable tax schemes available to firms that invest in research and development. So, while patents generate the prospect of reward by granting firms property rights that they can use *ex post*, in their exchanges with consumers and competitors, tax subsidies create financial stimuli *ex ante*—by subsidizing research activities at the time of investment.

44. See Roin, *supra* note 7, at 1027-30 (“There have always been flaws in the incentives that result from linking the reward for innovation to consumers’ willingness to pay. Many prize advocates have begun to argue that these flaws run so deep that a prize system would offer superior incentives for innovation.”); see also Hemel & Ouellette, *supra* note 13, at 556-57. See generally Sunstein, *supra* note 32.

45. See Stiglitz, *supra* note 7, at 1720; Lemley, *supra* note 33, at 996-97; SHAVELL, *supra* note 33, at 161-64.

46. Stiglitz regards this as an advantage and sees patents as a “benefit tax” system in which only those who benefit pay the costs. See Stiglitz, *supra* note 7, at 1714.

47. Prizes need to be announced beforehand and need to be calibrated by the magnitude of the contribution. *Id.* at 1719; Hemel & Ouellette, *supra* note 3, at 327. As they say in their later work, “[g]overnment-set rewards entail an informational burden that bureaucrats may be ill equipped to handle, even with mechanisms like peer review and expert panels for consolidating information,” and patents are preferable to prizes when market signals provide superior information about social benefits than the government can easily acquire (such as for pharmaceuticals affecting wealthy populations). Hemel & Ouellette, *supra* note 13, at 555.

48. Gallini & Scotchmer, *supra* note 5, at 54; Hemel & Ouellette, *supra* note 13, at 555.

49. This trend was initiated by Hemel & Ouellette, *supra* note 3, at 327-29.

The main insight that drives this further erosion of the property approach is that “tax expenditures can replicate many of the merits of a patent system under conditions of asymmetric information.”⁵⁰ Driven by Hemel and Ouellette’s influential article, IP scholars now accept tax expenditures as market-set tools for innovation: They make use of the benefits of markets, meaning they rely on entrepreneurs to “decide (1) which inventions are worth pursuing and (2) which R&D projects are most likely to yield the inventions in question.”⁵¹ Furthermore, as tax expenditures “do not refund 100% of R&D costs,” they “cause innovators to pursue inventions that will succeed in the market,” meaning that—just as with patents—the “reward size is then based on the forces of supply and demand.”⁵² In cases where prizes and grants are weak because “the government cannot foresee a potential invention or evaluate its costs and benefits,” tax subsidies are able to deal with the decentralized nature of economic knowledge.⁵³ Copying the benefits of patents alongside the first dimension of policy (“*who decides* the size of the transfer to innovators”), tax expenditures are presented as market-set rewards,⁵⁴ and Hemel and Ouellette conclude that “the ‘special advantage’ and ‘obvious virtue’ of patents can be reproduced through the use of R&D credits.”⁵⁵

And so, while it is accepted that tax subsidies beat prizes and grants in the way they aggregate information (and are in that regard similar to patents), the literature identifies two benefits of them as compared to patents. The first difference between subsidies and patents lies alongside a second dimension: namely “*when* should the reward be transferred?”⁵⁶ Tax expenditures are *ex ante* market-set awards. This means that the reward is assigned before any market exchange has occurred, and money is transferred “in the year that funds are expended on qualifying research.”⁵⁷ Patents are seen as *ex post* market-set rewards: the events triggering the flow of cash are the exchanges in the marketplace. The rewards under a patent system will occur during “a series of transfers occurring over a twenty-year timeframe.”⁵⁸ A common contention in the literature is that the difference between tax subsidies and patents is a *temporal one*, and the government’s choice of the two innovation instruments should be made alongside the costs and benefits of this temporal distinction.⁵⁹

50. *Id.* at 328.

51. *Id.*

52. *Id.* at 327-28.

53. *Id.* at 327.

54. *Id.* at 333; *see also id.* at 327-38.

55. *Id.* at 328.

56. *Id.* at 333.

57. *Id.* at 333-34.

58. *Id.* at 334.

59. Indeed, Hemel and Ouellette even see patents as “shadow taxes,” the only difference is when is the tax charged and who pays it. *See id.* at 371. Hence they propose these taxes be included in the federal budget as costs. *Id.*

Since the reward is deferred under a patent regime, “innovators may have trouble raising the required capital to pursue the project (unless the innovator is independently wealthy).”⁶⁰ By injecting capital at the time of investment, tax subsidies avoid this financial constraint, which requires innovators to rely “on expensive outside capital in the meantime.”⁶¹ Tax subsidies are also a way to deal with risk aversion among potential innovators.⁶² By giving certain rewards immediately, rather than a speculative payout in the future, governments can compensate for innovators’ underestimation of the probability that their projects will succeed.⁶³ Leaning on the work of Stephen Marglin and Amartya Sen, scholars also ground *ex ante* measures in the theory of differing discount rates.⁶⁴ Since private individuals put a higher value on consumption today (relative to consumption at a future time), *ex ante* measures are cheaper from a social planner perspective than *ex post* measures. Lastly, Hemel and Ouellette are not sure whether a “winner-takes-all reward is the best incentive structure,” and an *ex ante* reward system can be seen as a way to compensate “researchers whose work contributes to the ultimate solution to a technical problem—but whose work never yields an invention that satisfies the standards for patentability.”⁶⁵

In addition to the temporal distinction, the second difference (and the last dimension to distinguish incentive tools) between patents and tax subsidies relates to the question of *who pays* the reward. Patents are user-paid: those transferring the payment are the purchasers of the products.⁶⁶ Tax subsidies, while being market tools for Hemel and Ouellette, are funded via cross-subsidization. Because they are financed from a broad tax base, the costs of the rewards are being spread over all taxpayers so non-users subsidize users.⁶⁷ Since both tax subsidies and patents are presented as market-based tools, and hence efficient, the “*who pays*” dimension can be decided alongside

60. *Id.* at 336.

61. *Id.*

62. See Hemel & Ouellette, *supra* note 13, at 556 (stating that “the *ex ante* payment covers at least a portion of the innovator’s costs and thus leaves the innovator with less to lose in the event that the project fails”).

63. Hemel and Ouellette also take into account that an optimism bias can justify *ex post* rewards, but the “optimism bias is insufficient to offset the combined effects of capital constraints and risk aversion,” and the authors reason that the net effects of these effects justify *ex ante* mechanisms. Hemel & Ouellette, *supra* note 3, at 340, 342.

64. See Stephen A. Marglin, *The Social Rate of Discount and the Optimal Rate of Investment*, 77 Q.J. ECON. 95, 96, 111 (1963) (describing individual’s time preference for consumption today over savings tomorrow). Hemel and Ouellette conclude that this bias creates an opportunity for the government as “*ex post* transfers are costlier from the social planner’s perspective than they are beneficial from the innovator’s perspective.” Hemel & Ouellette, *supra* note 3, at 343.

65. Hemel & Ouellette, *supra* note 3, at 345.

66. *Id.* at 346.

67. *Id.* at 348.

noneconomic considerations for the policymaker.⁶⁸ Intuitions of distributive justice can, for instance, ground patents when it comes to pure consumption goods (video games), whereas cross-subsidization seems fair for necessity goods (medication).⁶⁹ Joseph Stiglitz goes further and generally prefers the tax system as the financing system for novelty, favoring prizes and subsidies over patents.⁷⁰

As demonstrated by recent literature contributions, law scholarship has “developed a framework for policymakers to consider when determining the optimal innovation policy in *a given context*.”⁷¹ In comparisons of various instruments, even under conditions of asymmetric information, it is now accepted that patents are not the sole or the best innovation instrument—and the predominant message of Hemel and Ouellette’s 2013 article is how tax subsidies can often replace patents.⁷² They conclude their article as follows:

[B]y truncating the menu of policy options, the framing of the debate has led participants to overlook the potential benefits of tax incentives for innovation. For example, we show that *even when market actors have superior information* regarding R&D projects than government officials do, patents are not the only mechanism for aggregating this privately held information and allocating R&D expenditures accordingly: tax credits can achieve similar outcomes.⁷³

Hemel and Ouellette thus place tax expenditures and patents on equal footing and argue for a context-specific balancing of pros and cons, while expressing a general preference for tax expenditures.⁷⁴ In the patent-versus-prize debate, tax subsidies are somehow presented as the best of both worlds, combining the advantages of prizes with the knowledge-generation function of patents.

This Article is a critique of the enthusiasm for the use of tax subsidies to steer innovation present in recent IP scholarship—with the influential article by Hemel and Ouellette as the main focus. This Article examines, in a nuanced fashion, their thesis that tax subsidies can be seen as *ex ante* market tools that effectively employ private information and facilitate the dissemination of knowledge in the economy. It shows how the proposal of tax subsidies for innovation relies on an overly idealistic view of human knowledge and that, in the

68. *Id.* at 347.

69. *Id.* at 350 (“The user-pays principle may seem heartless with respect to treatments for debilitating diseases; it may seem more attractive with respect to lifestyle drugs.”).

70. Stiglitz, *supra* note 7, at 1715 (“The bottom line is that raising revenues for financing research through the granting of monopoly power cannot be justified by any generally accepted principles of public finance.”).

71. Hemel & Ouellette, *supra* note 3, at 367 (emphasis added).

72. *Id.* at 381.

73. *Id.* (emphasis added).

74. *Id.* at 342 (“Which of these effects dominates is context-specific, but we can be fairly confident that in general, optimism bias is insufficient to offset the combined effects of capital constraints and risk aversion because the private rate of return on R&D spending is greater than the rate of return on ordinary capital investment.”).

context of decentralized information, the property approach remains superior.⁷⁵ In Part III, the Article also shows how rent-seeking issues further undermine the operationalization of subsidies and are more problematic than under a property-rights system.

II. TAX INCENTIVES FOR INNOVATION AND INSTITUTIONAL ECONOMICS

The field of institutional economics is devoted to the study of how the production of knowledge and incentives within a market is a function of an underlying set of rules.⁷⁶ If we wish to enhance the performance of the market, we need to look at the wider set of formal and informal institutions that govern it. For institutional economists, any normative question about the rules that *ought* to govern that market—the subject of this Article—must start with a positive analysis whereby we acquire a realistic image of what a market really is. If the laws and regulations that aim to regulate the market are based on a mirage—on false assumptions—they will fail to attain their goals.⁷⁷ Law, in this approach, is the more normative subfield of institutional economics that evaluates whether specific formal rules have acceptable knowledge-generating and incentive-aligning working qualities and enable the functioning of the market process.⁷⁸ This Part will focus on the first working property of rules, namely, whether they facilitate the production and distribution of knowledge in society. Resonating with the spirit of institutional economics, before evaluating whether tax subsidies for innovation are warranted, the Article describes the market process.⁷⁹ In Part A, it conceptualizes the market as a discovery process. Part B deduces a more refined notion

75. See Hemel & Ouellette, *supra* note 13, at 544.

76. During the twentieth century, institutional economics emerged as a critique and alternative to the dominant equilibrium models to be found in economics textbooks. For this neoclassical account, see generally HICKS, *supra* note 20; MARSHALL, *supra* note 20; PAUL A. SAMUELSON, *ECONOMIC FOUNDATIONS OF ECONOMIC ANALYSIS* (1963); WALRAS, *supra* note 20.

77. The thread running through Hayek's legal work is that we should understand the complexity and informational challenges of an economy, and of society at large. See, e.g., F.A. HAYEK, *LAW, LEGISLATION AND LIBERTY: A NEW STATEMENT OF THE LIBERAL PRINCIPLES OF JUSTICE AND POLITICAL ECONOMY* (digital prtg. 2003).

78. In the legal literature, the search for rules that can cope with the motivational and informational challenges of reality can be found in RICHARD A. EPSTEIN, *SIMPLE RULES FOR A COMPLEX WORLD* 32 (1995) ("Perfection is obtainable in the world of mathematics, not in the world of human institutions."); Adam Mossoff, *A Simple Conveyance Rule for Complex Innovation*, 44 *TULSA L. REV.* 707, 728-29 (2009) ("In essence, the socio-economic effects of innovation in science and technology seem unpredictable, at least given the current state of our knowledge concerning both innovation and how to model the relevant economic behavior."). See generally Jonathan M. Barnett, *The Costs of Free: Commoditization, Bundling and Concentration*, 14 *J. INSTITUTIONAL ECON.* 1097 (2018) (discusses the costs of commodification in digital markets); Todd J. Zywicki & Anthony B. Sanders, *Posner, Hayek & the Economic Analysis of Law*, 93 *IOWA L. REV.* 559 (2008) (discusses Hayek's critique of Posner's legal theory, which is mainly that judges don't have the requisite information to execute Posner's theory).

79. See, e.g., Hemel & Ouellette, *supra* note 3, at 349-50.

of innovation. Part C engages again with the dominant literature and debunks tax subsidies as a proper tool for innovation, and Part D ties in with the general IP literature and proposes an alternative innovation policy both in patent and tax law.

A. *The Market as a Process of Discovery*

IP scholars typically commence an economic exercise with the search for the perfect policy under a known set of production costs and individual utility functions:⁸⁰

Consider an inventor who discovers a drug that cures male pattern baldness. Let's say that the drug costs \$1 to produce, that there are 100 bald men in the world willing to pay at least \$1 for the drug, and that the demand schedule for the drug is linear: 100 bald men will purchase the drug if it is priced at \$1, 50 bald men will purchase the drug if it is priced at \$1.50, and no bald men will purchase the drug if it is priced above \$2.⁸¹

For most IP scholars, the question involves choosing the proper innovation policy given accurate information about the marginal costs and social value of a specific novelty.⁸² Noble Laureate Friedrich Hayek, trained as a jurist, directs our attention to the undeniable fact that, in reality, we do not know the values that are assumed in the example above.⁸³ Indeed, the neoclassical framework commences the economic exercise at a point where the economic process has been completed and we have acquired full access to the utility functions of consumers and the marginal costs of the techniques to satisfy them.⁸⁴ Within an equilibrium model, the outcome is confused with *the process* that leads to the outcome. This Article is interested in how the market

80. This Article treats the "utility function" as the numerical expression of an individual's underlying preferences. The "demand schedule" is the aggregate of all consumers' utility functions.

81. Hemel & Ouellette, *supra* note 3, at 349.

82. See, e.g., RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* 543-45 (6th ed. 2003) (depicting the role of judges as that of utility maximizers); Michael Abramowicz & John F. Duffy, *Intellectual Property for Market Experimentation*, 83 N.Y.U. L. Rev. 337, 338-39 (2008) (beginning their article with two similar situated companies, each marketizing a product with a cost of \$100.00 and an expected profit of over \$200.00).

83. See F.A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 519 (1945) ("What is the problem we wish to solve when we try to construct a rational economic order? On certain familiar assumptions the answer is simple enough. *If* we possess all the relevant information, *if* we can start out from a given system of preferences, and *if* we command complete knowledge of available means, the problem which remains is purely one of logic. That is, the answer to the question of what is the best use of the available means is implicit in our assumptions.").

84. See FRIEDRICH A. HAYEK, *INDIVIDUALISM AND ECONOMIC ORDER* 45-46 (1948) ("In the usual presentations of equilibrium analysis it is generally made to appear as if these questions of *how the equilibrium comes about* were solved. But, if we look closer, it soon becomes evident that these apparent demonstrations amount to no more than the apparent proof of *what is already assumed.*") (emphasis added).

produces such knowledge in the first place.⁸⁵ For Hayek, it is because we do *not* know the social value of products, nor the cheapest way to produce them, that we create competition among property-holding entrepreneurs to engage in exchanges with consumers.⁸⁶ Building on this, the *dynamic* purpose of competition is the *creation* and communication of economic knowledge. The purpose of the property approach, the economic game led by property and exchange, is that it drives entrepreneurs to disclose currently hidden knowledge, information that reveals itself via the emergence of new price structures, new products, and cheaper production techniques.⁸⁷

For instance, a discrepancy between a given price for a particular good and the underlying cost represents an opportunity for profit for the entrepreneur.⁸⁸ “Price breakers,” individual entrepreneurs who maximize revenue by lowering the price, are the driving forces behind the emergence of competitive prices.⁸⁹ The gradual or drastic alterations we witness within the market process are not confined to price competition. In their alertness for unexploited gain, entrepreneurs will test whether the current stock of goods is the one that satisfies consumer preferences maximally. They can bring modified or new products to the market that reveal the imperfections of previous products and turn them into private profit. When the submitted alterations are successful, they will generate profit and these changes will accumulate within the market process. Serving as product innovators, entrepreneurs help to fill gaps in knowledge about consumer’s preferences.⁹⁰

Getting back to the example of a government directing the invention of a remedy for male pattern baldness: knowledge about the cost to invent this, the cheapest way to produce it, and consumer’s

85. JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY 82-83 (2014) (“Capitalism then, is by nature a form or method of economic change and not only never is but never can be stationary The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers’ goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates.”).

86. See F.A. Hayek, *Der Wettbewerb als Entdeckungsverfahren*, 56 KIELER VORTRÄGE (1968) (Ger.) translated in *Competition as a Discovery Procedure*, 5 Q.J. AUSTRIAN ECON. 9, 13 (2002) (“Which goods are scarce, however, or which things are goods, or how scarce or valuable they are, is precisely one of the conditions that competition should discover: in each case it is the preliminary outcomes of the market process that inform individuals where it is worthwhile to search.”).

87. See Paul M. Romer, *Endogenous Technological Change*, 98 J. POL. ECON. 71, 89 (1990) (“Yet it is still the case that private, profit-maximizing agents make investments in the creation of new knowledge and that they earn a return on these investments by charging a price for the resulting goods that is greater than the marginal cost of producing the goods.”).

88. ISRAEL M. KIRZNER, COMPETITION AND ENTREPRENEURSHIP 13-14 (Peter J. Boettke & Frédéric E. Sautet eds., 2013); Israel M. Kirzner, *Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach*, 35 J. ECON. LITERATURE 60, 70 (1997).

89. See G. Marcus Cole, *Shopping for Law in a Coasean Market*, 113 N.Y.U. J. L. & LIBERTY 111, 119-20 (2005) (explaining that prices are an instrument whereby individuals adjust their actions to others, without having to know the reasons).

90. See Romer, *supra* note 87.

utility curves is “never so given to a single mind,” so we need an economic device that garners and spreads knowledge “that is *dispersed* among many people.”⁹¹ Indeed, “[i]f anyone actually knew everything that economic theory designated as ‘data,’ competition would indeed be a highly wasteful method of securing adjustment to these facts.”⁹² Once we drop the assumption of omniscience and enter the real world, we can conceive markets as a *discovery procedure* for revealing these facts.⁹³ Under competitive conditions, the lure of profit leads to the gradual emergence of information about what consumers value, what the cheapest production techniques are, and what the price is that equals marginal costs. Entrepreneurial competition organized by private property and freedom of contract is the decentralized device that reveals and publicizes knowledge that is initially tacit, hidden, and scattered throughout society.⁹⁴

B. Innovation: An Endogenous and Unpredictable Phenomenon

Now that we understand the knowledge problem that drives the market process, we can reach a deeper understanding of innovation.⁹⁵ Schumpeter said, “The essential point to grasp is that in dealing with capitalism we are dealing with an evolutionary process.”⁹⁶ Innovation is a necessary corollary of markets when observed as a process rather than a place. Under competitive conditions, the dispersion of knowledge will lead to gradual or disruptive changes in all elements in the market. Whereas the neoclassical approach will portray alterations in prices and products as exogenous shocks, in reality, innovation is an *endogenous* phenomenon.⁹⁷ An economy is a dynamic and open system, and change can be traced back to entrepreneurial action.⁹⁸ Secondly, flowing from the previous point, change is a

91. Hayek, *supra* note 83, at 530 (emphasis added).

92. Hayek, *supra* note 86, at 9.

93. *See id.* at 9-10; Romer, *supra* note 87, at 72 (“The raw materials that we use have not changed, but as a result of trial and error, experimentation, refinement, and scientific investigation, the instructions that we follow for combining raw materials have become vastly more sophisticated.”).

94. *See* Hayek, *supra* note 83, at 521 (stating that competition is a form of “decentralized planning by many separate persons”).

95. Mark Lemley admits that innovation scholarship has not fully developed its most central notion. Mark A. Lemley, *Reconceiving Patents in the Age of Venture Capital*, 4 J. SMALL & EMERGING BUS. L. 137, 139 (2000) (“Innovation, on the other hand, is very complex. We’re not sure exactly what causes it, but one of the things we do know is that it differs by industry: what drives innovation in the pharmaceutical industry is very different from what drives it in the software industry, and very different again from what drives it in the semiconductor industry.”).

96. SCHUMPETER, *supra* note 85, at 82.

97. *See id.* at 83 (“[T]he 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.”).

98. *See* Romer, *supra* note 87, at 72.

phenomenon that is happening *continuously*.⁹⁹ Because of the pressure for profit, markets are in ceaseless motion: there is always a firm trying a new business model, a company testing new advertising techniques, a developer adding alterations to the stock of goods.¹⁰⁰ The third element that stands out is that innovation is an *open concept*.¹⁰¹ Innovation is nothing more than the successful exploitation of previously unseized opportunities. Something does not need to have a specific property (for instance, being digital) to be innovative; innovation can thus relate all elements within the market such as products, production processes, marketing method, organizational methods, workplace organization, or external relations.¹⁰² Fourth, it is *unpredictable* what the content of innovation will be.¹⁰³ Mark Lemley acknowledged “that we do[] [not] have a clue how innovation works,” “we[] [are] not sure what causes it,” and “there is simply a large degree of serendipity associated with invention by its very nature. Part of the problem is that we may never be able to know exactly what sparks a thought or a creative idea in somebody’s mind.”¹⁰⁴ Adam Mossoff illustrates how new products and services are often the result of innovative leaps that even specialists in the industry did not predict.¹⁰⁵ Ted Sichelman underlines the difficulty of forecasting which inventions will end up being successful commercially.¹⁰⁶ This unpredictability has not one but two reasons. First, entrepreneurs systematically come up with new combinations and creative insights that cannot be listed a priori.¹⁰⁷ Furthermore, the selection mechanism by which the market system decides whether these novelties will accumulate or disappear through an economy is the *price mechanism*. The price mechanism is the unintended consequence of subjective decisions of millions of

99. Hayek, *supra* note 83, at 523-24.

100. The Schumpeter-Hayek-Romer model thus means that without any extra intervention, systems of private property and exchange systematically generate change.

101. Innovations are often not purely technical but can revolve around advertising or even the organizational structure of a firm. See Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 400 (2010) (arguing for enlarging patentable subject matter for commercialized products “to cover new forms of market experimentation, product testing, marketing, sales methods, and even the innovative identification of problems in need of solutions”); see also Abramowicz & Duffy, *supra* note 82; Shay, Fleming Jr. & Peroni, *supra* note 16, at 424; Harper, *supra* note 1, at 977.

102. See OSLO MANUAL, *supra* note 1, at 46-47.

103. See Hayek, *supra* note 86, at 9, 10 (2002) (stating that competition is important only because and insofar as its outcomes are unpredictable).

104. Lemley, *supra* note 95, at 139.

105. Mossoff, *supra* note 78, at 726-29.

106. Sichelman, *supra* note 101, at 362-64.

107. There is an endless number of potential new and old elements, which are generated by the imagination and perception of the entrepreneur; hence mathematical economics cannot model novelty. See Roger Koppl et al., *Economics for a Creative World*, 11 J. INSTITUTIONAL ECON. 1, 15 (Patrick Llerena & Mireille Matt eds., 2015); see also Stanley S. Metcalfe, *Systems Failure and the Case for Innovation Policy*, in INNOVATION POLICY IN A KNOWLEDGE-BASED ECONOMY: THEORY AND PRACTICE 47, 49-50 (2005).

people, and no one can predict the precise content of it.¹⁰⁸ Importantly for what follows, as neither specific entrepreneurial initiatives nor the way consumers will respond to them is predictable, the evolutionary pathways of an economy—that is, innovation—are not something we can forecast.¹⁰⁹

*C. Subsidies for Innovation:
An Institutional Critique*

Tax subsidies create financial stimuli *ex ante*, at the time of investment, not in subsequent exchanges. This Article outlines that steering the market *ex ante* is an anachronistic exercise: We assume knowledge about the outcome of a process that only the process can produce. To make a comparison, it is like using biological enhancement techniques today to optimize our adaptation to the environment ten thousand years from now. The information we need to efficiently interfere in the dynamic of innovation will only reveal itself in the course of the process in which we try to intervene.

So far, this Article has given conceptual indications of why tax subsidies cannot anticipate the movements of the market. To be complete, it is necessary to illustrate the *actual* information problems that arise when governments design tax subsidies. In order to do this, Section 1 describes what the informational requirements are for an efficient innovation subsidy. Section 2 shows how the U.S. research credit tries to satisfy those requirements. Section 3 gives a detailed analysis of the two informational failures that undermine any effective design of tax subsidies—the identification problem and the valorization problem. In doing so, this Article will engage with the theoretic advantages discussed under section I.C., as the following section 3 will criticize the temporal characteristics of tax subsidies. For comprehensiveness, section 4 will review the distributional characteristics of tax subsidies.

1. The Informational Requirements for Tax Subsidies

Remember the initial case for any innovation tool (tax or proprietary) mentioned in Part I section A. While economic innovation will yield growth, entrepreneurs will fail to invest in innovation “because it is risky, because the product can be appropriated only to a limited extent, and because of the increasing

108. See generally Hayek, *supra* note 83; GEORGE J. STIGLER, *THE THEORY OF PRICE* 12 (4th ed., 1987).

109. Sichelman, *supra* note 101, at 355-80 (observing that the unpredictability of the innovation process undercuts the current patent system and drives the commercialization debate in IP law); see also Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 711-12 (arguing that the complex, costly, and uncertain world of innovation requires strong, real property-like protections of inventions).

returns in use.”¹¹⁰ Novelty is a positive externality like pollution is a negative one. Tax subsidies try to lower the after-tax cost of innovation and thus aim to stimulate the discovery and commercial development of economic novelty. Shay et al. show that the effective design of tax subsidies suffers from a double information problem: We have to identify the source of novelty, and we have to know the amount of subsidies to transfer in order to correct the market failure.¹¹¹ Reiterating that innovation is the result of entrepreneurs engaging with experiments and consumers, via the price system, selecting those alterations, an effective design of tax subsidies meets the following conditions.

First, the subsidy needs to be directed to an experiment—a novelty in the market. If the subsidy is oriented to the production of goods or services we already have, or at initiatives that are not new, it results in waste (that is, the *identification problem* discussed below). Second, the end purpose of subsidies is to overcome underinvestment in order to create growth by satisfying consumer preferences (and satisfying them better than they would be in the absence of the subsidy).¹¹² So if the subsidy is oriented to products or services that nobody wants, it results in waste. This means that subsidies have to be allocated according to consumer demand (this is the *valorization problem*).

2. U.S. Research Credit

U.S. tax subsidies for innovation cost more than \$10 billion a year. The biggest portion of the cost is the research credit.¹¹³ As we saw, the essence of ex ante tax subsidies is to identify successful innovations and grant them subsidies in accordance with their value. Aiming to accomplish this task, the tax credit has been extended sixteen times and significantly modified five times. Eligibility for tax subsidies is subject to various conditions and requirements, and the relevant article, section 41 of the Internal Revenue Code, has been subject to numerous regulations by the IRS. As a result, section 41 and other tax subsidies under U.S. law are “among the most complex provisions in the Internal Revenue Code.”¹¹⁴ Given this complexity, businesses, the

110. Arrow, *supra* note 14, at 619. See generally LANDES & POSNER, *supra* note 14; Nelson, *supra* note 14.

111. Shay, Fleming Jr. & Peroni also argue that innovation is much broader than R&D. See Shay, Fleming Jr. & Peroni, *supra* note 16, at 424.

112. The initial justification for innovation policy was not to “correct” the choices of consumers when their willingness to pay does not fully appreciate a product’s social value. This goal of innovation policy emerged later in the literature and falls outside the scope of this discussion. This Part focuses on how to stimulate the development of novelty when consumer demand is a good proxy for social value but the process of creating novelty is too costly.

113. The cost of the research credit increases every year; it amounted to \$8.5 billion in 2010. GARY GUENTHER, RESEARCH TAX CREDIT: CURRENT LAW AND POLICY ISSUES FOR THE 114TH CONGRESS 17 (2015).

114. Hemel & Ouellette, *supra* note 3, at 306.

courts, the Treasury Department, and the IRS are constantly clashing over conditions for eligibility.¹¹⁵

Abstracting from most of the complexity, technical matters, and interpretation difficulties, we give the simplified and generalized conditions known as the “four-step test” that one will find in textbooks. This is the test that Congress formulated to solve the identification problem. First, the research must involve activities that qualify for the deduction under 26 C.F.R. § 1.174; namely, the activities must be “experimental” in the laboratory sense and aimed at the development of a new or improved product or process.¹¹⁶ This confirms the nexus between section 41 and market failure theory, as “research” is supposed to be directed to the creation of innovative knowledge, a process characterized by uncertainty.¹¹⁷ To be eligible for the tax credit, the “research” also has to pertain to the discovery of information that is technological in nature. This condition has been relaxed; for research to be technological in nature, it suffices if “the process of experimentation used to discover such information fundamentally relies on principles of physical or biological sciences, engineering, or computer science.”¹¹⁸ Thirdly, the research must involve a process of experimentation. Regulations have broadened the scope of this requirement. The taxpayer must identify uncertainty about one or more alternatives and conduct a process of evaluation.¹¹⁹ Lastly, research must relate to a qualified purpose. To constitute a qualified purpose, the research must pertain to “a new or improved function, performance, reliability or quality of the business component.”¹²⁰

The credit prioritizes specific kinds of experiments. Research is not conducted for a qualified purpose if it relates to style, taste, cosmetic, or seasonal design factors.¹²¹ Also, expenses are ineligible if they are related to adaptation or duplication of an existing business component, marketing research, market testing, surveys, management functioning, and any other social science research.¹²²

Once eligible for tax subsidies, the amount of tax subsidies to be allocated (i.e., the valorization problem) is calculated based on a complex statutory formula. To give a radical simplification, section 41 provides a dollar-for-dollar tax credit of 20% of qualified research expenses over a base amount, with the base amount calculated as a function of both past spending and gross receipts.¹²³ The tax credit was temporary for many years but was made permanent by the Obama

115. GUENTHER, *supra* note 113, at 3.

116. Treas. Reg. § 1.174-2(a) (as amended in 2014).

117. *See id.* § 1.174-2(a)(1).

118. Treas. Reg. § 1.41-4(a)(4) (as amended in 2016).

119. *See id.* § 1.41-4(a)(8).

120. *Id.* § 1.41-4(a)(5)(ii).

121. *Id.*

122. I.R.C. § 41(d)(4)(B)-(H).

123. *See id.* § 41(a)(1).

administration at the end of 2015. It also remained intact under the Tax Cuts and Jobs Act of 2017.¹²⁴

3. *The Inefficiency of Tax Subsidies Unraveled*

Harking back to the literature presentation, recall that tax subsidies are celebrated because they deal well with decentralized knowledge (like property rights), and additionally (unlike property rights), their timing and distributional properties offer benefits that the property approach does not allow. This theoretical optimism does not translate to the numbers. Despite the enormous burden on the federal budget, one of its core supporters, the OECD, found that government funding of R&D, for instance via tax incentives, had no or sometimes even negative impact on economic growth.¹²⁵ There are studies that are more optimistic,¹²⁶ yet the general observation is that “private R&D has a substantial and significant direct effect on productivity growth which is greater than the impact of total R&D” yet “public R&D appears to have a much weaker, if not insignificant, direct effect.”¹²⁷

While “many economists and policymakers have grown frustrated with the paucity of systematic statistical evidence documenting a direct contribution from public R&D,” the knowledge problem with the operationalization of tax subsidies has surfaced.¹²⁸ Studies now admit that, while we can measure the effect of tax expenditures on R&D inputs, when it comes to effects on innovation *output* and growth more generally, very little can be said with certainty.¹²⁹ Stephen Shay, J. Clifton Fleming Jr., and Robert Peroni conclude in their recent overview, “We question whether there is sufficient understanding of

124. See generally Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2054 (2017).

125. See OECD, *supra* note 18, at 64, 84.

126. See generally Dechezleprêtre et al., *supra* note 18.

127. Henri Capron & Bruno van Pottelsberghe de la Potterie, *Public Support to Business R&D: A Survey and Some New Quantitative Evidence*, in POLICY EVALUATION IN INNOVATION AND TECHNOLOGY: TOWARDS BEST PRACTICES 171, 172 (1997).

128. David, Hall & Toole, *supra* note 18, at 2 (explaining how tax incentives lead to a replacement of private R&D and to alterations in its composition such that firms will favor projects that will generate profits in the short run); see also Kealey & Al-Ubaydli, *supra* note 18, at 41-42 (observing that the United Kingdom and United States witnessed an explosion of innovation, not in the era of governmental sponsored R&D but before that during the nineteenth and early twentieth centuries).

129. Shay, Fleming Jr. & Peroni, *supra* note 16, at 424 (“[W]e question whether there is sufficient understanding of the process that leads from research to development to commercialization to economic growth to be able to specify an appropriate (and appropriately narrow) target for government intervention that can be achieved with a cost-effective tax incentive.”); see also Köhler, Laredo & Rammer, *supra* note 18, at 13-17 (showing that most studies measure the impact of tax incentives through *input* additionality—the contribution of the tax incentive to increased business R&D expenditure at the firm level—but there is less evidence on output additionality, R&D tax incentives leading to actual new products and services and thus economic impact). See generally Charles I. Jones & John C. Williams, *Measuring the Social Return to R&D*, 113 Q.J. ECON. 1119 (1998).

the process that leads from research to development to commercialization to economic growth to be able to specify an appropriate (and appropriately narrow) target for government intervention that can be achieved with a cost-effective tax incentive.”¹³⁰ Prominent economists recently presented a model whereby the efficiency of R&D incentives is mediated by factors that *cannot be observed*, such as whether a firm actually invests in the kind of knowledge about which a market failure arises and whether the firm under discussion is the kind of firm that is efficient in converting R&D in research productivity.¹³¹ David Schizer argues that governments are not well positioned to select specific sources of innovation.¹³²

Building on these empirical indications and the skepticism in the literature, this Article disentangles the knowledge problem for tax subsidies by carving out the identification problem and valorization problem mentioned in Part C.1. The empirical literature is presented along with an explanation of why tax subsidies for innovation seem to have little effect on innovation output and growth, and with a theoretic framework that can inspire further empirical research.

For comprehensiveness, the Article discusses the two other benefits that the literature attributes to tax subsidies—the timing and distributional characteristics.

(a) *The Identification Problem*

The first real issue for governments is how to tailor subsidies to genuine experiments. In the examples discussed in recent innovation scholarship, the government knows which entrepreneurs are actually investing in novelty. Statute drafters have no access to an exclusive list of inventors or experiments. So, as just described, legislation designers must set out a number of conditions for eligibility. This difficult legislative attempt to capture all novelty is subject to two forms of mistargeting. On one hand, a statute will often not support true experiments, and on the other, it will identify as innovation market activity that has little to do with novelty.

Consider “Orange” and “Green”, two innovators competing with new types of phones. Orange releases a new phone designed from scratch by engineers at a cost of about \$100,000. Green, another phone company, uses a \$100,000 marketing campaign (“buy a sustainable phone”) to promote new phones that are made from old phone parts. While both players are injecting novelty into the market, the IRC

130. Shay, Fleming Jr. & Peroni, *supra* note 16, at 424.

131. See Ufuk Akcigit, Douglas Hanley & Stefanie Stantcheva, *Optimal Taxation and R&D Policies* 15 (Nat'l Bureau of Econ. Research, Working Paper No. 22908, 2016), <http://www.nber.org/papers/w22908.pdf> [<https://perma.cc/7PWF-3UGF>] (the history of research productivity realizations θ^t and the unobservable R&D effort l_t are private information of each firm.).

132. Schizer, *supra* note 16, at 293.

supports only Orange. Section 41 of the IRC requires that research costs be technological in nature, so Orange will be eligible for the benefit. Section 41 excludes marketing research, so Green, which bears an equal investment cost of \$100,000 dollars, will not be supported by the tax credit and thus faces a much higher effective tax rate.¹³³

While the economic and law literature acknowledges that innovation is an open concept, and that elements like “worker training, workplace designs, and firm organizational processes, are now considered to make a commensurate contribution to innovation,” the IRC is lagging behind.¹³⁴ As a result of this mistargeting problem, genuine innovations will often not be identified as such. Consider a company that manages to lower its prices because it creates a unique business model based on shared ethical rules and consensus-based decision-making that ends up making the firm more efficient. Although this will involve sensible investment and transition costs, it is not a technological novelty, so no subsidies will be granted.¹³⁵ And what about a firm that was creative and worked out an entirely new product, say a laundry place where one can use equipped kitchens to make one’s own food. Will it receive innovation subsidies? No.

The mirror problem is that often the IRS will subsidize market activity that has little to do with novelty. For instance, multinational burger restaurants like McDonald’s and Burger King have offered essentially the same products for the last five decades. Under current U.S. tax law, even though the small burger places are the true innovators, it is known that McDonald’s and Burger King are the kinds of corporations likely to benefit from tax subsidies.¹³⁶ The restaurant

133. Marketing and testing a new product are ruled out by section 41 of the Internal Revenue Code. See I.R.C. § 41(d)(4)(D). We can assume that by default this cost is treated as an investment and the five-year depreciation rule applies.

134. Shay, Fleming Jr. & Peroni, *supra* note 16, at 424. Economists agree that the source of innovation lies in endless combinations of previously existing elements and does need not to involve new scientific or technological inventions or research. See Koppl et al., *supra* note 107, at 5; see also Metcalfe, *supra* note 107, at 64; PAUL A. LEWIS, TECHNICIANS AND INNOVATION: A LITERATURE REVIEW 5, 7 (2019), <https://www.ssrn.com/abstract=3405406> [<https://perma.cc/Y47Q-2A2K>].

135. Social research—for instance, oriented at management improvement is ruled out by section 41 of the Internal Revenue Code. See I.R.C. § 41(d)(4)(D) and § 41(d)(4)(G).

136. Tax specialists will service large-scale food companies to qualify any costs connected to new products as eligible for the tax benefit. BDO specializes in how restaurants can qualify costs connected to new recipes under section 41. Lisa Haffer, *Are There R&D Tax Credit Opportunities in the Restaurant Industry?*, BDO INDUSTRY BLOGS: RESTAURANT PRACTICE (Feb. 18, 2015), <https://www.bdo.com/blogs/restaurants/february-2015/rd-tax-credit-opportunities-restaurant-industry?feed=8799bc52-2237-4688-aeac-83e40e623b56> [<https://perma.cc/HUB8-34J5>]. Tax Point Advisors also advise their clients from the food industry to rely on their services to obtain the tax benefit. Jeffrey Feingold, *R&D Tax Credits Available for Companies Working to Push the Boundaries with Plant Based Products and Diets*, TAX POINT ADVISORS (Mar. 13, 2018), <http://taxpointadvisors.com/blog/view/rd-tax-credits-available-for-companies-working-to-push-the-boundaries-with-> [<https://perma.cc/MG5P-XCUD>]. Dan Shaviro pointed to the practice of burger producers monetizing the tax credit to qualify costs that are hardly innovative. See Daniel Shaviro,

industry may seem an odd example to illustrate the application of a tax benefit initially intended to boost technical innovation.¹³⁷ The fact that more than forty other industries use this provision to lower their tax liability is, however, highly instructive as to the point being made here.¹³⁸ Echoing Lemley: drivers of innovation are hard to identify. Because of the impossibility of tailoring subsidies to experiments, governments will broaden their application. Since its enactment in 1981, stipulations of the research credit have been expanded multiple times. The result is not efficiency but overbreadth, as the research credit now covers situations that are hardly innovative at all.¹³⁹ Daily, accountants for major firms make sure that wages and production costs incurred for the production of a slightly modified recipe get qualified as R&D for the tax benefit. To constitute a permitted purpose, the research must pertain to “a new or improved function, performance, reliability or quality of the business component.”¹⁴⁰ Recently, “new” does not mean new within the economy, but new to the firm.¹⁴¹ Restaurant chains also manage to call their research “technological in nature,” as grand-scale goods producers argue that they rely on the hard sciences, notably chemistry, to improve their products.¹⁴² These conditions allow large-scale restaurants the option to classify payroll and other daily costs under the tax credit. Small companies are literally experimenting yet cannot artificially qualify their endeavors as “research,” so they do not get state aid.

To conclude, section 41 illustrates the difficulty of detecting all true experiments without overbreadth and, by committing two kinds of targeting errors, the difficulty of overcoming the identification problem.

NYU Tax Policy Colloquium, Week 1: Stefanie Stancheva's Taxation and Innovation in the 20th Century, START MAKING SENSE (Jan. 23, 2019), <http://danschaviro.blogspot.com/search?updated-max=2019-02-15T23:03:00-05:00&max-results=20&start=32&by-date=false> [<https://perma.cc/7NT4-T85H>] (“[T]oo much of the activity that would end up qualifying for the credit was of the character of, say, McDonald’s or Burger King working on their sesame seed buns.”).

137. In the account of this article, even legislative intent is a good example of the point: innovation is much broader than technology, so why protect only that industry?

138. See the website of one of the big players in the accounting business, ALLIANTGROUP, <https://www.alliantgroup.com/industries/> [<https://perma.cc/WK5E-WVDG>] (last visited Jan. 24, 2021).

139. See *The R&D Tax Credit Is Not Just for Scientists*, ALLIANTGROUP, <https://www.alliantgroup.com/services/r-d-tax-credit-2/> [<https://perma.cc/A3DX-ABZX>] (last visited Sept. 25, 2020).

140. Cherie L. Jones et. al., *Practical Documentation of QRAs for the R&D Tax Credit*, THE TAX ADVISOR (July 1, 2016), <https://www.thetaxadviser.com/issues/2016/jul/practical-documentation-of-qras-for-r-and-d-tax-credit.html> [<https://perma.cc/CF2X-PRMS>].

141. See *The R&D Tax Credit Is Not Just for Scientists*, ALLIANTGROUP, <https://www.alliantgroup.com/services/r-d-tax-credit-2/> [<https://perma.cc/M4BR-3HB4>] (last visited Sept. 25, 2020).

142. Feingold, *supra* note 136 (“The research must rely on the hard sciences, such as engineering, physics, chemistry, biology or computer science.”).

(b) *The Valorization Problem Versus the Temporal Benefits of Subsidies*

Standard scholarship rests on the premise that innovation is a costly good, and without any additional policy the costs would not be offset by the benefits. To facilitate inventors bringing their new products to the market, government must increase the reward. With that in mind, let us get back to the example raised before:

Consider an inventor who discovers a drug that cures male pattern baldness. Let's say that the drug costs \$1 to produce, that there are 100 bald men in the world willing to pay at least \$1 for the drug, and that the demand schedule for the drug is linear: 100 bald men will purchase the drug if it is priced at \$1, 50 bald men will purchase the drug if it is priced at \$1.50, and no bald men will purchase the drug if it is priced above \$2. *Stipulate that the inventor should receive a benefit of \$25 for her discovery* (either on desert-based grounds or efficiency grounds).¹⁴³

In order to increase the reward size, the government can give the inventor an intellectual property right that opens up the prospect of profits and protects him against infringements in case consumers choose to buy his product. Or, to increase the inventor's profits, the government can stimulate innovation at an early stage and *decrease the costs* of the invention. For instance, it can grant a 25% tax benefit in relation to the dollar costs to produce a dose of the drug. Then, the inventor could sell one hundred doses of the drug while incurring only \$75 in costs and realize the required \$25 profit.

From this presentation, we can understand why mainly temporal and distributive characteristics distinguish the property approach from the tax approach.¹⁴⁴ Whereas a patent grants an uncertain income later on, tax subsidies transfer a secure dollar amount at the time of investment. However, this economic exercise is not a realistic one.¹⁴⁵ When designing rules for innovation like tax provisions, policymakers do not have access to the values inserted above.

A more realistic exercise is the following: Consider a society with 100 bald men. Consider also an unknown number of unspecified, anonymous potential inventors of a drug that cures male pattern baldness. Let us say that you have *no information* about the cost to produce the drug and no information about consumer demand. Stipulate that the inventor is unknown, and *no one knows the amount he should receive to cure* male pattern baldness.

143. Hemel & Ouellette, *supra* note 3, at 349 (emphasis added).

144. Hemel and Ouellette see patents as "shadow taxes"; the only difference is when is the tax charged and who pays it. *See id.* at 371.

145. The static neoclassical model was used by OECD countries as the "meta-rationale" behind their tax subsidies policy. *See* OECD, THE OECD INNOVATION STRATEGY: GETTING A HEAD START ON TOMORROW 88 (2010), https://www.oecd-ilibrary.org/science-and-technology/the-oecd-innovation-strategy_9789264083479-en [https://perma.cc/XY3S-TPVA]; Harper, *supra* note 1, at 987.

This last example realistically illustrates the conditions under which real-life policymakers design tax subsidies.¹⁴⁶ Examples such as the first one illustrate that innovation scholars present tax subsidies and property rights as interchangeable policy tools under the assumption that we have equal information *ex ante* (at the time of investment) as we have *ex post* (when products are fully developed, consumers reveal their preferences, etc.). This is an incorrect assumption; as sketched in Section II.A, market competition leads to the *discovery* of new information about what consumers value, what the cheapest production techniques are, and what the price is that equals marginal costs.¹⁴⁷ If we knew the individual utility curves or even the aggregate demand schedule regarding a new computer, we would not need a market that organizes a competition between various producers of different goods. The irony of the proposal for *ex ante* measures (i.e., tax subsidies) is that it requires the availability of information that is only *ex post* available, when the market process completes itself and all information has been successfully generated.

That said, the literature finds the temporal difference to be an advantage in favor of tax subsidies.¹⁴⁸ Recall that by injecting capital at the time of investment, tax subsidies avoid the financial constraint whereby innovators have to rely “on expensive outside capital in the meantime.”¹⁴⁹ By giving certain benefits immediately rather than after commercial exchange, tax subsidies also mitigate risk aversion.¹⁵⁰ This focus on the benefits of early rewards obscures the fact that at the time of investment, we have information neither on the relative cost of specific inventions nor on their future value. Even if the identification problem is solved, the *valorization problem* remains: How much tax benefits should be transferred to the potential inventor of the baldness remedy, when we *do not know* what the *costs* are to produce it, nor the *demand schedule* regarding this invention?

While the innovation literature presents the temporal dimension of subsidies as a benefit, the valorization problem is hard to overcome since governments have no information on the costs of specific inventions or on their value for consumers. In this scenario, the calibration of tax subsidies is as difficult as governments guessing what the price of a good should be.¹⁵¹

146. Hayek criticized standard economics for presuming to have access to all economic information. See HAYEK, *supra* note 84, at 48 (“I must now turn to the question of what are the concrete hypotheses concerning the conditions under which people are supposed to acquire the relevant knowledge and the process by which they are supposed to acquire it.”).

147. See Hayek, *supra* note 86, at 9-10, 13.

148. See Hemel & Ouellette, *supra* note 3 at 333-42. This Article will not repeat all the benefits for tax subsidies summarized in Part I. It is uncovering problems with rewarding innovation at the early stage, which naturally connects to all presumable benefits.

149. *Id.* at 336.

150. *Id.* at 340-41.

151. In a way, it simply *is* the same task since the point of tax subsidies is to level market profits to the optimal level.

Proponents of tax subsidies will try to solve the valorization problem by arguing that governments do not need to decide on the amount of subsidies.¹⁵² Unlike with prizes, the amount of tax subsidies is calculated in relation to the costs that businesses *themselves* invest.¹⁵³ This explains why the literature notes that subsidies are “market-set instruments”: The entrepreneurs, not the government, decide what inventions are worth pursuing.¹⁵⁴ There is some truth to this argument, in the sense that tax subsidies, unlike prizes, are not purely government-set rewards and operate within a wider context of market competition. This is why the literature argues that R&D credits “essentially cast[] the government as a financing partner,” with taxpayers choosing which projects to pursue and the government providing a matching grant.¹⁵⁵ For various reasons, the fact that subsidies are transferred in relation to costs actually incurred by inventors is not sufficient to prove that tax subsidies deal well with the knowledge problem or to qualify them as market-set tools.

First, even if tax subsidies are calculated based on the amount of expenditures businesses incur, this occurs at a stage when little is known about the actual costs of the project.¹⁵⁶ This issue about the actual costs of an invention, and thus the amount of subsidies to allocate *ex ante*, is magnified when we realize that the bulk of the costs of innovation are in *commercialization*, the process by which inventors bring their new products to consumers.¹⁵⁷ As for prizes, scholars argue that “it may be appropriate for rewards to be deferred until after there has been some time for commercialization,” as only at this stage do the true costs of commercialization reveal themselves.¹⁵⁸ If *ex post* rewards need to be postponed as much as possible to deal with information problems related to project costs, one may legitimately wonder

152. Hemel & Ouellette, *supra* note 3 at 328.

153. This is true in both theory and in practice, where the amount of tax subsidies to be allocated is calculated based on the statutory formula. In a radical simplification, section 41 provides a dollar-for-dollar tax credit of 20% of the qualified research expenses over a base amount, with the base amount calculated as a function of past spending and gross receipts. See I.R.C. § 41(a)(1).

154. Hemel & Ouellette, *supra* note 3, at 328.

155. *Id.* at 328 n.125. (Hemel and Ouellette refer to the work of Saul Levmore in their article.); *see also id.* at 375-76.

156. On the uncertainty of the innovation process and the importance of the commercialization process, see Sichelman, *supra* note 101, at 355-80 (observing that the unpredictability of the innovation process undercuts the current patent system and drives the commercialization debate in IP law).

157. *See* Barnett, *supra* note 78, at 1114 (“The second concern is whether commoditized content markets, in which copyright is weak, copy-protection technologies are limited, and market rents mostly flow to aggregation intermediaries, can support the efficient production and commercialization of content assets.”); Kieff, *supra* note 109, at 747-50 (the patent system rewards not just invention but more importantly commercialization). *See generally* Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977) (launched “the prospect theory of patents” which means that patents are not just rewards for inventions but incentives for technological investment *after* the patent has been granted).

158. Abramowicz, *supra* note 7, at 175.

whether tax subsidies, kicking in before investment, can truly deal with information problems *even if* they connect to costs that businesses decided to incur. Because of its *ex ante* nature, the knowledge problem that hinders the prize proposal only grows when it comes to tax subsidies. The reality and the importance of commercialization raise the case for a reward system that acts at a later stage and calculates the reward size when more is known about the costs of inventions after commercialization.¹⁵⁹

Second, even if tax subsidies are connected to costs incurred by businesses, not only are the costs not fully known (the first point), but there is also no information regarding *the value* that consumers attach to a specific novelty. The point of innovation policy (whether involving subsidies or patents) is to increase rewards and satisfy consumer preferences with goods that would not be profitable without the reward.¹⁶⁰ Tax subsidies kick in *ex ante*, at a moment when very little is known about consumer demand for a specific novelty. Absent any consumer demand benchmark, a tax subsidy will be either too high or too low. Let us go back to the example of the remedy for male pattern baldness. Hemel and Ouellette assume that the cost (\$1) does not offset the social value (one hundred bald men will purchase the drug if it is priced at \$1, etc.) and therefore propose to subsidize the project by 25%. Under epistemic uncertainty, it is quite possible that bald men actually were willing to pay \$5 for the remedy, which makes the subsidy a waste. It is also possible that bald men would buy the product only if it is priced at twenty-five cents because their desire to grow hair is very low. In that case, too, the subsidy was a waste because the project was not worth subsidizing. Even if the research credit connects to costs borne by businesses, this does not mimic the price signaling function within a market: at this stage we have no information on the individual utility curves or the demand schedule in aggregate.¹⁶¹

Third, it is not because tax subsidies are allocated to incurred investments that we can talk about a market-set instrument. Markets are economic systems where the government organizes competition between entrepreneurs through a system of general rules of the game and where *consumers* are the arbiters who get to allocate profit and loss.¹⁶² While tax subsidies operate within a market, subsidizing some

159. See *infra* Section II.D.3.

160. See *infra* Section II.D; The production of innovative knowledge is traditionally conceptualized as a positive externality—a good that produces benefits that cannot be charged directly to consumers. See SCOTCHMER, *supra* 23, at 35 (“However, the efficient competitive price, zero, will not cover the costs of developing the software and therefore the market will not work.”); Arrow, *supra* note 14, at 619 (“To sum up, we expect a free enterprise economy to underinvest in invention and research . . .”).

161. This also applies to the amount of tax subsidies to be allocated under U.S. tax law, which is calculated based on the statutory formula. See I.R.C. § 41(a)(1).

162. On the notion of consumer sovereignty, see Viktor J. Vanberg, *Market and State: The Perspective of Constitutional Political Economy*, 1 J. Inst. Econ. 23, 37-41 (2005).

investments is *in itself* not a market instrument.¹⁶³ The literature assumes that businesses will autonomously pursue specific innovations and that the government acts solely as a “financing partner.”¹⁶⁴ Empirical data contradict this, as tax incentives create feedbacks whereby obtaining the tax subsidy will often be the main driver of business decisions.¹⁶⁵ It is not because subsidies were obtained that the costs were incurred. Various sources report how tax incentives give rise to re-labeling practices as accounting firms strive to qualify already-incurred costs as deductible expenses in order to take advantage of the tax benefits.¹⁶⁶ It suffices to say that since consumer choice is not the driving force behind the distribution of tax subsidies, this is not a market instrument. Consequently, we cannot attribute the same knowledge-generating qualities to tax subsidies.

This Article shows that governments cannot calibrate tax subsidies in accordance with the costs and values of specific projects because no one knows the values of these variables at the time of investment.¹⁶⁷ Additionally, these values will differ for every single product, so tailoring the tax benefit efficiently would demand differentiated solutions for every single case, which makes the policy even more infeasible.¹⁶⁸ Policies that grant rewards before the market process require information that reveals itself only *ex post* through exchange. The result is that often the wrong projects will receive subsidies (the identification problem) or potentially successful experiments will receive excessive or insufficient dollars (the valorization problem). The difficulty of allocating rewards *ex ante* makes the case for a reward system that acts at a later stage, when more is known about the costs (for instance, through commercialization) and relative value of inventions.

163. Proponents could respond that they are qualifying tax subsidies as market-set instruments because they work in combination with market-set instruments (like patents). But if this were the case, the knowledge-generating elements cannot be ascribed to the subsidies, as they are now, in the literature.

164. See Hemel & Ouellette, *supra* note 3, at 375-76. Hemel and Ouellette refer to the work of Saul Levmore in this article. *Id.* at 375 n.327.

165. David, Hall & Toole, explain how tax incentives lead to private R&D being replaced and to alterations in its composition; firms will favor projects that will generate profits in the short run. See David, Hall & Toole, *supra* note 18, at 502.

166. Shay, Fleming Jr. & Peroni, *supra* note 16, at 443. See generally Stacie K. Laplante et al., *Limits of Tax Regulation: Evidence from Strategic R&D Classification and the R&D Tax Credit*, 38 J. ACCT. & PUB. POL’Y 89 (2019).

167. Note that to allocate the tax subsidy, one needs to know the net first mover benefit. Subsidies are thus subject to the same problems as prices. See Roin, *supra* note 7, at 1035 (“The prize system requires the government to identify an appropriate measure of social value because the default measure of social value provided by patents—that is, consumers’ willingness to pay—is intentionally eliminated to avoid deadweight loss.”).

168. This would also demand discretionary powers over the entire economy, which this Article discussed in Part III.

4. *Tax Subsidies and Distributive Justice*

This Article has thus far concentrated on two alleged strengths of tax subsidies: their capacity to aggregate decentralized information and their temporal nature—that is, the benefit of allocating rewards at the time of investment.¹⁶⁹ This brings us to the last benefit of tax subsidies: their distributional properties. Patents are user-paid, meaning that those transferring payment are the purchasers of the products.¹⁷⁰ Tax subsidies are funded via cross-subsidization. Because they are financed by a broad tax base, the costs of the rewards are spread over all taxpayers, so non-users subsidize users.¹⁷¹ Since both tax subsidies and patents are presented as market-based tools, and hence efficient, the “*who pays*” dimension can be decided alongside noneconomic considerations for the policymaker.¹⁷² The literature presents the case that for specific inventions—for instance, a remedy for deafness—a moral case can be made to sponsor them via cross-subsidization.¹⁷³

The author agrees that notions of distributive justice should inform public policy. But this cannot be done without a bridge to political philosophy. The goods that individuals should receive without necessarily paying for them are goods that individuals have a *moral right* to.¹⁷⁴ This Article agrees with the insight that there are a number of necessity goods, such as education and health care, to which people have a moral claim, even if they cannot afford the market price.¹⁷⁵ However, tax subsidies oriented at the private sector are not in any way an effective or realistic instrument for realizing this policy goal. If specific goods need to be provided without cost to individuals, it seems rather naïve to orient tax dollars to private firms in the hope that they will provide the goods for free to specific individuals. The assurance of specific welfare rights should be accomplished not

169. This Article does not fully describe all the benefits regarding the timing of the reward in Section II.B. Rather, it reveals the lack of information that one has at that stage.

170. Hemel & Ouellette, *supra* note 3, at 346.

171. *See id.* at 348.

172. *Id.* at 347.

173. *Id.* at 345-46; *see* MARK S. STEIN, DISTRIBUTIVE JUSTICE AND DISABILITY: UTILITARIANISM AGAINST EGALITARIANISM 267 (2006) (“When we attend to issues of disability, it seems right that resources be distributed to those who can most benefit rather than to those who are in some way worse off.”); *see also* Mark S. Stein, *Ronald Dworkin on Redistribution to the Disabled*, 51 SYRACUSE L. REV. 987, 988 (2001) (advocating for utilitarianism as the principle by which to redistribute wealth to people with disabilities).

174. *See generally* PHILIPPE VAN PARIJS, REAL FREEDOM FOR ALL: WHAT (IF ANYTHING) CAN JUSTIFY CAPITALISM? (2003), <https://oxford.universitypressscholarship.com/view/10.1093/0198293577.001.0001/acprof-9780198293576?rskey=sqCjX1&result=1> [<https://perma.cc/FLX6-U4X3>] (arguing that individuals have moral rights to receive an income unconditionally).

175. This line of thinking in political philosophy is known as “sufficientarianism.” *See* HARRY G. FRANKFURT, THE IMPORTANCE OF WHAT WE CARE ABOUT: PHILOSOPHICAL ESSAYS 134-58 (1988) (setting out the doctrine of sufficiency that means that everyone has a claim to have “enough” rather than to be equal in absolute terms).

through the taxing but through the spending side of government.¹⁷⁶ If distributive justice requires that tax dollars be used to assure those in need of specific goods, there is a case for the public provision of these goods. Public administration seems, by all means, better able to receive tax dollars and allocate goods, possibly after some investigation of whether the potential recipients are in need.

D. Stable, Secure and General Property rights

The combined presence of the *variation* that entrepreneurs raise in the system and the continuous *selections* with which the price mechanism arbiters these novelties leads to constant imputations of new economic phenomena in the system; i.e., innovation.¹⁷⁷ We cannot really steer this evolutionary process one way or another, since doing so would require knowledge of (1) all the possible variations in the system and (2) all the subjective preferences of consumers. That we cannot really orient the process in a specific substantive direction, and that we cannot a priori support some experiments over others, does not mean that we cannot facilitate the process that generates innovation. David Harper confirms that “innovation as an open-ended, dynamic, endogenous process” so “[t]he focus of policy analysis is upon cultivating innovation by securing the appropriate institutional environment.”¹⁷⁸ From an institutional perspective, rather than deciding upon the outcome of the system, we can assist the process of change by strengthening the background institutions that set the system in motion.¹⁷⁹

Now that this Article has shown the flaws of the meta-rationale for tax incentives for innovation and illustrated the ways in which this renders the specific policy unfeasible, some positive conclusions can, tentatively, be reached.

1. Property and Contract Rules

From an institutional perspective, novelty emerges against the backdrop of legal rights that entrepreneurs and consumers rely on to exchange goods and services. The lure of profit that drives experiments requires a legal system in which possession and profit from exchange are actually protected. Consumers are more likely to test and revise their preferences when they know that firms are likely to keep their end of the deal and much deliver to them the services they purchased.

176. This means that necessity goods fall outside the scope of this Article, which is about which rules best promote innovation in the market. If individuals have a right to receive specific goods, the government should buy them and provide them without cost to the user.

177. See RICHARD R. NELSON & SIDNEY G. WINTER, *AN EVOLUTIONARY THEORY OF ECONOMIC CHANGE* 14-17 (1982).

178. Harper, *supra* note 1, at 991.

179. Metcalfe, *supra* note 107, at 68 (“The state is not promoting individual innovation events in this view; rather it is setting the framework conditions in which innovation systems can better self-organize across the range of activities in an economy.”).

Most experiments require cooperative efforts, for which we should retain the traditional rules of contract law that enable us to do business with one another.¹⁸⁰ Novelty is a product of property and exchange, so legal systems that have relatively stable and secure property rights and contract law will facilitate more innovations than systems where one's possessions are insecure or contracts are not enforced.¹⁸¹ So we promote novelty by adopting the rules underpinning the market process, such as the right to keep goods for ourselves, modify them, manage them, or exchange them for things we value more. It is in this regard that David Harper and Anthony Endres suggest that the best innovation policy lies in support for general rules of property and contract.¹⁸²

2. *Stability, Simplicity, and Generality*

This policy advice does not pertain only to the *kind* of rights, *in this case* property rights and freedom of contract, but also to the *form* they take. The Posnerian idea that legal rules should enhance efficiency in society is still prevalent in legal scholarship.¹⁸³ This explains why for standard innovation scholarship, the purpose of the law is social engineering in a world of relatively accessible information.¹⁸⁴ Patent scholar Adam Mossoff, on the other hand, questions whether government officials have the knowledge that would make it appropriate for them to be granted discretionary powers regarding conveyance of patent rights: "Given that professional inventors and businesspersons often fail to predict the next wave of innovation, one may legitimately wonder whether judges have any better institutional competence."¹⁸⁵ Mossoff puts us on the right path to understanding that once we perceive the market as *a discovery process* for resolving a knowledge problem, the purpose of law somehow changes. Since the law can never extract and centralize the knowledge that lies scattered over society, the purpose of law is not to curate efficiency with interventions whose operationalization rests upon information about all the variables at stake.¹⁸⁶ In a world of informational uncertainty,

180. EPSTEIN, *supra* note 78, at 327.

181. See David A. Harper & Anthony M. Endres, *Innovation, Recombinant Capital and Public Policy*, 23 SUP. CT. ECON. REV. 193, 211 (2015) ("The thrust of the argument is that government can cultivate innovation by providing an appropriate institutional scaffolding; government has a role in innovation only to the extent that it supports general rules of property and contract and other basic rules of the game that permit the participation of all potential entrepreneurs and entrepreneurial firms.").

182. *Id.*

183. See generally POSNER, *supra* note 82.

184. Hemel and Ouellette's otherwise insightful theory proposes mixing and matching various instruments depending on the specific variables rests on the idea that we know the value of these variables. See Hemel & Ouellette, *supra* note 13, at 563-86.

185. Mossoff, *supra* note 78, at 731.

186. The knowledge problem was influentially articulated by Hayek. See Hayek, *supra* note 83, at 519 ("The peculiar character of the problem of a rational economic order is

the purpose of law is to install a framework of rules that enables separate individuals to communicate their unique knowledge and coordinate their actions.¹⁸⁷ In providing certainty and fostering predictability of social behavior, the goal of a legal system is to reduce information and coordination costs.¹⁸⁸ Such a system—not specifically intended to enhance efficiency—will be effective in maximizing the production and communication of knowledge between individuals, and will thus maximize wealth for its members.¹⁸⁹

The goal of reducing information and coordination costs suggests a criterion for institutional design.¹⁹⁰ One of the quintessential contributions to this query was made by Richard Epstein, who connects the more abstract Hayekian purpose of law to the virtues of stability, simplicity, and generality of legal rules.¹⁹¹ The central thesis of his now twenty-five-year-old book is that, within a universe of ever-changing and complex interactions, the *simpler* and more transparent the legal rules are, the easier the production of human wealth and prosperity will be.¹⁹² Time and energy are scarce, information is costly, and “the fewer and the more accessible the inputs needed to make any legal decision,” the easier individuals will be able to overcome information barriers and engage in mutually beneficial exchange.¹⁹³ In his institutional analysis, Epstein adds a temporal element when he contends that “while I support innovation in technology and business, I think that *permanence and stability* are the cardinal virtues of the legal rules that make private innovation and public progress possible.”¹⁹⁴ Whereas simplicity reduces the cognitive costs of rules via their content (ideally taking the form of a rule of thumb), stability of rules avoids new costs arising over time because, once the rules are learned, the investment is made and does not need to be renewed.

determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess.”). This is the reason that Mario Rizzo proposes that a simple rule of strict liability is to be preferred to one of negligence in tort law. See Mario J. Rizzo, *Law amid Flux: The Economics of Negligence and Strict Liability in Tort*, 9 J. LEGAL STUD. 291, 317 (1980).

187. Zywicki, *supra* note 78, at 574 (“Legal rules convey information to individual actors about how they should behave and permit accurate predictions about how *other* people are likely to behave, thereby enabling a more seamless dovetailing of expectations and individual plans.”).

188. See Hayek, *supra* note 83, at 521.

189. See HAYEK, *supra* note 77, at 110.

190. Harper, *supra* note 1, at 991-93, 989-91.

191. See generally EPSTEIN, *supra* note 78. But see John Duffy, *Rules and Standards on the Forefront of Patentability*, 51 WM. & MARY L. REV. 609, 611 (2009) (offering the opposite intuition that changing societies and creativity requires “standards [that] can provide the flexibility to accommodate the new and unpredictable wonders of human ingenuity”).

192. See generally EPSTEIN, *supra* note 78, at 21-29.

193. This is how Epstein operationalizes legal simplicity. See *id.* at 27.

194. *Id.* at xii (emphasis added).

Particularly useful for the purposes of this Article is that these virtues apply a fortiori when we wish to promote innovation.¹⁹⁵ Innovation is basically the Achilles heel of the neoclassic model of stasis: It points at the serendipitous and unforeseeable nature of market phenomena.¹⁹⁶ Mario Rizzo argues that complex rules that demand discretionary powers are possible in a very stable and predictable world, yet a dynamic and unpredictable world needs certainty and simplicity.¹⁹⁷ Todd Zywicki agrees: The more complex, decentralized, and thus unpredictable a system is, the more we need simple rules so that dispersed individuals doing many different tasks can incorporate them in their plans and use these rules to coordinate an infinite array of different tasks.¹⁹⁸ By embracing simplicity and stability, legal rules are the institutional life buoys in a world in flux.¹⁹⁹

The last institutional lesson that can be drawn from this institutional account is *generality*.²⁰⁰ By this, it is meant that rules will apply to an infinite variety of yet-unknown people and situations, irrespective of specific circumstances of time and place.²⁰¹ The requirement that rules will apply to all individuals is connected to their coordinative function: If rules apply to all constituents, they help to predict the behavior of *all* individuals.²⁰² Not only will general rules facilitate coordination, but they also maximize the use of decentralized

195. For IP scholars on the importance of legal certainty of the intellectual property rights, see, for example, Douglas Baird & Thomas Jackson, *Information, Uncertainty and the Transfer of Property*, 13 J. LEGAL STUD. 299, 320 (1984) (writing that the “wisdom of [the] rules [governing the transfer of property] turns in large measure on how successfully they enable present and would-be property claimants to reduce the uncertainties that every assertion of ownership brings”); Clifford G. Holderness, *A Legal Foundation for Exchange*, 14 J. LEGAL STUD. 321, 322 (1985) (“A necessary foundation for exchange[.] . . . the law assign[s] all rights in any resource to a closed class of clearly identifiable persons, each of whom is able (both physically and mentally) to contract at any moment.”); Troy A. Paredes, *A Systems Approach to Corporate Governance Reform: Why Importing U.S. Corporate Law Isn’t the Answer*, 45 WM. & MARY L. REV. 1055, 1133-34 (2004) (writing that “[l]egal certainty” is “part and parcel of well-defined property rights” and that it “is a valuable asset that facilitates business and investing”).

196. See generally Ben Depoorter, *The Several Lives of Mickey Mouse: The Expanding Boundaries of Intellectual Property Law*, 9 VA. J.L. & TECH. 1 (2004) (observing that the goods that intellectual property law tries to regulate change systematically).

197. Rizzo, *supra* note 186, at 291.

198. See generally Todd J. Zywicki, *Epstein and Polanyi on Simple Rules, Complex Systems, and Decentralization*, 9 CONST. POL. ECON. 143 (1998).

199. See Rizzo, *supra* note 186, at 291.

200. See Frederick Schauer, *The Generality of the Law*, 107 W.V. L. REV. 217, 233 (2004); see also Charles Delmotte, *Tax Uniformity as a Requirement of Justice*, 33 CANADIAN J.L. & JURIS. 59, 73 (2020) (connecting the concept of generality to protection against misuse of power and applying this to tax issues).

201. Interestingly, Gallini and Scotchmer defend the opposite view. Gallini & Scotchmer, *supra* note 5, at 71 (“We thus believe that it is incorrect to criticize the economic design arguments on grounds that, in IP, ‘one size fits all.’ While we do not think it would be appropriate to define new IP regimes for every small category of technology, we wish to emphasize that the Congress can exercise as much flexibility as it wishes, and that courts also have some flexibility.”). This Article discusses the repercussions of the view expressed in it in Section II.D.

202. Zywicki, *supra* note 78, at 587.

knowledge.²⁰³ The law cannot foresee the circumstances that enable novel experiments or the kinds of projects that will be successful, so rules for innovation must facilitate the use of unpredictable circumstances, subjective knowledge, and suddenly appearing opportunities by people we do not know.²⁰⁴ In order to maximize the use of knowledge for these future entrepreneurs, we need a legal system that is open-ended and that will apply to a wide range of unforeseeable circumstances.²⁰⁵ *Ceteris paribus*, this means that innovation policy will favor abstract rules of conduct that enable individuals to pursue their own goals while using “local knowledge at the point of local decision-making.”²⁰⁶

3. Intellectual Property Rights

With these institutional cues in mind, we can extend the defense of property rights to intellectual property rights. The purpose of this Article is not to present a full-blown defense of patents. This Article also does not deny that patents and tax subsidies are policy complements, rather than substitutes. Accepting the broader framework of the context-specific balancing of different incentive mechanisms, this Article has shown how information problems with tax subsidies are severely underestimated in the current literature.²⁰⁷ Within contexts of decentralized and hidden knowledge, this paper tentatively suggests a preference for ex post measures (like patents) and suggests caution about ex ante policies (such as subsidies). From a comparative perspective, patent rights will promote entrepreneurial experiments while being less vulnerable to the informational challenges that this Article has uncovered.

203. The information problem thus raises the case for rules over standards. See this debate generally in FREDERICK SCHAUER, *PLAYING BY THE RULES: A PHILOSOPHICAL EXAMINATION OF RULE-BASED DECISION-MAKING IN LAW AND IN LIFE* (1991); Louis Kaplow, *Rules Versus Standards: An Economic Analysis*, 42 DUKE L.J. 557 (1992); Duncan Kennedy, *Form and Substance in Private Law Adjudication*, 89 HARV. L. REV. 1685 (1976); Russell B. Korobkin, *Behavioral Analysis and Legal Form: Rules vs. Standards Revisited*, 79 OR. L. REV. 23 (2000); Eric A. Posner, *Standards, Rules, and Social Norms*, 21 HARV. J.L. & PUB. POL'Y 101 (1997); Pierre Schlag, *Rules and Standards*, 33 UCLA L. REV. 379 (1985); Cass R. Sunstein, *Problems with Rules*, 83 CALIF. L. REV. 953 (1995).

204. The unpredictability of the innovation process gets mentioned in the commercialization debate in IP law, as various scholars notice the difficulty the law has in foreseeing which patents—and thus innovations—will end up being successful with consumers. See generally Sichelman, *supra* note 101, at 355-80; Kieff, *supra* note 109, at 747-50.

205. Burk & Lemley, *supra* note 4, at 1636 (discussing how industry-specific statutes fail to be effective since “they are drafted with current technology in mind and are not sufficiently general to accommodate the inevitable change in technology”).

206. Cole, *supra* note 89, at 119-20 (stating that the dissemination of knowledge is the institutional purpose of legal rules).

207. Hemel and Ouellette have a slight preference for tax subsidies over patents in cases of decentralized information. See Hemel & Ouellette, *supra* note 3, at 557 (“Finally, refundable tax credits, like patents, are most effective when the government is at a disadvantage evaluating projects, but they may be more effective than patents when researchers face a high risk of failure and run up against binding capital constraints.”).

Patent law is less required to favor some experiments or expenditures over others.²⁰⁸ Although some minor discretion cannot be avoided (e.g., in the drafting of patent law and in the process whereby patents are granted),²⁰⁹ the design of patent law basically constitutes a general recognition of a *private right* over inventions “by providing effective judicial remedies against infringers, both private citizens and public officials . . . [and] in securing the alienation of patents in the marketplace on legal and commercial par with other property rights.”²¹⁰ Within this private law approach, it is substantially less necessary for the government to curate innovation by selecting the operations and expenditures, as it must do in granting tax subsidies.²¹¹ When patent legislation is drafted in a general fashion and the granted

208. See *supra* Section II.C.3. Patent rules are general when the conditions for patentability apply to all patentable subject matter. In this regard, the United States Supreme Court has held that patent standards in the United States are designed to adapt flexibly to both old and new technologies, encompassing “anything under the sun that is made by man.” *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980) (citing S. Rep. No. 82-1979, at 5 (1952); H.R. Rep. No. 82-1923, at 6 (1952)). For a contrary approach, see *Harvard Coll. v. Canada (Comm’r of Patents)* (2002), 4 S.C.R. 45, 46 (Can.) (holding that the Canadian Patent Act, unlike the United States Patent Act, does not automatically cover new technologies and specifically does not encompass transgenic higher organisms). Some patent scholars advocate a more divergent patent law based on industry-specific variables. Gallini & Scotchmer, *supra* note 5, at 70-71 (defending the divergence of patent law for specific industries, and proposing to tailor the optimal length, breadth, and standard for protection to the “shape of the demand curve, the rate at which improvements to existing technologies are developed, or the relative costs of sequential innovators”); see also Burk & Lemley, *supra* note 4, at 1589-95 (defending a uniform patent law yet making a case for judicial interpretation of patent law with sensitivity to the characteristics and nature of particular industries).

209. The author does not deny that patent law needs to determine general conditions for patentability, like subject matter and novelty, and the patent office needs to screen whether specific novelties meet these requirements. The matter discussed here is whether different patent rules should be tailored to different innovations. In the debate on the supremacy of general rules versus industry-specific interventions, the author defends the restoration of the former.

210. Adam Mossoff, *Institutional Design in Patent Law: Private Property Rights or Regulatory Entitlements*, 92 S. CALIF. L. REV. 921, 923 (2019). See generally Depoorter, *supra* note 196, at 45 (conceptualizing patents as “exclusion rights”: “Other potential users of the resource are constrained not only from manufacturing, but also from using, selling, or importing the resource without prior consent from the patent holder.”); Henry E. Smith, *Intellectual Property as Property: Delineating Entitlements in Information*, 116 YALE L.J. 1742, 1744-51 (2007) (conceptualizing patents as property rights).

211. Unfortunately, patent law in the last few decades was tailored to the needs and desires of particular industries. This has led to numerous sector-specific divergences in patent law being granted by Congress. See Burk & Lemley, *supra* note 4, at 1631-38 (criticizing the emergence of industry-specific statutes); Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1844 (1984) (“In addition, the more one attempts to vary the patent life and the rules of exploitation industry by industry and case by case, the less compelling becomes the justification for rewarding invention through a patent system at all. In theory, direct reward systems are preferable because they avoid the monopoly costs associated with a general patent system. A central reason for reliance on a patent system is that it is thought to be too difficult to determine the appropriate level of reward fairly and accurately on a case-by-case basis.”).

patent rights avoid the danger of being too broad,²¹² experiments emerge in a relatively bottom-up way as entrepreneurs “use their superior knowledge to screen investments” and rely on patent protection in the hope of monetizing their experiments.²¹³ Tax subsidies, on the other hand, are regulatory entitlements that cash out rewards before the market process occurs, meaning that provisions drafted in a general and broad fashion would mean a budgetary disaster. By virtue of being *rewards* handed out (rather than private *rights* that can be used in a market), subsidies will always be more specific and tailored than patents. Since subsidies actually transfer tax dollars to companies, the knowledge problem with subsidies multiplies as governments need to identify which projects are new and potentially successful.²¹⁴ From a comparative perspective, well-designed patent law merely recognizes “enforceable and tradeable property rights”²¹⁵ and delegates the bulk of this identification problem—which projects will count as innovation—to entrepreneurs on the ground, when they file and pay for patents.

The second comparative benefit is that patents are essentially agnostic to the reward size that should be granted to specific innovations.²¹⁶ With tax subsidies, some statutory formula inevitably has to be used to decide how many tax dollars should be allocated in advance of the market process, while patent rights delegate such questions to a large degree to consumers on the ground.²¹⁷ Contrary to

212. So, while patent legislation must be general and subject matter must be defined broadly, patents themselves must be narrow since the goal is to grant entrepreneurs a property right on *their specific innovation*, not for them to monopolize an entire industry with their product, marketing technique, or business model, which would stifle competition. See Sichelman, *supra* note 101, at 401 (stating that patents “should be limited exactly to the product described in the specification”).

213. Gallini & Scotchmer, *supra* note 5, at 55. Mossoff points at “the ‘democratization’ effects that accessible, reliable, and effective property rights have historically achieved via the private law model of the U.S. patent system.” See Mossoff, *supra* note 210, at 940.

214. Putting tax subsidies and patents on an equal footing somehow misses the point that patents are private property rights, not regulatory entitlements. See Mossoff, *supra* note 210, 923-25.

215. *Id.* at 940.

216. Hemel and Ouellette argue that tax subsidies avoid carrying with them a problem of “reward size” of the kind discussed here in Section II.D.2 only by assuming some non-tax tools that actually define the reward size. See Hemel & Ouellette, *supra* note 3, at 328 (“Like patents, tax incentives cause innovators to pursue inventions that will succeed in the market: refundable tax credits do not refund 100% of R&D costs, so innovators will seek to recover the rest of their costs by appropriating some of the benefit of their invention through mechanisms such as first-mover advantage (or weak patents).”). Since Hemel and Ouellette rely on patents or the first mover principle to “solve” the reward issue, it can only mean they somehow realize subsidies themselves cannot solve the reward problem.

217. The author admits that the difference is one of degree since, for patents, governments nonetheless have to define the contours of property rights, namely the duration, subject matter, and scope of the patent. Both of these concern policy decisions that have an indirect effect on the rewards that companies will be able to reap. Nonetheless, patents remain “rules of the game” since legislators can determine these conditions in a fairly general way and, consequently, exchange with consumer is still the event that triggers the reward.

a system where R&D support is derived through tax measures, under a patent approach, income can be generated only in the event of *consumer consent* to purchase the product or service.²¹⁸ Reiterating that the market is a solution to a knowledge problem, it is clear that patents, at least conceptually, are more capable of dealing with the decentralized nature of human knowledge.²¹⁹ A subsidy approach relies on the minds of a few government officials and entrepreneurs (when they apply for the subsidy) to determine the reward size, whereas patents, by virtue of being a user-paid system, garner information from all individuals within a marketplace.²²⁰

By transferring the decision on the reward size to consumers within the market, patents also overcome the uncertainty regarding the costs of commercialization.²²¹ Giving inventors a property right over their inventions postpones the question of the proper remuneration for costs. Under the IP approach, inventors can respond to the costs of commercialization along the way, when they reveal themselves, and take these into account when they deal with investors and consumers.²²²

Once we depict the market as a discovery process, *ex post* (i.e., user-paid) market tools appear a tautology and *ex ante* market rewards seem an oxymoron: The market is a solution to knowledge problem. Since the market is a device to find out what the costs and value of specific novelties are, we have no informational benchmark to *ex ante* grant rewards to any initiative. The property approach has unique knowledge-generating qualities, since to a large extent it authorizes consumers on the ground to answer the valorization question.

218. See Gallini & Scotchmer, *supra* note 5, at 70 (“In addition, IP encourages firms to accelerate progress, since the reward is conditional on success.”).

219. This is not to deny that there are forms of “patent failure,” for instance in case of patent trolling, where private companies’ business model is the litigation of patents rather than profit via consumer consent. For an interesting contextualization of patent trolling, see generally Mark A. Lemley & A. Douglas Melamed, *Missing the Forest for the Trolls*, 113 COLUM. L. REV. 2117 (2013).

220. Markets incorporate both information about people who decide to buy something and about those who decide to forego a product because, for instance, the price is too high. Except with respect to patents of products that meet basic needs, which fall outside the scope of this Article, consumers can always reject a product by not buying it.

221. See Kieff, *supra* note 109, at 707 (“Any system focused on rewarding inventive effort, when an actual good or service is brought to the market, runs the risk of failing to address the activities that take place after an invention is made but before it can be profitably exploited.”).

222. For various scholars, this is one of the strengths of patents. This Article is one of the first to properly understand this as a knowledge problem. For references to the uncertain process of commercializing inventions, see generally Sichelman, *supra* note 101, at 355-80; Kieff, *supra* note 109, at 707-12; Jonathan M. Barnett, *Why Is Everyone Afraid of IP Licensing?* 30 HARV. J.L. & TECH. 123 (2017) (describes the role of licensing in the commercialization process).

III. PUBLIC CHOICE THEORY

A. *Tax Incentives for Innovation:
A Public Choice Critique*

In Part II, this Article explained how information problems undermine the operationalization of subsidies. Since James Buchanan and Gordon Tullock published their *Calculus of Consent*, scholarship has focused on how political opportunism shapes the design and working qualities of legal rules.²²³ The exercise is indeed to treat government “as a network of individuals, each with an incentive to maximize his own interest.”²²⁴ The introduction of the “self-interestedness assumption” in the fiscal process means individuals and corporations will engage in political exchanges with politicians, not to pursue some external goal, but to minimize their tax liabilities.²²⁵

One of the key observations in tax literature is how the interplay between private groups and policymakers produces fiscal exceptionalism and complexity.²²⁶ Empirical scholarship seems to warrant these public choice concerns and reports that whenever politicians have the liberty to reduce the tax burden on specific groups or industries, potential and real beneficiaries will mobilize through voting and lobbying in order to slash their tax debt.²²⁷ For Allison Christians, this entanglement between private interest and fiscal policy generated a tax system that “becomes increasingly unresponsive to legitimate policy goals and increasingly out of touch with justice.”²²⁸ As a result, discretionary powers are subject to rent-seeking whereby the politically affluent create benefits by exempting themselves from taxation. These are pure rents in the sense that the increased income

223. Public Choice Theory sets up models and predicts behavioral patterns based on the assumption that voters politicians and bureaucrats will behave opportunistically. *See generally* EAMONN BUTLER, PUBLIC CHOICE—A PRIMER (2012); JAMES M. BUCHANAN & GORDON TULLOCK, THE CALCULUS OF CONSENT: LOGICAL FOUNDATIONS OF CONSTITUTIONAL DEMOCRACY 206-207 (Liberty Fund 1999) (1962).

224. Fred S. McChesney, *Rent Extraction and Rent Creation in the Economic Theory of Regulation*, 16 J. LEGAL STUD. 101, 101 (1987).

225. *See* JAMES M. BUCHANAN & ROGER D. CONGLETON, POLITICS BY PRINCIPLE, NOT INTEREST: TOWARD NONDISCRIMINATORY DEMOCRACY 90 (1998).

226. *See* Allison Christians, *Putting the Reign Back in Sovereign*, 40 PEPP. L. REV. 1373, 1399 (2013); Barry, *supra* note 16, at 15 (“It seems more likely that a company lobbying for tax policy changes will simply seek to minimize its tax liability through some sort of special industry-focused carve-out.”).

227. Brian Kelleher Richter, Krislert Samphantharak & Jeffrey F. Timmons, *Lobbying and Taxes*, 53 AM. J. POL. SCI. 893, 893 (2009); Jennifer L. Brown, Katharine Drake & Laura Wellman, *The Benefits of a Relational Approach to Corporate Political Activity: Evidence from Political Contributions to Tax Policymakers*, 37 J. AM. TAX’N ASS’N 69, 69 (2013); Raquel Alexander, Stephen W. Mazza & Susan Scholz, *Measuring Rates of Return for Lobbying Expenditures: An Empirical Case Study of Tax Breaks for Multinational Corporations*, 25 J.L. & POL. 401, 404 (2009).

228. Allison Christians, *Trust in the Tax System: The Problem of Lobbying*, in BUILDING TRUST IN TAXATION 151, 151 (Bruno Peeters, Hans Gribnau & Jo Badisco eds., 2017).

does not involve the production of social welfare but gets financed by a transfer of means from other taxpayers less influential in the political process.²²⁹

Because of the *direct* effect that tax rules exert on profits of individuals and corporations, tax policy can be expected to be highly vulnerable to rent-seeking.²³⁰ Tax credits, for instance, create a dollar-for-dollar benefit. The intimate nexus between the operationalization of tax rules and the net revenue of taxpayers explains why so many corporations invest in tax lobbying.²³¹ In another work, the author has described the behavior that occurs in relation to the possibility of tax exemptions as a form of prisoner's dilemma.²³² Although each party can benefit from the provision of public goods under some equal taxation principle, the optimal strategy is to maximize income by transferring the tax burden onto other taxpayers. Unless there are additional checks, tax rules that enable differentiated taxation between taxpayers unavoidably bring with them the risk of rent-seeking.

While innovation scholars sketch scenarios where policymakers can alleviate the tax liabilities of innovating companies, there is no guarantee that policymakers will reduce the tax burden for specifically those types of industries or expenditures that are proposed by the theory.²³³ Quite the contrary, public choice economics predicts that tax benefits will be directed to economic corporations with decisive political influence.²³⁴ The general risk of regulatory capture is exacerbated for tax subsidies because of the knowledge problem discussed in Part II. Since, paraphrasing Mark Lemley, no one knows what causes innovation, there is no scientific or objective list of input expenditures that should be met with tax relief.²³⁵ Private parties are more likely to manipulate systems of differentiated taxation when it is unclear how they should be shaped in the first place. When the

229. See generally COMPANION TO THE POLITICAL ECONOMY OF RENT SEEKING (Roger D. Congleton & Arye L. Hilman eds., 2015); Delmotte, *supra* note 200.

230. Hemel and Ouellette agree, yet do not ascribe this defect to tax subsidies since these are claimed to be market-set rewards. Hemel & Ouellette, *supra* note 3, at 327 ("Government set rewards also raise the significant risks of politicization, rent-seeking, and mismanagement, which may explain why the social rate of return on R&D funded through government grants has been estimated to be lower than on private R&D.").

231. Richter, Samphantharak & Timmons, *supra* note 227 (when U.S. firms increase their lobbying expenditures by 1% in a given year, they reduce their effective tax rates by an average of 0.5 to 1.6 percentage points the following year); Alexander, Mazza & Scholz, *supra* note 227 (estimating the return on investment from political influence on the U.S. Job Creation Act (2004) to be as high as 22,000%, meaning that every dollar invested in lobbying yields a return of \$220).

232. Delmotte, *supra* note 200, at 68.

233. See RICHARD E. WAGNER, POLITICS AS A PECULIAR BUSINESS: INSIGHTS FROM A THEORY OF ENTANGLED POLITICAL ECONOMY 35-36 (2016) (opining that "there is no strong reason to think that political processes would *operate* in the manner the theory *envisions*").

234. See BUCHANAN & TULLOCK, *supra* note 223, at 285-86; see also BUTLER, *supra* note 223, at 60-61.

235. See Lemley, *supra* note 95, at 139.

pressure that naturally emerges when governments can create tax benefits (the public choice worry) is combined with the fact that there is no objective consensus of the actual beneficiaries of such exemptions (the knowledge problem) the result is: “an ‘anything goes’ regime, a political jungle in which well-organized subgroups of society are successfully fighting for controversial privileges at the expense of (the welfare of) their fellow citizens.”²³⁶

Empirical data point in the direction of these public choice concerns. Various sources report on the political pressures that industries have exerted on Congress and the IRS to shape the application and interpretation of innovation subsidies in the IRC.²³⁷ While small companies have fewer resources and lack the networks needed to buy political influence, large corporations with strong lobby forces exert pressures on policy.²³⁸ This could help to explain why 84% of corporate R&D credit amounts were claimed by large corporations with receipts over \$250 million.²³⁹ Tax scholars report that start-up companies are seldom the beneficiaries of innovation subsidies.²⁴⁰ This is specifically problematic since the literature suggests that important innovations are to be expected not from the dominant market players, but from small-scale challengers and start-ups.²⁴¹ If anything, the digital revolution showed how disruptors, from the bottom up, reorganized our economy by launching new products, services, advertising schemes, and business models.²⁴² While further empirical

236. Delmotte, *supra* note 200, at 62.

237. Wamsley, *supra* note 11, at 182. *See generally* Natbony, *supra* note 11.

238. *See generally* BRINK LINDSEY & STEVEN MICHAEL TELES, *THE CAPTURED ECONOMY: HOW THE POWERFUL ENRICH THEMSELVES, SLOW DOWN GROWTH, AND INCREASE INEQUALITY* (2017) (describing how rent-seeking is increasingly pervading our economic system, with artificial profits being made from the opportunity to limit competition or from financial transfers extracted from others).

239. In 2012, 84% of corporate R&D credit amounts were claimed by corporations with receipts over \$250 million. *See SOI Tax Stats*, *supra* note 17; *see also* Kim, *supra* note 17, at 183 (stating that 80% of R&D credits were distributed to corporations with over \$250 million of business receipts in 2001-2005). Other sources also signal that R&D incentives become subject to the lobbying power of big businesses. Various legal scholars report that tax incentives do not benefit start-up companies. *See* Hemel & Ouellette, *supra* note 3, at 337; Morse & Allen, *supra* note 17, at 358-59.

240. Hemel & Ouellette, *supra* note 3, at 337; Morse & Allen, *supra* note 17, at 357; *see also* Barry *supra* note 16, at 11.

241. *See* Robert Hunt & Leonard Nakamura, *The Democratization of U.S. Research and Development after 1980*, in *MEETING PAPERS* 121 (2006); Michael J. Meurer, *Inventors, Entrepreneurs, and Intellectual Property Law*, 45 *HOUS. L. REV.* 1201, 1202 (2008). On a positive link between a country's start-up rates and innovation or economic development, *see* Rui Baptista, Vítor Escária & Paulo Madruga, *Entrepreneurship, Regional Development and Job Creation: The Case of Portugal*, 30 *SMALL BUS. ECON.* 49-50 (2008); *see also* William Bygrave et al., *Executive Forum: A Study of Informal Investing in 29 Nations Composing the Global Entrepreneurship Monitor*, 5 *VENTURE CAP.* 101, 103 (2003); Tobias Weiblen & Henry W. Chesbrough, *Engaging with Startups to Enhance Corporate Innovation*, 57 *CAL. MGMT. REV.* 66, 67 (2015).

242. Netflix and Amazon were newcomers in the industry that reshuffled the entire market. This is one application of Christensen's general thesis that disruptive innovation is

research is needed, this Article proposes an explanation of why empirical research finds little proof that tax subsidies work in practice. Combining the knowledge problem with the reality of rent-seeking for tax benefits, there is little certainty about whether genuine innovators are the prime recipients of subsidies.

*B. Promoting Innovation Within the
Public Choice Tradition*

Patents will be subject to rent-seeking as well. As argued by William Landes and Richard Posner, since the interests of (potential) inventors are concentrated and the interests of the consumers (for less stringent patents) are diffused, the legislative process may well lead to overprotection of creative knowledge.²⁴³ The same economic powers as discussed in the previous section can thus be expected to shape the legislative process by, for example, maximizing the duration of patent protection or broadening the scope of patents.²⁴⁴ To the extent that the generated profits exceed the incentive necessary for companies to produce and market the novelty, these profits are rents as well.²⁴⁵ Also, corporations can file for patents not with the goal to bring novelty into the market, but in order to claim damages after obtaining injunctions in court.²⁴⁶ Patent trolling is a clear form of rent-seeking since means are simply sucked out of other, often real, inventors. Since these two problems, overprotection and patent-trolling, are related yet different, this Article will treat them separately, starting with rent-seeking for overprotection.

Lobbying for tax subsidies results in laws that transfer money from the pockets of citizens to the account of corporations. Lobbying for patent protection results in laws that determine corporations' *private right* over inventions, which they can use to charge other parties when they *consent* to use the corporations' product or against infringers. The first form of rent-seeking involves the use of force to receive money; the second involves the guarantee that force will be used when agreed-upon contracts are not respected or when property is not respected. Ethically, but more importantly economically, these are two different

driven by outsiders and start-ups while market leaders are so focused on keeping their customers that they cannot risk surprising experiments. Clayton Christensen, Thomas Craig & Stuart Hart, *The Great Disruption*, 80 FOREIGN AFF. 80, 82 (2001).

243. See WILLIAM M. LANDES & RICHARD A. POSNER, *THE POLITICAL ECONOMY OF INTELLECTUAL PROPERTY LAW* 14-18 (2004).

244. One often-named example is the Sonny Bono Act, by which Congress retroactively extended copyright by twenty years. See Michele Boldrin & David K Levine, *Rent-seeking and Innovation*, 51 J. MONETARY ECON. 127, 129 (2004); LANDES & POSNER, *supra* note 243, at 16-17.

245. This is the problem of deadweight loss discussed earlier. See *supra* Section I.B. See generally Amy Kapczynski, *supra* note 31; Roin, *supra* note 7, at 1023; Shavell & van Ypersele, *supra* note 7 at 525-26.

246. Silver Blair, *Controlling Patent Trolling with Civil RICO*, 11 YALE J.L. & TECH. 70, 73 (2009).

things.²⁴⁷ While it is undoubtedly true that big companies can influence patent legislation, strong patent protection does not force any consumer to buy a product. This means that except with respect to necessity goods like medication (which are outside the scope of this Article), consumers can protest by using their liberty to *not buy* a product.²⁴⁸ If consumers move away from products, they signal that they do not think the exchange is a mutually beneficial one, leaving entrepreneurs with an incentive to lower the price.²⁴⁹ The scope of the patent is important here, since a system of narrow patent protection will generate more substitution goods for consumers, boosting competition between producers.²⁵⁰

The tax approach does not enable this dynamic: You cannot protest by not paying your taxes.²⁵¹ Under the tax approach, the consequences of self-interest will be channeled in a more socially harmful way, since funds can be extracted from consumers by force. Creation of IP rules will be subject to rent-seeking, yet the effects of lobbying and the reward received are still mitigated by consumer choice. At the end of the day, the property approach secures an essential role for the millions of consumers in the market, limiting the range of profits purely resulting from regulatory capture.

The second nuance is that, for tax subsidies, the problem of rent-seeking seems hard to resolve, whereas for patents, legislation can be enacted that is either less or more vulnerable to rent-seeking. The more patent legislation is *general*, meaning the same conditions apply to the various subject matters, the less specific industries will be tempted to engage in rent-seeking. The reason is straightforward: most creators of intellectual property also purchase intellectual property, so “[a]ny law that strengthens rights to such property beyond the level necessary to assure an adequate supply is likely to increase

247. For elaborations on the ethical or “natural law” foundations of intellectual property, see generally Adam Mossoff, *Rethinking the Development of Patents: An Intellectual History, 1550-1800*, 52 HASTINGS L.J. 1255 (2001).

248. Recall that this Article takes the position that if individuals have a right to receive specific goods (e.g., medication), government should organize its provision. This means that necessity goods fall outside of the scope of this Article, which is about which rules best promote innovation within the market.

249. See ALBERT O. HIRSCHMAN, EXIT, VOICE, AND LOYALTY: RESPONSES TO DECLINE IN FIRMS, ORGANIZATIONS, AND STATES 21 (2004).

250. The goal is to grant entrepreneurs a property right on *their specific innovation*, not for them to monopolize an entire industry with their product, marketing technique, or business model, which would stifle competition. See Sichelman, *supra* note 101, at 401.

251. Ideally, one could protest by migration, yet most scholars agree that transaction costs are many times higher for “voting with your feet,” as compared to having the ability to buy other products. See Nick Cowen, *Markets for Rules: The Promise and Peril of Blockchain Distributed Governance*, 9 J. ENTREPRENEURSHIP & PUB. POL’Y 213, 221 (2020) (“Classical liberals emphasize the power of exit from political arrangements as a necessary part of political accountability (Pennington, 2010). Blockchain schemes allow people to exit without needing to use their actual feet as often. In comparison, voting, especially at large scale, can often be an ineffectual way of providing feedback to a system or holding rulers to account.”); HIRSCHMAN, *supra* note 249.

those input costs.”²⁵² General IP legislation that produces rents for companies in their capacity as IP creators will also generate losses for companies in their capacity as IP users.²⁵³ Hence, another mitigating remedy for patent rent-seeking is to adopt general legislation, which gives IP holders a direct incentive to not demand too much protection. Similar reform in relation to tax subsidies is not possible. Since subsidies do not distribute rights but rather money straight away, a generalized approach would be a budgetary disaster. Also, a general subsidy for all industries and corporations is not an innovation incentive anymore since the very definition of a tax subsidy for innovation is to direct it to some investments and not to others.

Some of these public choice considerations also shed light on the problem of patent trolling. Merges insists that patent trolling emerged in the wake of the strengthening of patent protection.²⁵⁴ Once more, the importance of narrowly defined patents appears. Sichelman says, and this author agrees, that patents must be narrow and “should be limited exactly to the product described in the specification.”²⁵⁵ Indeed, the range of unwarranted injunctions is likely to shrink in lockstep proportion with the broadness of patents, so narrowly defined patents will scare off rent-seekers that acquire patents purely for judicial reasons. Additionally, from a comparative perspective, this Article argues that since patents are granted at a much later stage than tax subsidies, the possibility of governments imposing some qualitative tests and filtering out the rent-seekers enlarges.²⁵⁶ Although the proof is in the pudding—consumer choice—at the time patents are requested, the patent office can perform a rudimentary test to check whether the novelty has been produced or only judicial intentions drive the patent application.²⁵⁷

CONCLUSION

The purpose of this Article is not to contend that tax subsidies can never be used, or to deny that they might have strengths in specific contexts. Rather, the goal of this Article is to show that tax subsidies are not market-set incentives and are not optimal tools for aggregating decentralized information. In cases where we need “private parties [to] decide which projects to pursue” and we want “market actors to

252. LANDES & POSNER, *supra* note 243, at 15.

253. *See id.* The insight, borrowed from Landes and Posner, holds only under general legislation. Rent-seeking will still occur under industry specific legislation.

254. *See* Robert P. Merges, *The Trouble with Trolls: Innovation, Rent-Seeking, and Patent Law Reform*, 24 BERKELEY TECH. L.J. 1583, 1586 (2009).

255. Sichelman, *supra* note 101, at 401.

256. *See* Merges, *supra* note 254, at 1588-89.

257. Merges connects such a “utility requirement” to the timing of the reward: patent should be granted at a relative late stage so that officers can perform a test “by requiring those who obtain a patent to show real technological progress.” *See id.* at 1589.

determine how large the reward will be,” tax subsidies are not the general ground rules that we are looking for.²⁵⁸

Tax subsidies target specific investments *ex ante* in relation to the market process when there is little information on the costs of specific projects or their social value. This means that governments will lack the knowledge required to decide which projects to support and to calibrate the subsidies in any way coherent with the theory of tax subsidies. Additionally, tax incentives allocate rewards via the political process. Given realistic assumptions about political opportunism, we can predict that they are subject to rent-seeking.

From an institutional perspective, a more sensible innovation policy lies in simplifying, stabilizing, and generalizing the rules of property and contract that set the market process in motion. Following the precepts of generality, a patent system equally deals better with the decentralized nature of information. Moreover, it relies on entrepreneurs and inventors to decide which new projects to pursue and on consumers within the marketplace to evaluate the value of these innovations.

Although political problems with respect to the current patent system cannot be neglected, the fact that under the patent approach rewards kick in only when consumers decide to buy a product forms a limited check on rent-seeking and remains a comparative advantage over subsidies. Problems of overprotection and patent-trolling within IP can partially be mitigated by more narrowly defined patents, rather than through tax subsidies, which will only magnify the public-choice problem for innovation policy.

258. Hemel & Ouellette, *supra* note 3, at 307.