JOURNAL
OF
LAW & INNOVATION

VOL. 3 JUNE 2020 NO. 1

HTTPS://WWW.LAW.UPENN.EDU/INSTITUTES/CTIC/JLI/

JOURNAL
OF
LAW & INNOVATION

VOL. 3 JUNE 2020 NO. 1

CONTENTS

ARTICLES

Board of Officers
Volume 3

Editors-in-Chief
Saba Bajwa
Michael Buchwald

Community Relations
Nadia Zivkov

External Partnerships
Adam Zuckerman

Publication
Thomas Kienzle

Symposium Management
Amanda Gould

Symposium Operations
Sue Anna Yeh

Senior Board
Harrison Gunn
Louis Lesser

Senior Editors
Molly Brekhus
Kathryn Gardner
Peter Li
Davina Okonkwo
Meghana Thadani
Alan Waldron

Associate Editors
Colin Benthien
Sarah M. Byrne
Matthew Copeland
Milad Emamian
Zachary Furcolo
Ravina Gogna
Wooseok Ki
Isabel Kim
Alicia Lai
Andrea Leelike
Lillian Li
Emily Losi
Sarah Marmon
Alex Mueller
Ben Nichols
Chris Pak
Jessica Rizzo
Anna Sheu
Maria Tartakovsky
Jeffrey Turben

JOURNAL
OF
LAW & INNOVATION

VOL. 3 JUNE 2020 NO. 1

ARTICLE

EXPERIMENTAL STRATEGIES FOR REGULATING FINTECH

HILARY J. ALLEN[†]

Faced with new technologies that confound existing financial regulatory structures, regulators around the world have been experimenting with new approaches to regulating fintech. The most prominent of these experiments have been innovator-focused programs that provide guidance (and in the case of regulatory sandboxes, regulatory relief) to private sector firms, in order to help them navigate a confusing thicket of financial regulation that might otherwise impede their innovation. These innovator-focused programs can improve efficiency and competition in the provision of financial services, but can—at best—only make incidental contributions to the financial regulatory goals of consumer and investor protection, and the promotion of financial stability. This Article argues that when regulatory resources are scarce, the priority should be experimentation by the regulators in order to advance the

[†] Associate Professor, American University Washington College of Law. Many thanks go to Tom Baker and other participants in the Journal of Law & Innovation's Symposium on "Rethinking Innovation Policy: The Role of the State" for helpful comments and perspectives.

core financial regulatory goals of protecting investors, consumers and the financial system. This Article therefore surveys recent technological experimentation by financial regulators (known as "SupTech") and concludes that while the experimentation to date has been valuable and may improve the execution of longstanding financial regulatory functions, further experimentation is needed to address the new problems and risks created by the rise of fintech.

INTRODUCTION

Our current financial regulatory system is struggling to deal with the rise of fintech, and this Article examines the experimental governmental programs that are being trialed in response. From innovation hubs to regulatory sandboxes to specialty charters, recent efforts by governments and regulatory authorities to promote fintech innovation and competition have been in the spotlight. However, the technological advances afoot in the financial industry also impact the core regulatory goals of protecting consumers, investors and financial stability. This Article argues for financial regulators to experiment more with their own technological approaches to furthering these goals (a phenomenon known as "SupTech"). In particular, such experimentation is needed to respond to the new threats to consumers, investors and financial stability posed by fintech business models that use

technologies like machine learning and smart contracts to deliver financial services in new ways.

All regulators, not just financial regulators, struggle when confronted with new innovations.[2] Under-resourced regulators can find it challenging to keep pace with a nimbler private sector that often seeks to exploit loopholes in regulations that were drafted long before the innovation was even dreamt of. The fear of unintended consequences looms large over any steps that regulators take to regulate the innovation. Regulators must also address new innovations in accordance with their statutory mandates, which are often multiple and conflicting. This Article uses three innovative business models—marketplace lending, robo-investing, and smart contract swaps—as case studies to illustrate some of the new challenges facing four financial regulatory agencies: the Office of the Comptroller of the Currency ("OCC"), Consumer Financial Protection Bureau ("CFPB"), Securities and Exchange Commission ("SEC") and Commodity Futures Trading Commission ("CFTC").

Each of these agencies is currently experimenting with different forms of fintech regulation, but the most visible of these are designed to encourage private sector innovation.[3] Private sector fintech innovation can further regulatory goals of promoting market efficiency and competition in the interests of consumers. However, regulators cannot rely on the private sector to protect investors or consumers from predatory practices, or to ensure the ongoing stability of the financial system. This Article argues that regulators should instead prioritize *their own* technological experimentation in order to further these core regulatory goals. It therefore surveys the current (nascent) state of "SupTech" innovation, and explores many of the challenges it faces. In many respects, these are the perennial challenges—limited resources, opportunities for arbitrage, and fear of unintended consequences—that animate all debates about regulating innovation. Notwithstanding these challenges, however, this Article urges regulators to experiment with SupTech as much as possible. The SupTech innovations advocated for in this article (including circuit breakers for smart contracts and hypothetical data sets for machine learning algorithms) are things that must be "plugged in" to private sector products in order to be effective. Such regulatory strategies will have the most impact if developed while the private sector technology is still in its infancy and therefore more malleable; time is therefore of the essence for SupTech experimentation.

---

[2] For an excellent discussion of the challenges regulators face in regulating new innovations, *see generally* Tim Wu, *Agency Threats*, 60 DUKE L. J. 1841 (2011).

[3] *See infra* Part III.

The rest of this Article will proceed as follows. Part II will briefly engage with the administrative law literature on regulating innovation in general, before using case studies from the financial industry to illustrate some of the particular problems facing the OCC, CFPB, SEC, and CFTC. Part III surveys the most high-profile regulatory experiments conducted by these and other financial agencies and makes clear that these high-profile programs and policies are all designed to encourage private sector innovation. Part III then explores why encouraging private sector innovation will not address the core financial regulatory mandates of consumer/investor protection and financial stability. Part IV then makes the case for SupTech innovation by the regulatory agencies themselves to advance their core mandates and considers the challenges facing SupTech innovation.

II. THE CHALLENGES OF REGULATING NEW FINANCIAL TECHNOLOGIES

Innovation is the process by which the economy is revitalized with new types of products and services, as well as new ways of providing existing products and services.[4] However, while often beneficial, innovation is not always improvement, and so regulators must remain alert to the new ways in which products and services are being provided.[5] All types of innovation pose some basic challenges for regulators. First, because innovation often allows outcomes to be achieved in ways that were previously unanticipated, existing regulatory structures often do not contemplate that innovation. As a result, desirable processes and outcomes might be unintentionally prohibited, whereas problematic processes and outcomes might be unintentionally permitted by the regulatory structures already in place.[6] Regulators can seek to update their regulations to address innovation, but the pace of innovation is typically more rapid than the slow-moving apparatus of regulatory action.[7]

---

[4] *See, e.g.*, JOSEPH SCHUMPETER, CAPITALISM, SOCIALISM AND DEMOCRACY 82–83 (1975) (describing progress as the "destruction of capital values in the strata with which the new commodity or method of production competes").

[5] *See* Hilary J. Allen, *A New Philosophy for Financial Stability Regulation*, 45 LOY. U. CHI. L. J. 173, 215-22 (2013) (discussing the hazards of heralding the latest advancement as necessarily the best).

[6] *See* Eric Biber et al., *Regulating Business Innovation as Policy Disruption: From the Model T to Airbnb*, 70 VAND. L. REV. 1561, 1565 (2017) (describing a "policy disruption" as "disjunction between the structure of the regulatory system and the industry that is being regulated").

[7] *See* Wu, *supra* note 2, at 1851 (describing such speed-related issues that arise when regulating an uncertain or developing industry); *see also* Dan Awrey, *Complexity, Innovation,*

Furthermore, if rules are adopted before the innovation is properly understood, they may become sticky and hard to change, even if it ultimately becomes clear that they are poorly suited to the evolved innovation.[8] On the other hand, if regulators wait too long, the market for the innovation can become well established and regulators may then be loath to intervene for reasons of political economy.[9]

Regulators are typically under-resourced when compared with the private sector's technical expertise and funding, and often struggle to keep up with the pace of innovation.[10] As a result, regulators become increasingly reliant on the industry for information and expertise, which can breed regulatory capture (a condition in which regulators start to take on the worldview of the industry they regulate, as opposed to prioritizing the interests of the public they are charged to protect).[11] This type of capture is particularly likely to arise when there is no crisis at hand to motivate the public to call regulators to account.[12] In such circumstances, regulators face few negative consequences for neglecting the public interest, and an uphill battle in challenging the interests of the industry.

Even when regulatory measures are taken, market participants will typically adjust their behavior in light of the new standards.[13] If those adjustments involve acting in a way designed to skirt the regulation, then they are known as regulatory arbitrage—a perennial thorn in the side of any

---

and the Regulation of Modern Financial Markets, 2 HARV. BUS. L. REV. 235, 239 (2012) (discussing that "the pace of innovation has left financial regulators and regulation chronically behind the curve").

[8] Wu, *supra* note 2, at 1849-50 (pointing out that the regulatory landscape may be set before any of the key players have even had a chance to weigh in).

[9] *See* Allen, *supra* note 5, at 223 (arguing that as an industry grows, regulators will be more subject to capture by certain interest groups).

[10] *See* Yueh-Ping (Alex) Yang & Cheng-Yun Tsang, *RegTech and the New Era of Financial Regulators: Envisaging More Public-Private Partnership Models of Financial Regulation* 21 U. PA. J. BUS. L. 354, 360-61 (2018) (discussing the problems associated with regulators' naturally slower speeds).

[11] *See also* Hilary J. Allen, *Putting the "Financial Stability" In Financial Stability Oversight Council*, 76 OHIO ST. L. J. 1087, 1102 (2015) (discussing the related phenomenon of cognitive capture, in which regulators take on the worldview of the industry they regulate). For a survey on the administrative law literature on informational and cultural capture, *see* Jonas Anderson, *Court Capture*, 59 B.C. L. REV. 1543, 1560-63 (2018).

[12] *See* Allen, *supra* note 11, at 1102 (discussing the increased risk of capture when the public loses interest in regulation).

[13] *See* Lawrence G. Baxter, *Adaptive Financial Regulation and RegTech: A Concept Article on Realistic Protection for Victims of Bank Failures* 66 DUKE L. J. 567, 594 (2016) ("market participants quickly and rationally adjust their behavior around the 'certainty' created by the new targets").

regulatory regime.[14] Two well-worn categories of regulatory arbitrage are jurisdictional and categorical arbitrage.[15] The first exploits differences in the laws of different jurisdictions; the latter "exploits a legal discrepancy between the treatment of two types of activity or products that are functionally similar."[16] Technological innovation increases opportunities for a process-oriented variant of categorical arbitrage: often, innovations are designed to avoid regulation by creating functional equivalents that achieve the same outcomes as regulated products and services, using processes that were not anticipated by the regulatory regime.

Financial regulators contemplating new fintech innovations suffer acutely from all of these difficulties. They also have to assess new fintech innovations in the context of their competing legal mandates. The primary goals of financial regulation around the world are the protection of consumers and investors, financial stability, market efficiency, competition, and prevention of financial crime.[17] Most financial regulators need to balance more than one of these mandates, which further complicates the task of regulating new innovations. For example, the first financial regulatory agency to adopt a regulatory sandbox for fintech, the United Kingdom's Financial Conduct Authority (FCA), identified three main benefits that it hoped to achieve with the sandbox: "reduced time-to-market at potentially lower cost," "better access to finance" (for innovators), and "more innovative products reaching the market."[18] These benefits are consistent with its mandate to promote competition in the financial services markets,[19] but the FCA also has a mandate to protect consumers,[20] and to support the integrity of the U.K.'s financial system, including "its soundness, stability and resilience."[21] The case studies in this Part will demonstrate some situations in which fintech innovation, while improving competition and efficiency in the markets, may ultimately conflict with goals of consumer/investor protection and financial stability.

---

[14] For a discussion of the term "regulatory arbitrage," *see* Elizabeth Pollman, *Tech, Regulatory Arbitrage, and Limits*, 20 EUR. BUS. ORG. L. REV. 567 (2019).

[15] *Id.* at 8.

[16] *Id.*

[17] JOHN ARMOUR ET AL, PRINCIPLES OF FINANCIAL REGULATION 61-69 (2016).

[18] FIN. CONDUCT AUTHORITY (FCA), REGULATORY SANDBOX 5 (Nov. 2015), https://www.fca.org.uk/publication/research/regulatory-sandbox.pdf.

[19] Financial Services Act 2012, c. 21, § 6 (U.K.) (amending Financial Services and Markets Act 2000, c. 1E).

[20] *Id.* (amending Financial Services and Markets Act 2000, c. 1C).

[21] *Id.* (amending Financial Services and Markets Act 2000, c. 1D).

Like the FCA but unlike most U.S. financial regulators, the CFPB and CFTC both have a mandate to promote competition. The CFPB was created to ensure "that all consumers have access to markets for consumer financial products and services and that markets for consumer financial products and services are fair, transparent, and competitive."[22] The CFTC has a mission "to protect market users and the public from fraud, manipulation, and abusive practices related to the sale of commodity futures and options and to foster open, competitive, and financially sound commodity futures and option markets."[23] Both agencies, then, must seek to balance their competition mandate (which militates for policies that promote innovation that would result in more firms and products in the market) with their respective consumer or investor protection mandates. The CFTC's mission to pursue financially sound markets could also be interpreted as a direction to pursue financial stability, providing yet another example of the conflict inherent in these agencies' mandates.

For the U.S. regulators who do not have statutory mandates to promote competition, policies designed to promote innovation must be tied to other parts of the missions of these agencies—most obviously, a market efficiency function. For example, the SEC has a mandate to promote efficient markets and capital formation,[24] which could be invoked as the basis for efforts to promote innovation. However, the SEC also has an investor protection mandate that could conflict with its efforts to promote fintech innovation.[25] The OCC has no statutory mandate to pursue competition or innovation; instead it is charged with "assuring the safety and soundness of, and compliance with laws and regulations, fair access to financial services, and fair treatment of customers" by national banks.[26] However, the OCC has committed to supporting "responsible innovation" by national banks, and justifies such support by recognizing that the banking system must innovate in order to "remain relevant and vibrant and to meet the evolving needs of the consumers, businesses, and communities it serves."[27] The OCC

---

[22] Dodd-Frank Wall Street Reform and Consumer Protection Act, 12 U.S.C. § 5511(a) (2018).

[23] COMMODITY FUTURES TRADING COMMISSION, *About the CFTC*, https://www.cftc.gov/sites/default/files/anr/anrabout99.htm.

[24] SECURITIES AND EXCHANGE COMMISSION, *About the SEC*, https://www.sec.gov/about.shtml.

[25] The SEC arguably has a financial stability mandate as well. *See generally* Hilary J. Allen, *The SEC as Financial Stability Regulator*, 43 J. CORP. L. 715 (2018).

[26] 12 U.S.C. § 1(a) (2011).

[27] OFFICE OF THE COMPTROLLER OF THE CURRENCY (OCC), POLICY STATEMENT ON FINANCIAL TECHNOLOGY COMPANIES' ELIGIBILITY TO APPLY FOR NATIONAL BANK

recognizes, however, that it must approach such innovation with a view to protecting consumers and maintaining the stability of the banking system.[28]

Regulators contemplating new fintech innovations thus face many challenges. The remainder of this Section aims to make this discussion less abstract by discussing some concrete examples of fintech innovations that confound existing regulatory structures. I have chosen to discuss marketplace lending, robo-investment services and smart contract derivatives here, because they illustrate many of the regulatory quandaries raised by advances in big data analytics, artificial intelligence and smart contracts. However, this is in no way intended to be an exhaustive list of fintech innovations.

A. *Marketplace Lending*

In the marketplace lending business model, a borrower requests a loan using an online platform, and loan applications are assessed using a combination of big data analytics and machine learning.[29] Advances in data collection and processing technologies allow for a variety of non-traditional sources to be consulted, including "social media, public records (property transactions, births, deaths, marriage, divorce, criminal and civil legal matters, and the like), GPS and satellite tracking, and cameras."[30] Machine learning algorithms can be trained to process this voluminous data set relatively quickly, using rules learned by observing correlations between equivalent data points and default that exist for other customers.[31] If a prospective borrower meets the algorithmic criteria, then the loan will be made – initially by a bank, but the bank is soon repaid with funds provided by investors, whose interest in the loan is ultimately evidenced by a note issued by the online platform.[32] The platform also processes repayments and provides administrative services.[33]

CHARTERS (Jul. 31, 2018), https://www.occ.gov/news-issuances/news-releases/2018/pub-other-occ-policy-statement-fintech.pdf.

[28] *Id.* at 1.

[29] John L. Douglas, *New Wine into Old Bottles: Fintech Meets the Bank Regulatory World*, 20 N.C. BANKING INST. 17, 27 (2016).

[30] Jo Ann S. Barefoot, *Disrupting FinTech Law*, 18 FINTECH L. REP. 1, 5 (2015).

[31] Hilary J. Allen, *Driverless Finance*, 10 HARV. BUS. L. REV. 101, 113 (2020).

[32] Eric C. Chaffee & Geoffrey C. Rapp, *Regulating Online Peer-to-Peer Lending in the Aftermath of Dodd-Frank: In Search of an Evolving Regulatory Regime for an Evolving Industry*, 69 WASH. & LEE L. REV. 485, 491-95 (2012)

[33] For further discussion of the marketplace lending model and applicable regulations, *see id*. at 493.

The somewhat convoluted nature of the marketplace lending business model ensures that many regulators have oversight over at least some part of the process. The notes issued to the lenders are securities, and so that part of the process is regulated by the SEC.[34] The CFPB oversees the compliance of the platforms with federal financial consumer protection laws, and accepts complaints from marketplace lending customers.[35] The platforms must also comply with consumer protection regulations in each state in which they do business;[36] this has generated interest in the OCC's proposal to grant special purpose national bank charters to fintech companies that would preempt many of these state rules.[37] Although this so-called "fintech charter" is currently mired in legal challenges from state authorities, there has been speculation that large marketplace lending platforms like Prosper and LendingTree would be among the candidates for a fintech charter, if its legality is upheld. Furthermore, while marketplace loans are typically unsecured and for small amounts,[38] we should not be surprised if, in the future, regulated banks begin to adopt some of these new credit scoring innovations for mortgages and other larger loans. If this transpires, the OCC (which oversees national banks) will certainly have a significant interest in understanding how machine learning assesses creditworthiness.

Machine learning is a form of artificial intelligence, which can be distinguished from earlier generations of algorithms on the basis of its ability to function without precise instructions directing it to achieve a particular outcome. Instead, machine learning algorithms are "programmed to draw their own decision-making rules from exposure to voluminous data sets . . . ."[39] These algorithms work by detecting patterns and correlations from the data, but they cannot infer causation.[40] As a result, the decisions made by machine learning algorithms can be unpredictable, and their results may seem

---

[34] Douglas, *supra* note 29, at 38.

[35] CONSUMER FINANCIAL PROTECTION BUREAU, CFPB NOW ACCEPTING COMPLAINTS ON CONSUMER LOANS FROM ONLINE MARKETPLACE LENDER (Mar. 7, 2016), available at https://www.consumerfinance.gov/about-us/newsroom/cfpb-now-accepting-complaints-on-consumer-loans-from-online-marketplace-lender/.

[36] Douglas, *supra* note 29, at 30-32.

[37] OCC, *supra* note 27.

[38] Marketplace loans are typically under $50,000 for small businesses and around $10,000 for individual consumers, *see Marketplace Lending 2.0: Bringing on the Next Stage in Lendin*g, DELOITTE, at 7 (2017), https://www2.deloitte.com/content/dam/Deloitte/us/Documents/financial-services/us-fsi-markeplace-lending2.pdf.

[39] Allen, *supra* note 31, at 105-6.

[40] *Id.* at 120.

inexplicable to humans.[41] Because these algorithms learn probabilistically, machine learning responses are most likely to diverge from human responses when assessing low-probability events.[42]

Machine learning is not central to the issuance of notes by the lending platforms, and so nothing in the marketplace lending business model seems to significantly upend the SEC's application of the securities laws that pertain to the offering and issuance of notes to investors. However, the consumer and prudential laws that have traditionally been applied to lending are likely to struggle with the machine learning aspects of this business model. A loan approval process based on new data sources and machine learning is vastly different to the more labor-intensive way that loan applications have been traditionally processed in the past. While by no means perfect, more traditional methods of borrower assessment have been honed and tested through many credit cycles, and regulators are accustomed to supervising these forms of assessments.[43] Machine learning, however, has only been applied to financial services in the decade since the last financial crisis,[44] putting "pressure on regulators to move from regulations designed to control human behavior to regulation that seeks to supervise automated processes."[45] Furthermore, these machine learning algorithms rely on a wide range of sources of granular data that will be new for regulators charged with assessing the quality of a financial institution's lending practices[46] – and most of these new data have been generated since the recovery from the financial crisis began, and so provide little indication of people's creditworthiness in a struggling economy.[47]

Machine learning therefore has the potential to upend supervision and examination strategies that have been developed over time to assess

---

[41] Andrew Tutt, *An FDA for Algorithms*, 69 ADMIN. L. REV. 83, 87 (2017).

[42] Allen, *supra* note 31, at 128-9.

[43] For a discussion of the banking supervisory process, *see* RICHARD S. CARNELL, JONATHAN R. MACEY & GEOFFREY P. MILLER, THE LAW OF FINANCIAL INSTITUTIONS 344-9 (6th ed. 2017).

[44] U.S. DEPARTMENT OF THE TREASURY, OPPORTUNITIES AND CHALLENGES IN ONLINE MARKETPLACE LENDING, 1 (2016), https://www.treasury.gov/connect/blog/Documents/Opportunities_and_Challenges_in_Online_Marketplace_Lending_white_paper.pdf.

[45] Dirk A. Zetzsche et al., *Regulating a Revolution: From Regulatory Sandboxes to Smart Regulation*, 23 FORDHAM J. CORP. & FINCORP. & FIN. L. 31, 93 (2017).

[46] Dirk A. Zetzsche ET AL., *The Future of Data-Driven Finance and RegTech* 48 (Eur. Banking Inst., Working Paper No. 2019/35), https://ssrn.com/abstract=3359399.

[47] In 2016, IBM published a report that found that "90 percent of the data in the world today has been created in the last two years alone." *See*, IBM Marketing Cloud, *10 Key Trends for 2017*, 3 (Dec. 2016).

traditional loan approval processes, which can serve as an indicia of the lender's safety and soundness.[48] Mispriced loans can also be problematic from a consumer protection perspective. While a consumer may initially be very interested in obtaining a low-interest rate loan, if the credit assessment algorithm is improperly calibrated, the consumer may ultimately find themselves unable to repay the loan, which could expose them to default, collections processes and ultimately bankruptcy.[49] The stability of the financial system as a whole would suffer if a sufficiently large group of consumers received enough mispriced credit to create a bubble in a particular asset class, and then that bubble inevitably popped – generating negative impacts for the balance sheets of banks and other financial institutions[50] (those same banks and financial institutions could also be harmed if they themselves invested heavily in the mispriced loans). Regulators like the OCC will therefore have to experiment with new ways of assessing data quality (an issue that will be explored more fully in the next Part). They should also explore the technology available to allow machine learning algorithms to contextualize and provide explanations of their decisions,[51] and consider requiring regulated firms that rely on machine learning to use a form of this technology. Such explanations will better enable the regulators to supervise a firm's credit assessment process, and then address common errors with informal guidance or rules.

Advances in machine learning will also make it more difficult for the CFPB to assess whether the Equal Credit Opportunity Act (1974) ("ECOA") has been breached. This statute prohibits discrimination in the provision of credit on the basis of an applicant's race, color, religion, national origin, sex, marital status, age or participation in public assistance programs,[52] and the prohibition extends to credit scoring policies that have a disparate impact on any one of these classes.[53] ECOA prohibits:

---

[48] "To evaluate a bank's financial soundness, examiners use the Uniform Financial Institutions Rating System, commonly known as the CAMELS system." CARNELL, MACY & MILLER, *supra* note 43, at 346. As part of this assessment, "[t]hey scrutinize the bank's lending and investment standards, internal controls, and risk-identification and loan-administration practices." *Id.* at 248.

[49] Leonard J. Kennedy et al., *The Consumer Financial Protection Bureau: Financial Regulation for the Twenty-First Century*, 97 CORNELL L. REV. 1144-5 (2012).

[50] *Id.*

[51] Andrew D. Selbst & Solon Barocas, *The Intuitive Appeal of Explainable Machines*, 87 FORDHAM L. REV. 1085, 1087 (2018).

[52] 15 U.S.C.§ 1691(a).

[53] CARNELL, MACY & MILLER, *supra* note 43, at 508.

> a creditor practice that is discriminatory in effect because it has a disproportionately negative impact on a prohibited basis, even though the creditor has no intent to discriminate and the practice appears neutral on its face, unless the creditor practice meets a legitimate business need that cannot reasonably be achieved as well by means that are less disparate in their impact.[54]

Over the decades, regulators have developed ways of assessing the disparate impact of facially neutral credit scoring techniques, but different strategies will be needed to assess whether machine learning algorithms have engaged (perhaps unwittingly) in discrimination by making decisions on the basis of proxy variables for protected classes.[55] As Prince and Schwarcz observe, a machine learning algorithm:

> does not care that the link between the variable and the desired outcome is actually due to association with a protected class; it only seeks to find the link. Indeed, because a model's goal is to find the best possible predictors though correlation, it will often be difficult, if not impossible, to determine from the model alone whether proxy discrimination is occurring.[56]

In addition to technologies that allow machine learning algorithms to provide explanations and context for their decisions, other technological solutions may also be useful to the CFPB: Prince and Schwarcz have suggested the possibility of exposing machine learning algorithms to additional data sets that will train them to control for membership of a protected class when making decisions.[57]

B. *Robo-Investment*

Robo-advisory firms offer automated investing services to consumers that aim to be at least as good as (if not better than) what a human financial

---

[54] 12 CFR § 1002.6(a) (Supp. I 2019).

[55] Solon Barocas & Andrew D. Selbst, *Big Data's Disparate Impact*, 104 CAL. L. REV. 671, 675 (2016).

[56] Anya Prince & Daniel Schwarcz, *Proxy Discrimination in the Age of Artificial Intelligence and Big Data*, IOWA L. REV. (forthcoming 2020) (manuscript at 65), https://ssrn.com/abstract=3347959.

[57] *Id.* at 63. ("[T]he first step…is for the statistical model under consideration to be re-estimated in a way that explicitly includes data on legally prohibited characteristics.").

advisor can provide, at a fraction of the cost.[58] While robo-advisory firms already use predictive algorithms to provide automated "customer profiling, asset allocation, portfolio selection, trade execution, portfolio rebalancing, tax-loss harvesting, portfolio analysis,"[59] there is significant interest in developing machine learning techniques that can gather information about a client's financial situation and improve portfolio selection.[60] Because robo-advisory firms typically provide investment advice to their clients as well as executing transactions for them, they will usually be regulated both by the SEC and by FINRA (a self-regulatory organization that is overseen by the SEC and focuses on broker-dealer regulation).[61]

The SEC has traditionally not viewed itself as having a mandate to promote financial stability, and this stance has perhaps been most controversial in the context of its supervision of the asset management industry, of which robo-advisors form a part.[62] The potential for the asset management industry to negatively impact the stability of the financial system will likely be exacerbated by the increasing prominence of the robo-advisory services that the SEC oversees. Currently, the approach taken by many robo-advisory firms is to assign its investor clients to one of several buckets, with identical portfolios for everyone included in the same bucket, which raises the possibility that this business model will make investment decisions more monolithic, and thus exacerbate trends towards the asset bubbles and panics that undermine financial stability.[63] New advances in machine learning may ultimately be used to create more personalized portfolios, moving away from the current industry standard of putting

---

[58] Tom Baker & Benedict Dellaert, *Regulating Robo Advice Across the Financial Services Industry*, 103 IOWA L. REV. 713, 719-20 (2018).

[59] FINRA, REPORT ON DIGITAL INVESTMENT ADVICE, 2 (2016), https://www.finra.org/sites/default/files/digital-investment-advice-report.pdf.

[60] *See, e.g.*, DELOITTE, *The Next Frontier: The Future Of Automated Financial Advice In The UK*, at 22 (2017), https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/financial-services/deloitte-uk-updated-robo-advice-new-horizons-layout-mww8.pdf ("[I]t is possible that we will see automated advisers enter more sophisticated advice markets and be able to deal with issues as complex as tax and holistic financial planning . . . .")

[61] Allen, *supra* note 31, at 12 ("For example, Betterment has registered with the SEC . . . [and] . . . registered with FINRA.").

[62] Allen, *supra* note 25, at 726. ("[T]he FSOC issued a Notice Seeking Comment on Asset Management Products and Activities that stated 'the SEC's initiatives are not specifically focused on financial stability.'")

[63] Allen, *supra* note 31, at 27 ("[W]hen financial decision-making is automated and performed by a few algorithms rather than a crowd of individuals, market behavior is likely to become even more correlated.").

investors in just a few buckets,[64] but if the algorithms in question are learning from the same data set of historical market information, then they are nonetheless likely to learn to react in correlated ways.[65] Furthermore, because machine learning algorithms learn probabilistically, there is a real risk that they will consistently underemphasize low-probability but potentially high-consequence risks in choosing investment strategies.[66] If such a high-consequence tail event were to occur, the ramifications would be felt extremely quickly in a market characterized by automated portfolio rebalancing.

Stronger tendencies towards bubble-bust dynamics in the securities markets could have significant ramifications for the broader economy. I have therefore argued that "[i]n order to mitigate systemic risk, financial algorithms capable of machine learning may therefore need to be exposed to hypothetical scenarios that emphasize worst-case scenarios, and demonstrate the consequences of correlated responses to such events."[67] While by no means a perfect solution, such hypothetical scenarios would at least force machine learning algorithms to anticipate the possibility of a tail event, and then they could perhaps be trained in simulated 'war games' with other algorithms to mitigate the systemic repercussions of their decisions. The creation of hypothetical scenarios and conduct of war games would be an expensive and laborious process, with parallels to the creation of the stress testing scenarios currently devised by the Federal Reserve.[68] It is unlikely that the SEC would be eager to take the lead on such a process, but it could collaborate with the Federal Reserve using the Financial Stability Oversight Council (of which the SEC and Federal Reserve Chairs are both members) as a forum for such cooperation.[69]

---

[64] FIN. STABILITY BD., ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN FINANCIAL SERVICES: MARKET DEVELOPMENTS AND FINANCIAL STABILITY IMPLICATIONS at 30 (2017), http://www.fsb.org/wp-content/uploads/P011117.pdf.

[65] Allen, *supra* note 31, at 29.

[66] *Id.*

[67] *Id.* at 45.

[68] The Federal Reserve creates "hypothetical macroeconomic scenarios that incorporate an assumed sharp deterioration in economic and financial conditions." Daniel K. Tarullo, Governor, Fed. Reserve, *Speech at the Federal Reserve Third Annual Stress Test Modeling Symposium*: *Stress Testing after Five Years* (Jun. 25, 2014), https://www.federalreserve.gov/newsevents/speech/tarullo20140625a.htm; Allen, *supra* note 31, at 45 ("The difficulty and cost of developing such scenarios should not be understated.").

[69] The FSOC recently committed to an "activities-based approach" to protecting financial stability. U.S. DEP'T OF TREASURY, FINANCIAL STABILITY OVERSIGHT COUNCIL PROPOSES CHANGES TO NONBANK DESIGNATIONS GUIDANCE (Mar. 6, 2019), https://home.treasury.gov/news/press-releases/sm621 ("The proposed guidance [regarding

The SEC's more traditional investor protection function will also face challenges as robo-advisory business models become more prominent. The Investment Advisers Act of 1940 seeks to protect investors from their advisers' conflicts of interest by requiring disclosures from advisers and prohibiting certain types of transactions:[70] while many have argued that such conflicts are less likely when investment decisions are being made by machines rather than fallible human beings, it is quite possible that machine learning algorithms might *learn* predatory behavior from data sets that include examples of conflicted transactions.[71] As with discrimination in the provision of credit (discussed in the previous Part), such undesirable behavior may be harder to detect when it is performed by a facially neutral algorithm. The SEC's approach of regulating conflicts through disclosure will be ineffective in this context unless the algorithm is designed to provide explanations and context for its decisions.

C. *Swaps as Smart Contracts*

At the most basic level, a derivative is simply a contract that derives its value from some kind of financial variable. A swap is a particular type of derivative contract that involves two counterparties swapping promises to exchange payments (which are calculated as a percentage of a specified notional amount).[72] The percentage is often derived from some kind of economic variable, such as an interest rate.[73] Perhaps the most notorious type of swap is the credit default swap ("CDS"), which played a pivotal role in the last financial crisis. A credit default swap involves one party swapping a premium (calculated as a percentage of a notional amount) for a promise from the other party to make a payment if a "credit event" occurs with respect to a referenced debt instrument (depending on the contract, credit events might

---

nonbank financial company designations] would implement an activities-based approach to . . . financial stability."). Though some have questioned how genuine this push for activities-based regulation is, *see, e.g.*, Jeremy C. Kress et al., *Regulating Entities and Activities: Complementary Approaches to Nonbank Systemic Risk*, 92. S. CAL. L. REV. 1455, 1505 (2019), if the FSOC is truly committed to activities-based regulation, creating hypothetical data sets for robo-advisory firms would help address the threats to financial stability posed by this activity.

[70] COX ET AL., SECURITIES REGULATION: CASES AND MATERIALS 1019 (9th Ed.2020).

[71] Rory Van Loo, *Rise of the Digital Regulator*, 66 DUKE L. J. 1267, 1277, 1290 (2017).

[72] MARK JICKLING & RENA S. MILLER, CONG. RESEARCH SERV., DERIVATIVES REGULATION IN THE 111TH CONGRESS 27 (2011).

[73] *Id.*

include a ratings downgrade, a default, or a bankruptcy).[74] The contract itself is usually based on a form contract promulgated by the International Swaps and Derivatives Association, and referred to colloquially as an "ISDA."[75]

In the lead up to the last financial crisis, AIG alone had issued $1.8 trillion of credit default swaps that insured the holders of mortgage-backed securities against the occurrence of a credit event.[76] AIG did not have sufficient funds to actually pay all of the holders of those credit default swaps if a credit event occurred, but it had assumed that the underlying mortgage-backed securities would never default and that it would therefore never be required to make any payments.[77] AIG had grossly underestimated the risks associated with those mortgage-backed securities, however, and ultimately required a bailout from the federal government once systemic problems with mortgage-backed securities became apparent.[78] In response to the financial crisis, Title VII of Dodd-Frank was enacted, which was designed to manage the risks inherent in swap contracts by requiring most swaps to be cleared through a regulated central clearinghouse, and by requiring swap counterparties to post deposits (referred to as margin) with the clearinghouse to cover any losses.[79] The size of the deposit required is adjusted daily (marked-to-market) to reflect fluctuating risks associated with the underlying variable for the contract.[80] Title VII also requires most swap transactions to be reported.[81] This regulatory regime is primarily overseen by the CFTC, although the SEC has jurisdiction over security-based swaps.[82]

Dodd-Frank was enacted in 2010, before the current wave of fintech innovation. There is now significant interest in representing swaps as smart contracts, though,[83] so it is important to consider whether Title VII is equipped to deal with any new problems that smart contracts might create. "Smart contracts" are computer algorithms that govern the functionality of a

---

[74] *Id.* at 31.

[75] STEPHEN J. LUBBEN, CORPORATE FINANCE 316 (2014).

[76] RENA S. MILLER & KATHLEEN ANN RUANE, CONGRESSIONAL RESEARCH SERVICE, THE DODD-FRANK WALL STREET REFORM AND CONSUMER PROTECTION ACT: TITLE VII, DERIVATIVES 5 (2012).

[77] *Id*; *see also* THE FIN. CRISIS INQUIRY COMM'N, THE FINANCIAL CRISIS INQUIRY REPORT, 266. (2011) [hereinafter FCIC Report].

[78] *Id.*

[79] *Id.*

[80] *Id.* at 3.

[81] *Id.* at 3.

[82] *Id.* at 5.

[83] *See, e.g.*, ISDA & King & Wood Mallesons, *Smart Derivatives Contracts: From Concept to Construction*, 27 (Oct. 2018) (available at https://www.isda.org/a/cHvEE/Smart-Derivatives-Contracts-From-Concept-to-Construction-Oct-2018.pdf).

contractual relationship (in this instance, a swap) and that are intended to be self-executing and self-enforcing.[84] Smart contracts are recorded and transferred on a "distributed ledger," "an electronic record that is updated in real-time and intended to be maintained on geographically disperse servers or nodes."[85] If a credit default swap were memorialized as a smart contract, the smart contract would automatically calculate and deduct the premium from one counterparty, and regularly check in with designated external sources (known as "oracles") to see if a credit event has occurred that would automatically initiate a transfer from the other counterparty.[86] The CFTC takes the view that swaps memorialized as smart contracts should be regulated like any other swap covered by Title VII.[87] Such an approach certainly has benefits – a credit default swap memorialized as a smart contract will still pose the risks posed by credit default swaps memorialized in paper contracts, and so Title VII's clearing and margin requirements remain appropriate. However, there are additional risks raised by smart contracts that are not contemplated by Title VII (particularly new kinds of operational risks relating to the distributed ledger on which the smart contracts will be hosted).[88]

Furthermore, many have expressed skepticism that Title VII's margin and collateral requirements are large enough to protect swap counterparties during a systemic event that affects more than one institution – in such circumstances, the solvency of the clearinghouses themselves could even be threatened, with major systemic implications.[89] It is quite possible that extraordinary measures would need to be taken during a future systemic crisis to prevent catastrophic failures, including the suspension of contractual terms that relate to the posting of margin.[90] Smart contracts–even when working as intended without any technological glitches or misinformed oracles–could create new problems in such a context.

---

[84] Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 DUKE L. J. 313, 333 (2017); Carla L. Reyes, *If Rockefeller Were a Coder*, 87 GEO. WASH. L. REV. 374, 383–84 (2018).

[85] LabCFTC, *A Primer on Smart Contracts*, 7 (Nov. 27, 2018), available at https://www.cftc.gov/sites/default/files/2018-11/LabCFTC_PrimerSmartContracts112718.pdf.

[86] *Id.* at 15.

[87] *Id.* at 25.

[88] *Id.* at 27-29.

[89] *See, e.g.*, Adam J. Levitin, *The Tenuous Case for Derivatives Clearinghouses*, 101 GEO. L. J. 445, 462-463 (2013).

[90] Katharina Pistor, *A Legal Theory of Finance*, 41 J. COMPARATIVE ECON. 315, 320-321 (2013).

To illustrate, we can imagine how the CDS agreements that AIG entered into with Goldman Sachs and others in the lead up to the last financial crisis might have performed had they been smart contracts. In July 2007, Goldman Sachs sought to enforce provisions in its ISDAs with AIG that authorized Goldman Sachs to determine whether and how much collateral AIG should post in connection with those ISDAs.[91] At the time it had entered into these ISDAs, AIG had not developed its own models for assessing the amount of collateral requested by a counterparty – or even really recognized that a collateral call might be made at all.[92] Because AIG failed to negotiate over the possibility of a collateral call, if this right had been recorded in a smart contract, Goldman Sachs would simply have had to type the dollar amount of desired margin into a computer, and the smart contract would have withdrawn that dollar amount from AIG's account on the distributed ledger. This could have been a fatal blow for AIG, as early as the summer of 2007 – but smart contracts had not yet been developed, which gave AIG an opportunity to negotiate with Goldman Sachs over the amount of collateral to be provided. This is what transpired: Goldman Sachs agreed to negotiate, and they ultimately agreed that AIG could post much less collateral than Goldman Sachs had initially demanded.[93]

Of course, AIG had issued so many credit default swaps referencing ailing mortgage-backed securities that other counterparties were soon clamoring for collateral,[94] and AIG reached the brink of failure in September 2008 as a result of these margin calls.[95] AIG's insolvency was averted by the federal government, however, in order to prevent the domino effect of insolvencies that likely would have occurred if AIG had defaulted on all of its contracts with other financial institutions.[96] The federal government achieved this by pledging to provide AIG with funds to cover the margin calls.[97] If AIG's CDSs had been automated smart contracts, however, AIG's accounts might have been automatically debited for the collateral, rendering AIG insolvent before government funds could arrive. Unless a smart contract were programed in advance to delay execution following the announcement of a government bailout of a counterparty (an unlikely event that would probably not have been contemplated at the time the smart contract was formed), the

---

[91] FCIC Report, *supra* note 77, at 266.
[92] *Id.* at 266.
[93] *Id.* at 268.
[94] *Id.* at 268-69.
[95] FCIC Report, *supra* note 77, at 344-345.
[96] MILLER & RUANE, *supra* note 76, at 5.
[97] *Id.*

government's ability to stave off a crisis by announcing relief would be circumscribed, making financial instability far more likely.

Title VII does nothing to address the new fragilities that are being introduced into the financial system by using smart contracts to automate (and therefore speed up and preclude the exercise of human judgment with respect to) the execution of swap contracts. The CFTC therefore needs to experiment with new types of regulatory measures that could pause and potentially undo these transactions when the circumstances warrant. Such measures might include requiring that all smart contract swaps be programmed to respond to an oracle maintained by the CFTC that could function as a circuit-breaker, allowing the CFTC to pause smart contract execution in extraordinary circumstances.[98] In order to detect the extraordinary circumstances that warrant the use of the circuit-breaker, the CFTC would need to invest in data analysis tools (such as risk indicator dashboards) that would provide it with early warning signals.[99] The CFTC could also consider requiring that all such smart contracts be hosted on a distributed ledger maintained by identifiable nodes with the power to undo erroneous transactions when necessary.[100] However, no such steps have yet been taken. The following two Sections will instead survey the regulatory experimentation that *has* been conducted to date by financial regulatory agencies with respect to fintech.

III. EXPERIMENTS WITH REGULATORY SANDBOXES AND OTHER INNOVATOR-FOCUSED REGULATORY APPROACHES

A. *Regulatory Models*

Technology entrepreneurs seeking to enter the market for financial services often find it hard to understand and comply with the regulations that apply to the financial industry – indeed, even established financial institutions can find it complicated to understand the regulations that would apply to a new financial product.[101] Jurisdictions seeking to encourage fintech innovation have therefore adopted a variety of measures to help innovators navigate the applicable financial regulations. The most prominent of these

---

[98] Allen, *supra* note 31, at 141.

[99] Dirk Broeders and Jermy Prenio, *Innovative Technology in Financial Supervision (Suptech) – The Experience of Early Users*, BANK FOR INT'L SETTLEMENTS FIN. STABILITY INST. INSIGHTS ON POL'Y IMPLEMENTATION NO. 9, 3 (Jul. 2018).

[100] Allen, *supra* note 31, at 142.

[101] Hilary J. Allen, *Regulatory Sandboxes* 87 GEO. WASH. L. REV. 579, 588-592 (2019).

is the "regulatory sandbox" designed to allow innovators to conduct a limited test of fintech products and services in a lenient regulatory environment,[102] but there are many other ways in which financial regulators can and do support fintech innovation. This Section will discuss a sample of the measures that have been adopted, with a focus on the United States and the United Kingdom. This is admittedly a very limited sample–sandboxes and other measures to promote innovation have been prolific in many other jurisdictions (particularly in Asia)[103] –but this Article is focused primarily on the United States. The United Kingdom is discussed in this Article, however, because it pioneered the regulatory sandbox concept and as such has significant precedential value. Also, as a common law jurisdiction with a vibrant financial sector, the United Kingdom shares many similarities with the United States – analyzing the United Kingdom's approach therefore sheds light on the United States' situation.

The United Kingdom's FCA was the first to implement a fintech regulatory sandbox in 2016: the FCA describes this sandbox as "a 'safe space' in which businesses can test innovative products, services, business models and delivery mechanisms while ensuring that consumers are appropriately protected."[104] Applicants who are selected by the FCA receive six months of regulatory relief, after which (if the business model is sufficiently successful) they are expected to transition to the fully regulated environment.[105] The regulatory relief provided takes the form of a restricted authorization, which the firms can rely upon in order to test their financial products and services with a limited pool of customers – this alleviates the cost and delay associated with applying for a full authorization.[106] The FCA also provides individual guidance to sandbox firms as to how it will interpret the application of existing regulatory requirements (typically developed prior to the smartphone era) to new technologies.[107] Importantly, a restricted authorization still entails some regulation – sandbox firms must develop

---

[102] *Id.* at 580.

[103] For a more global discussion of these efforts, see Ross P. Buckley et al., *Building Fintech Ecosystems: Regulatory Sandboxes, Innovation Hubs and Beyond*, 4 (Euro. Banking Inst., Working Paper Series no. 53, 2019), https://ssrn.com/abstract=3455872.

[104] Press Release, FIN. CONDUCT AUTHORITY, *Financial Conduct Authority's Regulatory Sandbox Opens to Applications* (May 9, 2016), https://www.fca.org.uk/news/press-releases/financial-con- duct-authority's-regulatory-sandbox-opens-applications.

[105] Allen, *supra* note 100, at 596.

[106] *Id.*

[107] *Id.*

policies in conjunction with the FCA to ensure some protections for the participating consumers.[108]

The FCA's sandbox has a very high profile, but it is only one part of the FCA's Project Innovate, which was started in 2014.[109] Through this project, the FCA also provides advice and other support to fintech innovators who are not participating in any sandbox cohort.[110] Buckley et al. observe that far more firms have benefited from this support than have benefitted from the FCA's regulatory sandbox.[111] Similar support programs for fintech have also been established in the United States, where they are arguably more necessary because of the limited opportunities for fintech innovators to participate in regulatory sandboxes. True sandboxes, offering waivers of regulatory requirements as well as guidance for innovators, have only been adopted by the states of Arizona, Utah and Wyoming and by the federal Consumer Financial Protection Bureau,[112] and each of these sandboxes faces significant limitations that undermine its appeal to innovators seeking to trial their products and services.

The appeal of the state-based sandboxes is limited by the fact that these sandboxes only allow innovators to test their products and services with customers residing in the relevant state.[113] There has been some discussion of "passporting," which would allow innovators to access consumers in all states that have established reciprocal sandbox arrangements and thus make state-administered regulatory sandboxes more useful for innovators, but such an arrangement would only be valuable if a large number of states adopted sandboxes with similar passporting arrangements.[114] Furthermore, federal laws will continue to apply to innovators participating in a state-administered sandbox. The CFPB's "Compliance Assistance Sandbox," which was launched in September of 2019,[115] is administered at the federal level and therefore provides access to a much larger market than state-administered

---

[108] *Id.* at 597.

[109] Buckley et al., *supra* note 103, at 7.

[110] *Id.*

[111] *Id.* at 4.

[112] Anthony C. Kaye, *Utah's New Regulatory Sandbox,* CONSUMER FIN. MONITOR (Jun. 11, 2019), https://www.consumerfinancemonitor.com/2019/06/11/utahs-new-regulatory-sandbox/.

[113] Hilary J. Allen, *Sandbox Boundaries,* 22 VAND. J. ENT. & TECH. L. 299, 314 (2020)

[114] Wendy Kearns & Andrew J. Lorentz, *Fintech Sandboxes – Update on State Approaches*, DAVIS WRIGHT TREMAINE LLP BLOG (Apr. 16, 2018), https://www.dwt.com/blogs/payment-law-advisor/2018/04/fintech-sandboxes—update-on-state-approaches.

[115] BUREAU OF CONSUMER FINANCIAL PROTECTION, POLICY ON THE COMPLIANCE ASSISTANCE SANDBOX, 84 Fed. Reg.FR 48246 (Sept. 13, 2019).

sandboxes. However, the CFPB only claims the legal authority to preempt three enumerated federal consumer protection statutes[116] – and even that authority has been questioned by state attorneys-general.[117] Given the fragmented nature of financial regulatory authority in the United States, no regulatory sandbox is likely to give innovators any real certainty that they will be exempt from regulatory enforcement unless it is coordinated amongst all of the federal regulators, and designed to preempt all state regulation.[118]

In the absence of any compelling regulatory sandbox, many regulators in the United States have offered other types of support for fintech innovation. The main differentiating factor between regulatory sandboxes and these other forms of innovation support seems to be the "signaling" feature that regulatory sandboxes have, communicating that a jurisdiction is committed to fostering fintech innovation (although that signal may depreciate in value as more and more jurisdictions adopt sandboxes).[119] These other forms of regulatory support can nonetheless be very successful in promoting innovation. For example, many financial regulators have pre-existing powers to grant waivers and no action letters that can facilitate testing and piloting of innovative products and services, where appropriate, even in the absence of a sandbox.[120] Regulators have also pursued programs that do not provide any regulatory relief, but provide guidance to innovators in navigating regulatory regimes that were often adopted long before the technologies in question were designed, and as such are often difficult to reconcile. This support typically takes the form of providing opportunities for innovators to consult with the regulators – for example, the CFTC's LabCFTC, FinCEN's Innovation Hours and the P2P meetings hosted by the SEC's FinHub are all designed to allow for innovators to meet and receive guidance and feedback from regulatory personnel at an early stage of the innovation. As the CFTC puts it, "[s]uch feedback may include information that, particularly at an early stage, could help innovators/entities save time and money by helping them understand relevant regulations and the CFTC's approach to oversight."[121]

---

[116] *Id.* at 48249.

[117] Kate Berry, *State AGs Assail CFPB Plan to Build Fintech Sandbox*, AM. BANKER (Feb. 12, 2019), https://www.americanbanker.com/news/state-ags-assail-cfpb-plan-to-build-fintech-sandbox.).

[118] Allen, *supra* note 101, at 619-20.

[119] Buckley et al., *supra* note 103, at 7, 18.

[120] *Id.* at 25.

[121] Commodity Futures Trading Commission, *LabCFTC Overview*, https://www.cftc.gov/LabCFTC/Overview/index.htm.

The Office of the Comptroller of the Currency has taken a slightly different approach, offering tailored regulatory regimes coupled with ongoing guidance in order to encourage innovation. It has proposed an "Innovation Pilot Program" that is intended to assist regulated banks experimenting with new technologies to navigate the regulatory requirements that apply to those technologies.[122] It also offers a so-called "Fintech Charter" that is available to non-banks[123] – although recipients of this charter would be subject to significant regulation by the OCC, it may nonetheless be appealing because it purports to preempt the application of state laws to the fintech firm.[124] However, because neither of the OCC's programs offers relief from federal regulations, they would not typically be considered sandboxes.

Efforts to support fintech innovation at the transnational level have also begun. The UK's FCA spearheaded the creation of the Global Financial Innovation Network in January 2019.[125] The CFPB was a founding member of the GFIN; the CFTC, SEC, FDIC and OCC joined in October of 2019 (the New York State Department of Financial Services and the Office of the Arizona Attorney General have also joined). It is not yet clear precisely what support the GFIN will give to individual innovators, but one of the GFIN's stated goals is to "provide accessible regulatory contact information for firms," and the GFIN also intends "to provide firms with an environment in which to trial cross-border solutions."[126] While the FCA had initially envisaged the GFIN as offering "a full multilateral sandbox that allows concurrent testing and launch across multiple jurisdictions," the level of regulatory coordination necessary for a project has been conceded as too ambitious for now.[127] Even bilateral regulatory coordination on sandbox trials is likely to involve a significant commitment of regulatory resources.

---

[122] OFFICE OF THE COMPTROLLER OF THE CURRENCY, OCC INNOVATION PILOT PROGRAM 2 (Apr. 2019), https://www.occ.treas.gov/topics/supervision-and-examination/responsible-innovation/occ-innovation-pilot-program.pdf.

[123] OCC, *supra* note 27, at 2.

[124] The OCC's fintech charter would be a specialized national banking charter. *Id.* National banking charters preempt the application of state law in circumstances where the state law would "prevent or significantly interfere with the national bank's exercise of its powers." Barnett Bank of Marion County v. Nelson, 517 U.S. 25, 18 (1996).

[125] Gina Conheady, *Is Fintech Ready for a Global Regulatory Sandbox?*, A&L GOODBODY (Nov. 27, 2018), https://www.algoodbody.com/insights-publications/is-fintech-ready-for-a-global-regulatory-sandbox.

[126] *Terms of Reference for Membership and Governance of the Global Financial Innovation Network (GFIN)*, FIN. CONDUCT AUTHORITY (Feb. 27, 2020), 1https://www.fca.org.uk/publication/mou/gfin-terms-of-reference.pdf.

[127] Conheady, *supra* note 125.

B. *Limitations*

These experimental innovator-supporting programs have primarily been adopted to further the regulatory goals of efficiency, and to promote competition.[128] Fostering efficiency and competition can help ensure that consumers have better and cheaper access to financial services, but these regulatory goals must also be balanced against the goals of financial stability and investor/consumer protection. Given the far-reaching societal costs of financial crises, financial stability should be the apex goal of financial regulation.[129] The protection of consumers and investors (in order to ensure that they have sufficient confidence to participate in a financial system characterized by information asymmetries) is also a key purpose of financial regulatory regimes around the world – widespread harm to investors and consumers was the genesis of the SEC and CFPB respectively.[130] Financial stability and consumer/investor protection are the core functions of financial regulators.

This Article therefore argues that when designing financial regulatory experiments, the core goals of financial stability and consumer/investor protection should not be neglected in favor of innovation-driven efficiency and competition. In practice, however, these latter goals have been the preeminent drivers of regulatory experimentation to date. This is likely part of a larger phenomenon: as Professor Coffee has explained, the attitudes of regulators and the public towards the necessity of protective financial regulation tend to move in a "regulatory sine curve," waxing immediately following a crisis and waning as time passes and memories fade.[131] It is therefore not particularly surprising that more than a decade after the last crisis, regulatory focus has shifted towards promoting innovation and competition, potentially at the expense of consumers, investors and the

---

[128] Zetzsche et al., *supra* note 45 at 69-70; *Global Financial Innovation Network (GFIN) Consultation Document*, FIN. CONDUCT AUTHORITY, 17 (Aug. 2018), https://files.consumerfinance.gov/f/documents/bcfp_global-financial-innovation-network_consultation-document.pdf.

[129] Allen, *supra* note 11, at 1088. *See also* Jeffrey N. Gordon, *'Dynamic Precaution' in Maintaining Financial Stability: The Importance of FSOC* (Colum. L. and Econ., Working Paper No. 587, 2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3229518.

[130] MICHAEL S. BARR ET AL., FINANCIAL REGULATION: LAW AND POLICY. 49, 63 (2nd ed., 2016).

[131] John C. Coffee Jr., *The Political Economy of Dodd-Frank: Why Financial Reform Tends to be Frustrated and Systemic Risk Perpetuated*, 97 CORNELL L. REV. 1019, 1029 (2012).

stability of the financial system as a whole. The fact that it is unsurprising does not make it good policy, however.

Most of the methods of innovation support discussed in the previous Part are very resource intensive, as a result of the one-on-one support provided to innovators by the regulators (it has been observed that programs that fail to invest significant regulatory resources are unlikely to be as successful in promoting innovation).[132] Such support can certainly help innovators bring their products and services to market, but if the innovation process primarily benefits the innovator and does not generate broader benefits for society, then it is not good public policy to dedicate scarce public resources to facilitating the innovation process.[133] Ideally, such support will result in innovations that are both profitable *and* beneficial for consumers/investors (particularly in previously underserved markets) by providing financial services more cheaply and efficiently.[134] However, if "financial inclusion" turns out to be a euphemism for unscrupulous fintech providers preying upon unsophisticated consumers and investors, then it will be particularly important for financial regulators to continue to exercise their more traditional consumer/investor protection functions. Furthermore, it is unrealistic to expect private sector innovation to further the regulatory goal of financial stability, except inadvertently (private sector innovators almost always lack the incentives – not to mention the ability to coordinate their competitors – necessary to promote the stability of the financial system as a whole).[135] Regulatory sandboxes could prove to be a particularly problematic form of regulatory experimentation if they dispense with regulations that are designed to protect consumers, investors or financial stability – in such circumstances, they could operate as a form of deregulation that results in real harm.

Unfortunately, the limitations of innovator-supporting regulatory programs often receive less attention than they deserve, perhaps because of an unwarranted presumption that innovation is inherently good.[136] That presumption should not be left unexamined, however. Supporting fintech innovation should not result in financial regulators neglecting their core objectives of consumer/investor protection and financial stability.

---

[132] Buckley et al., *supra* note 103, at 6.

[133] Allen, *supra* note 101, at 606.

[134] FIN. CONDUCT AUTHORITY, REGULATORY SANDBOXES LESSONS LEARNED REPORT 9 (Oct. 2017), https://www.fca.org.uk/publication/research-and-data/regulatory-sandbox-lessons-learned-report.pdf.

[135] Allen, *supra* note 11, at 1103.

[136] For a critique of this assumption, see Allen, *supra* note 101, at 605 *et seq*.

Experimentation with innovator-supporting regulatory programs can *incidentally* benefit these regulatory goals, by allowing regulators to influence the development of new innovations, and to learn about nascent technologies (as such, the value of these programs should be assessed by reference to the level of collaboration, influence and information-sharing involved).[137] However, the regulatory experiments discussed in the previous Part were not adopted for the *primary* purpose of helping financial regulators to execute their core regulatory goals.

Furthermore, all of the regulatory experiments discussed in the previous Part require an affirmative decision by a private firm to participate. They do not provide any tools for financial regulators to pursue their core mandates of consumer/investor protection and financial stability against firms that do not opt in to collaborating with the regulator. The next Section will therefore explore other types of experimentation that regulators should consider engaging in – experimentation that uses technology in an attempt to address the problems for investors, consumers and financial stability raised by fintech's new processes for delivering financial products and services, irrespective of whether a fintech firm has chosen to work with the regulator.

IV. EXPERIMENTATION WITH SUPTECH

A. *The State of Regulatory Innovation*

The previous Section demonstrated that the most high-profile experimentation with fintech regulatory strategies has been outward facing, designed to support private-sector innovators. In the last year, however, regulators around the world have increased their own experimentation behind the scenes, exploring the use of technologies to address their own core mandates.[138] This Article uses the term "SupTech" to refer to innovation by financial regulators that is informed by technological advances in big data analytics, machine learning, and distributed ledger technology.[139] Readers may be more familiar with the term "RegTech," but this Article prefers "SupTech" because of the confusion inherent in the former term. "RegTech" is used to describe technologies that are used by industry participants to

---

[137] Allen, *supra* note 101, at 636.

[138] "Suptech solutions have emerged only recently, with a marked take-off in 2019." Simone de Castri et al., *The Suptech Generations*, BANK FOR INT'L SETTLEMENTS FIN. STABILITY INST. INSIGHTS ON POL'Y IMPLEMENTATION NO. 1, 14 (Oct. 2019).

[139] *Id.* at 1; Yang & Tsang, *supra* note 10, at 366. (stating that Suptech is when financial authorities use innovative technology).

facilitate their own regulatory compliance, as well as innovations that are used by the regulators themselves to improve their regulatory functions.[140] This Article focuses primarily on the latter, and so the narrower term "SupTech" provides more precision.

While few SupTech applications are operational,[141] regulators around the world are becoming increasingly interested in trialing or developing such applications, with the Financial Stability Institute of the Bank for International Settlements reporting in October 2019 that approximately twenty financial regulatory bodies were engaging in some type of SupTech experimentation.[142] To date, SupTech has focused primarily on improving the collection and analysis of voluminous amounts of data relating to reporting requirements, fraud detection, and AML compliance.[143] The focus on reporting requirements makes sense in light of the increased volume of data that must be disclosed post-Crisis[144] and the private sector's increasing use of RegTech solutions to automate their compliance with those regulations[145] (as Baxter has noted, "[m]anual surveillance of automated activities . . . is entirely unrealistic, and the automation of many of the regulatory tasks traditionally performed manually seems imperative").[146] Regulators are also realizing that SupTech has the potential to be more than a defensive necessity; market surveillance for fraud and money-laundering may increasingly allow for real-time detection and intervention[147] and the hope is that "risk and compliance monitoring [will turn] from a backward-looking into a predictive and proactive process."[148]

Looking more specifically at the US financial regulators discussed in this Article, there is little information available (at least publicly) regarding any

---

[140] For a discussion of the different meanings of the word "RegTech", *see* Luca Enriques, *Financial Supervisors and RegTech: Four Roles and Four Challenges* (Revue Trimestrielle de Droit Financier 53, 2017), https://ssrn.com/abstract=3087292.

[141] De Castri et al., *supra* note 138, at 2 (stating most Suptech solutions are experimental in nature).

[142] *Id.* at 8.

[143] *Id.* at 10.

[144] Broeders & Prenio, *supra* note 999, at 3. ("Post-crisis regulatory reforms have led to an upsurge in reporting requirements. This increases the need for efficient and effective monitoring to benefit from the resulting boost in data availability").

[145] De Castri et al., *supra* note 138, at 14. (stating Suptech solutions began to arise because of the burden on complying with regulations).

[146] Baxter, *supra* note 13 at 597.

[147] De Castri et al., *supra* note 138, at 11-12 (stating AI tools are well equipped to handled time-sensitive and unstructured data).

[148] Broeders & Prenio, *supra* note 99, at 1.

SupTech experimentation by the CFPB or OCC,[149] while the SEC and CFTC have engaged in more highly publicized experimentation. The SEC has focused its attentions on XBRL (machine readable data) reporting requirements, the MIDAS system to analyze big data generated by the equity markets, the ARTEMIS big data enforcement tool, and the Consolidated Audit Trail for tracking and recording trading activity across the securities exchanges.[150] These SEC programs are primarily focused on improving disclosure and surveillance processes, and the CFTC has similarly emphasized disclosure and surveillance in its "CFTC 2.0" initiative, noting that:

> [n]ew technologies hold the promise to change the way the CFTC fulfills its mission. For example, FinTech innovation could reshape the way the CFTC conducts market oversight to enhance market and risk surveillance vital to market integrity. FinTech innovation may also provide new ways for the CFTC to gather and disseminate market data to improve transparency. Through CFTC 2.0, CFTC staff can explore promising ideas and have the opportunity to develop greater in-house capability and knowledge.[151]

Experimentation with these types of SupTech is laudable. However, such experimentation has thus far sought to streamline *existing* regulatory functions. This Article (particularly Section II) has made the case that *new* regulatory functions are needed to respond to the qualitative changes that fintech is making to the processes by which financial services are being delivered. This type of SupTech experimentation is sorely lacking. Furthermore, there has only been very limited exploration of using SupTech

---

[149] An argument could be made that the CFPB engaged in SupTech experimentation from its inception, as it sought to be a data-driven, technologically-savvy agency. Kennedy et al., *supra* note 49 at 1143. However, under its current leadership, the CFPB's Office of Innovation appears very innovator focused, with little apparent emphasis on developing new regulatory solutions in-house. CFPB, *Bureau of Consumer Financial Protection Announces Director for the Office of Innovation* (Jul. 18, 2018), https://www.consumerfinance.gov/about-us/newsroom/bureau-consumer-financial-protection-announces-director-office-innovation/. Similarly, materials available on the OCC's Office of Innovation make no reference to SupTech or to RegTech more generally. See, for example, OCC, *Office of Innovation*, https://www.occ.gov/topics/supervision-and-examination/responsible-innovation/occ-innovation-general-brochure.PDF.

[150] Michael S. Piwowar, *Old Fields, New Corn: Innovation in Technology and Law*, REMARKS AT THE 2018 REGTECH DATA SUMMIT (Mar. 7, 2018), https://www.sec.gov/news/speech/piwowar-old-fields-new-corn-innovation-technology-law.

[151] COMMODITY FUTURES TRADING COMMISSION, *CFTC 2.0*, https://www.cftc.gov/LabCFTC/CFTC2_0/index.htm.

to improve the performance of existing *prudential* regulatory functions,[152] which will become crucial as private firms increasingly use machine learning algorithms for risk management.[153] Yang and Tsang have observed that "[s]ome financial regulators have applied Al in model validation to detect anomalous projections generated by its models of stress tests, while others have applied it to model the capital market business for bank stress testings",[154] and the Bank of Italy is using machine learning to "analyse real estate ads in a popular online portal to forecast housing prices and inflation."[155] Overall, however, the BIS has found that very few financial regulators are dedicating their SupTech resources to prudential oversight responsibilities[156] – notwithstanding the potential for aggregating new data sources and machine learning analysis techniques to detect threats to individual institutions and the financial system as whole.[157] More experimentation with SupTech is therefore necessary, although such experimentation raises a host of challenges that are discussed in the next Section.

B. *Challenges for SupTech Innovation*

U.S. financial regulators have been comparatively slow to experiment with innovator-supporting regulatory approaches to fintech, so it would not be particularly surprising if they were not early movers in experimenting with SupTech either. However, while caution is justified when considering regulatory sandboxes and other innovator-supporting approaches (because of the resource-intensive nature of such policies and uncertainties about their ability to further core regulatory goals),[158] experimentation with SupTech should be pursued as a matter of priority. The application of machine learning and smart contracts to financial services is only just beginning, and so there is still significant scope for regulators to require that SupTech technologies be incorporated into privately-developed financial products.[159] Inserting SupTech technologies into such products once they have become operational will be far more difficult, and more likely to result in unexpected (and potentially negative) side effects.[160] Time is therefore of the essence in

---

[152] De Castri et al., *supra* note 138, at 10.
[153] Yang & Tsang, *supra* note 10, at 363; 367.
[154] *Id.* at 367.
[155] De Castri et al., *supra* note 138, at 14.
[156] *Id.* at 10.
[157] Broeders & Prenio, *supra* note 99, at 12-13.
[158] Allen, *supra* note 101, at 581.
[159] Allen, *supra* note 31, at 109.
[160] *See e.g.* Hilary J. Allen, *Payments Failure* (manuscript on file with author).

SupTech experimentation – unfortunately, SupTech experimentation is very resource intensive, and faces other challenges as well. This Part will consider these challenges.

Many of the problems highlighted in Section II regarding the difficulty of regulating innovation generally pertain to the development of SupTech tools. Limited resources and expertise are an unavoidable constraint. Some form of regulatory arbitrage is inevitable, and regulators must also be careful to balance their commitments to preserving financial stability and protecting consumers/investors with any mandates to promote competition and market efficiency (the latter of which are often facilitated by new innovation). The enormity of these challenges may help explain regulators' limited embrace of SupTech so far. The BIS has made similar observations with regards to regulators' hesitancy to experiment with SupTech, noting "(i) concerns among financial authorities about the uncertain value and risks of suptech [particularly operational risks]; (ii) resource constraints; and (iii) a limited product offering for suptech solutions from a small pool of specialised technology vendors. The inertia inherent in legacy IT systems is another factor." [161]

The most obvious and pressing concern is a lack of resources and expertise. If technology is to be harnessed to achieve the regulatory goals of consumer/investor protection and financial stability, regulators will either have to develop that technology in-house or enlist someone to develop it for them. The approach chosen will depend in large part upon the resources available internally – often, regulators will lack the necessary personnel and expertise for in-house development.[162] However, regulators can only outsource if there is someone they can outsource to, and there are few vendors specializing in SupTech tools.[163] If regulators can find a suitable third party vendor, the efficacy of the technology they receive from that vendor will be necessarily constrained by their budget, and by the ability of regulators to monitor the vendor.[164] Input into the process of technological development is vital to shaping it, and so ongoing dialogue between the regulator and the vendor is vital to ensuring that the technology will properly execute regulatory priorities.[165] In order to be able to achieve this, regulators need

---

[161] De Castri et al., *supra* note 138, at 14.

[162] Enriques, *supra* note 140, at 5. (A supervisor can act as a developer of RegTech if the supervisor has people with the required skillset).

[163] De Castri et al., *supra* note 138, at 15. (Only a quarter of suptech initiatives are developed by external vendors).

[164] For a discussion of private firms' analogous difficulties in overseeing outsourced technology development, *see* Veerle Colaert, *RegTech as a Response to Regulatory Expansion in the Financial Sector* 14 (Working Paper, 2018), https://ssrn.com/abstract=2677116.

[165] *Id.*

personnel who are able to communicate with the technical specialists at the vendor. As such, if regulators do not have the resources necessary to execute SupTech solutions in-house, they at least need to prioritize hiring or cultivating 'interpreters', who have one foot in the regulatory world and one foot in the technical world. These interpreters may not be as technologically sophisticated as the people actually creating the SupTech solutions, but they should be able to communicate at a sufficient level that they can relay the regulator's demands, and check at all intermediate steps that the technical solutions are responsive to those demands. Unfortunately for the regulatory agencies, such a skill set will be very valuable, and they may have difficulty retaining these 'interpreters.'[166]

Retention efforts must be made, however, because interpreters will remain vital after the initial solution has been built. Regulators must remain humble about their technological solutions, and admit when they have failed or require substantial revision – otherwise, the product will entrench and institutionalize flawed regulatory approaches.[167] The interpreters will be needed to determine if the technology is performing as needed, and the technology should be designed in a way that is sufficiently transparent to allow interpreters to either make any necessary changes themselves, or at least detect the parts of the system that require revision and contract technological experts to make the necessary changes.[168] SupTech solutions are therefore not costless to maintain, although they may increase regulatory efficiency and thus conserve resources that would otherwise need to be devoted to supervision.[169]

Luca Enriques has noted that where regulators have limited funds available to pay vendors for SupTech solutions, the same vendors may wish to leverage their work by providing related compliance solutions to private firms who can pay more – this may result in a very sophisticated form of regulatory arbitrage where the vendors skew the SupTech software in favor of their more lucrative private clients.[170] One possible way to avoid such an

---

[166] Broeders & Prenio, *supra* note 99, at 18-19 ("Because of the scarcity of staff with the right background, each suptech solution may be dependent on just one or two key persons. . . . retaining qualified staff for the long term is likely to become increasingly difficult.").

[167] Colaert, *supra* note 164, at 13.

[168] *Id.* at 18 ("Internal transparency should further guarantee that changes can be made to complex systems at a later stage, even when the original developers of the system are no longer available for support.").

[169] *Id.* at 8 (". . . RegTech has been claimed to offer massive cost savings.").

[170] Enriques, *supra* note 140, at 5 (". . . when in a position to exploit information asymmetries vis-à-vis supervisors as customers, rather cater to the interests of market players [the larger and higher-margin clientele] than to those of supervisors.").

outcome is for regulators to partner with quasi-public sector entities with significant research capacity, such as universities with strong data science or software engineering departments[171] – this may be the most fruitful approach for developing the cutting edge regulatory tools advocated for in this Article.[172] Even when arbitrage is not baked into the SupTech technology itself, other forms of regulatory arbitrage remain possible – through interviews with financial regulators around the world, the BIS found that "a few supervisory agencies recognize the risk that their use of suptech might lead to market participants adjusting their behavior in order to "game" the technology."[173]

Regulatory bodies adopting SupTech solutions must therefore remain alert to forms of arbitrage, and they must also devote more resources to managing their own internal operational risks.[174] Technology-driven regulatory tools may become a target for cyberattacks, and the more complex they are, the more susceptible they are to unanticipated glitches that can cascade and compound as they move through the regulatory apparatus.[175] Such operational failures may not be confined within the agency – they may ultimately cause problems for regulated entities as well, particularly if RegTech and SupTech software are designed to be interoperable.[176] Such a possibility creates reputational and legal risks for regulatory agencies that must also be managed. Ultimately, some SupTech failures should be expected (particularly when new technologies are being layered over legacy technology systems); trial and error will be necessary.[177] While fear of the fallout from the errors might understandably deter regulators from embracing SupTech solutions, waiting too long to address the new fintech processes being adopted by the private sector is ill-advised for both political economy and technological reasons. Regulators often find it difficult to upset market expectations about the regulatory treatment of an established product

---

[171] Yang & Tsang, *supra* note 10, at 400.

[172] De Castri *et al.*, *supra* note 138, at 15 ("Academic partnerships, meanwhile, can be fruitful for exploratory projects on the cutting edge of suptech research.").

[173] Broeders & Prenio, *supra* note 99, at 2.

[174] *Id.*

[175] *See e.g.* Hilary J. Allen, *Payments Failure* (manuscript on file with author).

[176] Interoperability is an identified goal of SupTech experimentation: "The key to effective OversightTech, or the use of RegTech by supervisors for oversight purposes, will be for the software to be interoperable (that is, able to dialogue) with ComplianceTech products and possibly even with Operations RegTech products." Enriques, *supra* note 140, at 4.

[177] Yang & Tsang, *supra* note 10, at 361.

or service,[178] and it is also much easier to shape a technology (for example, by inserting a circuit breaker into a smart contract) during its development than it is to alter an operational technology – and the latter is much more likely to result in unanticipated negative consequences.[179]

Even when financial regulators accept that proactively engaging in SupTech innovation is in their long-term best interests, it can be challenging to identify and prioritize opportunities for SupTech applications. Some regulatory agencies are directing their researchers to develop technological responses to questions posed by policymakers and academics; at other agencies, the regulators themselves are identifying technologies that would assist them in discharging their functions.[180] In either instance, the technological solutions adopted may have to straddle a number of different regulatory objectives. In some situations, there may not be any cause for conflict – the financial industry, regulatory agencies and financial intelligence units like FinCEN tend to be aligned in seeking more efficient ways to investigate and prevent financial crime (this win-win mentality is perhaps part of the explanation for why so much SupTech innovation has occurred in the field of AML/KYC technology, including biometrics and big data analytics).[181] More efficient and targeted approaches to reporting and fraud detection could also be considered a win-win, but some SupTech solutions may have negative consequences for other financial regulatory mandates.

For example, algorithms work more quickly with fewer lines of code, and so adding technological requirements like circuit breakers to smart contracts could make the product marginally less efficient. It may also be hard to determine upfront whether a SupTech innovation will have unintended consequences that could ultimately undermine a regulatory goal. For example, if multiple machine learning algorithms are trained with the same regulator-developed hypothetical scenarios in order to expose them to the possibility of tail events, then the result may be greater correlation in the behavior of the algorithms – which could ultimately create financial instability.[182] In developing such scenarios, regulators should therefore try to anticipate the reflexivity of algorithmic interactions,[183] but it is still possible that regulatory efforts could create what Whitehead has termed

---

[178] Wu, *supra* note 7, at 1850; Kenneth C. Kettering, *Securitization and its Discontents: The Dynamics of Financial Product Development*, 29 CARDOZO L. REV. 1553, 1651 (2008).

[179] Allen, *supra* note 31, at 109.

[180] Broeders & Prenio, *supra* note 99, at 13-14.

[181] Yang & Tsang, *supra* note 10, at 368-710.

[182] Allen, *supra* note 31, at 145.

[183] *Id.*

"destructive coordination."[184] The possibility of such an outcome will be heightened if there is international regulatory collaboration on developing SupTech tools – and such collaboration is to be expected, because it can help scale many of the other benefits of SupTech.[185]

Regulators therefore need to constantly interrogate their SupTech innovations in light of their broader understanding of the financial system and their regulatory goals.[186] This can be challenging even for experienced regulators – it can be tempting to instead defer to a technological solution without interrogating its underlying process (a heuristic known as "automation bias").[187] Indeed, many tech tools seem designed to encourage automation bias, offering "intuitive, user-friendly interfaces with advanced graphics and interactive tools, which empower end users with non-technology backgrounds . . . to tap into the benefits of these advanced technologies."[188] However, automation is not a neutral process, but a reflection of the policy views of the regulators implementing the solution, perhaps tempered by the beliefs and understandings of the third-party vendor actually constructing the solution.[189] Regulators must therefore maintain some degree of skepticism and humility regarding their SupTech solutions. For more junior personnel who join regulatory agencies in the era of SupTech, it will be even more important that they be trained in developing nuanced regulatory expertise and temper their use of SupTech with human judgment.[190] Otherwise, the skillsets of regulatory expertise and judgment may be lost as regulators increasingly defer to technological solutions.[191]

CONCLUSION

SupTech is not a panacea, and we should remain mindful of Haldane and Madouros' admonition that it can be counterproductive for regulators to meet

---

[184] Charles K. Whitehead, *Destructive Coordination*, 96 CORNELL L. REV. 323 (2011).

[185] There are a number of international fora already working to coordinate SupTech experimentation, including the BIS' Innovation Hub. De Castri et al., *supra* note 138, at 2.

[186] Baxter, *supra* note 13, at 603.

[187] Kenneth A. Bamberger, *Technologies of Compliance: Risk and Regulation in a Digital Age*, 88 TEX. L. REV. 669, 676 (2010).

[188] FINRA, TECHNOLOGY BASED INNOVATIONS FOR REGULATORY COMPLIANCE ("REGTECH") IN THE SECURITIES INDUSTRY 7 (Sept. 2018), available at https://www.finra.org/sites/default/files/2018_RegTech_Report.pdf.

[189] Baxter, *supra* note 13, at 603.

[190] Colaert, *supra* note 164, at 16.

[191] Colaert has cautioned against a similar outcome for private firms relying on RegTech tools. *Id.* at 26.

industry complexity with regulatory complexity.[192] However, when the industry is using complex technologies like smart contracts and machine learning, it is difficult to see how regulators can develop simple strategies for engaging with them – other than banning them, or requiring a preapproval process that would significantly slow their development. A preapproval process for new financial technologies would have many benefits, but seems politically infeasible at present (as well as ripe for jurisdictional arbitrage).[193] And bans, although they may be warranted in some circumstances, are an extreme response that could restrict the development of products and services that might ultimately benefit individual consumers and investors.[194] Financial regulators therefore need to experiment with technological responses to the technologies they regulate, and they need to do so as a matter of priority. Experimentation will take time, and if regulators miss their window, the financial system will be shaped entirely by the experimentation of a private sector with little motivation to protect consumers, investors, or the stability of the financial system.

---

[192] Andrew G. Haldane, Exec. Dir., Fin. Stability, Member, Fin. Policy Comm. & Vasileios Madouros, Economist, Bank of Eng., *Speech at Federal Reserve Bank of Kansas City's 36th Economic Policy Symposium: The Dog and the Frisbee* (Aug. 31, 2012), available at http://www.kansascityfed.org/publicat/sympos/2012/ah.pdf.

[193] Allen, *supra* note 5, at 209 *et seq*.

[194] Rory Van Loo, *Making Innovation More Competitive: The Case of Fintech*, 65 UCLA L. REV. 232, 232 (2018).

ARTICLE

INCONVENIENT TRUTHS: INTERPRETING THE ORIGINS OF THE INTERNET

SHANE GREENSTEIN[†]

A conventional economic narrative provides intellectual underpinnings for governments to subsidize research and development ("R&D") that coordinates risky research to benefit many in society. This essay compares this narrative with the origins and invention of the internet. Are the historical facts consistent with the conventional economic narrative? Does the conventional economic narrative offer a complete explanation for why government subsidized R&D related to the internet produced high economic value? The essay shows why that narrative is consistent with historical experience, and incomplete in crucial respects. To remedy incompleteness, an analyst needs to appreciate the role of lead-users and good governance of technology transfer. Accounting for such factors, the essay develops a number of implications for technology policy.

[†] Martin Marshall Professor of Business Administration, Harvard Business School. Thanks to Janet Abbate, Rebecca Henderson, Roger Noll, and Christopher Yoo for their comments, and special thanks to Maggie Kelleher, Louis Lesser, Michael Buchwald and Saba Bajwa for their editorial improvements. All errors are mine alone.

INTRODUCTION[1]

The conventional economic narrative for federal subsidies of Research and Development (R&D) finds its intellectual roots in the economics literature about R&D. A large conversation covers all aspects of this topic, and blossoms in many directions.[2] A summary goes like this: federal support for R&D overcomes the predictable inadequacies with privately financed R&D. Private firms shun risky and scientific inquiry that results in diffused future benefits. Private organizations cannot capture sufficient value in such circumstances, and so, absent any extraordinary action from a government, private organizations face low incentives to invest in the R&D. That holds even when those (expected) benefits add up to far more than needed to justify the expense. Governments subsidize scientific research because government possesses the ability to coordinate and undertake risky actions that benefit many in society.

This narrative, which for convenience will go by the label "the conventional economic narrative," plays a central role in U.S. federal support

---

[1] Some parts of this draws from previous writing, notably, SHANE GREENSTEIN, HOW THE INTERNET BECAME COMMERCIAL: INNOVATION, PRIVATIZATION, AND THE BIRTH OF A NEW NETWORK (2015), and Shane Greenstein, *Nurturing the Accumulation of Innovations: Lessons from the Internet*, *in* ACCELERATING INNOVATIONS IN ENERGY: INSIGHTS FROM MULTIPLE SECTORS 189 (Rebecca Henderson & Richard Newell eds. 2011).

[2] The historiography of the economic literature related to government sponsored R&D covers considerable ground that would take us far afield. Many date the literature to Kenneth Arrow, *Economic Welfare and the Allocation of Resource for Invention*, *in* THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609-626 (Richard Nelson, ed., 1962) (at the time of this writing, Google Scholar indicates that Arrow's article has garnered more than one thousand citations. There has been considerable writing on the economics of R&D in this vein, and a thorough historiography would take several books.). *See generally* Kenneth Arrow, *The Economics of Inventive Activity over Fifty Years*, *in* THE RATE AND DIRECTION OF INVENTIVE ACTIVITY REVISITED (Josh Lerner & Scott Stern, eds., 2012) (reflecting on fifty years after the original); JONATHAN GRUBER & SIMON JOHNSON, JUMP-STARTING AMERICA, HOW BREAKTHROUGH SCIENCE CAN REVIVE ECONOMIC GROWTH AND THE AMERICAN DREAM (2019) (continuing this view into the context of the current U.S. R&D system).

for R&D, primarily at the National Science Foundation ("NSF") and the National Institute of Health ("NIH"), and elsewhere within the federal government. It underpins tens of billions of dollars of federal R&D money in health, biology, physics, engineering, computer science, and more. Moreover, it offers a view of the role of the boundary between the public and private R&D in the economy. Private firms perform R&D when the incentives exist, and government pays for R&D when the societal benefits exist, but the private incentives are insufficient. If governments properly execute the portfolio of R&D, and if researchers correctly anticipate (on average) where their efforts could have the largest payoffs to society, according to this conventional economic narrative, years later the R&D should result in productivity gains in many (typically knowledge-based) parts of the economy, where new knowledge has created opportunities for economic growth.

This essay has one goal: to compare the conventional economic narrative with the origins and invention of the internet. This comparison starts from a position of comfort, in that the conventional economic narrative seemingly sits comfortably next to common understanding of events. Two graduate assistants in Len Kleinrock's UCLA lab first logged into their Interface Message Processor ("IMP") in August of 1969.[3] Internet historians recognize that event as the first of thousands of messages using inventions and prototypes that led to today's internet, much of which have been subsidized by federal money for more than two decades.[4] It is also widely believed that the diffusion of these inventions into private commercial services caused an economic boom in the late 1990s. Given this common understanding, not surprisingly, the internet has become Exhibit A to illustrate how government support for R&D can yield valuable innovations that contribute to economic growth.

Unlike the politics behind internet policy,[5] the correspondence between

---

[3] An IMP was the earliest prototype for what we today call routers. These are nodes in a network, designed to move packets of data. To communicate with each other, both IMPs must use the same protocols, or computer commands, to organize, send, and receive data. The IMP at UCLA was seeking to communicate with another at the Stanford Research Institute.

[4] *See, e.g.*, JANET ABBATE, INVENTING THE INTERNET (1999) (providing thorough analysis of events at DARPA and NSF); ARTHUR NORBERG ET AL., TRANSFORMING COMPUTER TECHNOLOGY, INFORMATION PROCESSING FOR THE PENTAGON, 1962-1986 (1996) (providing thorough analysis and original interviews of events at DARPA); MITCHELL WALDROP, THE DREAM MACHINE: J.C.R. LICKLIDER AND THE REVOLUTION THAT MADE COMPUTING PERSONAL (2001) (tracing Licklider's influence).

[5] Several prominent U.S. politicians, most notably Al Gore, hitched agendas to the internet. There exist cartoonish versions of these claims, largely affiliated with numerous Al Gore jokes. *See* Richard Wiggins, *Al Gore and the Creation of the Internet*, FIRST MONDAY (Oct. 2, 2000), http://www.firstmonday.org/issues/issue5_10/wiggins/). *See also* GREENSTEIN (2015), *supra*

the conventional economic narrative and actual historical events has not received much scrutiny, presumably because they seem to sit comfortably together. What would an informed examination show? That comparison motivates this essay, which explores related questions: are the historical facts consistent with the conventional economic narrative? Why or why not? Does the conventional economic narrative offer a complete explanation for why government subsidized R&D related to the internet produced high economic value? Why or why not?

The first section of the essay analyzes a few examples that illuminate the broad historical outline behind the internet's development. The first conclusion arises easily: the facts appear consistent with the conventional economic case for subsidizing R&D on a broad level. Yet, the conventional narrative errs in two important respects that make such consistency unsatisfying. For one, the conventional narrative contains a retrospective bias that misinterprets the motivation for creating the internet, and, for two, it compresses a sequence of events into a singular invention. Those lead to omission of crucial features of the experience that led the internet to have such a large economic impact. In short, consistency is not near completeness. The conventional economic narrative, by itself, does not explain why the internet created large value. More is required.

The second section of the essay offers one remedy to incompleteness. It stresses events related to both the internet's inventiveness and to its deployment throughout the universities of the U.S. This part of the essay offers a framework with the label, "lead user," and summarizes a set of observations about the first users of the internet and their inventions. Lead user frameworks have a long history in economics and managerial scholarship for innovation. The approach directs attention at innovations initiated by early users, enhanced by learning from operational experience. This framework provides insights about why government stewardship led to some innovations the conventional narrative would otherwise overlook. It also underlays implications for R&D policy that partially overlap with, and contrast with, those derived from the conventional economic justification for subsidizing R&D.

The third section of the essay introduces one additional set of observations to remedy the incompleteness; stressing events related to moving the internet from government stewardship to private hands. This part of the essay offers the label, "good governance of technology transfer," because this section summarizes observations about lessons from the experience transferring internet technology into private hands. This section

---

note 1, at 65-68 (explaining the historical origins and their (lack of) veracity).

stresses where governance had consequences for the creation of economic value from the internet, and it illustrates lessons about how to manage this transfer, and *how not to*. As with the other sections, these are lessons that the conventional narrative overlooks, and they are central to understanding how the internet created value.

Several implications follow from this assessment. For one, this essay offers a (narrow) warning to (my fellow) innovation economists to *not* rely exclusively on the conventional narrative to understand how the internet developed and why it had a large impact on the economy. While the internet can illustrate the conventional economic narrative, the narrative alone is not enough to explain the most salient features of events, in particular, why events around the privatization of the internet created so much value. The essay also offers (a more broad) warning for any future policy. Any lesson based solely on the conventional narrative is unlikely to be adequate for creating economic growth from government-subsidized innovation. Attention to concerns about lead users and good governance must accompany any subsidy to R&D to bring about innovation with large societal impact.

Finally, and perhaps more controversially, the essay contains other cautionary lessons for future federally subsidized R&D. The assessment implies it will be difficult to recreate high-impact technical inventions with government subsidies when events stray outside the conventional economic narrative, as any sufficiently ambitious attempt will tend to do. The value from decades of federal investment in R&D in such cases depends on whether some future decision makers show good judgment at the right moments. Said simply, successful R&D alone is insufficient to create value. Good policy must accompany it.

This essay aims at the concerns of economic technology policy, and owes considerable debt to the work of internet historians who have extensively documented its origins. However, this essay does not aim to uncover new historical insight. Rather, as stressed, it aims to help those familiar with the conventional economic narrative make sense of events about which they may be unfamiliar. Accordingly, it provides details in an accessible presentation to those unfamiliar with the internet's history. With those goals in mind, it would be counterproductive for the essay's goals to offer the history of invention for its own sake, and it also would be unsatisfying to wave away detail with a wistful "it's complicated." That leads to an essay that stresses "illustration instead of extensive analysis" and "a bottom line instead of pedantic detail." The essay generously deploys variations on the phrase "the curious reader can follow the footnotes."

I. THE CONVENTIONAL NARRATIVE

The experience with the internet appears consistent with the conventional economic narrative about government subsidy of R&D. To illustrate, it is necessary to provide a selective reading of the history of the internet that (conveniently but judiciously) does not dwell on every detail.

A. *Consistency and Illustration from History*

The history of budgets and governance align with the conventional narrative. Long before there was a major industry supplier, and long before any private supplier invested in developing packet switching, the U.S. military budget provided funds for the efforts (i.e., prior to 1985). NSF, with some extra help from special Congressional allocations,[6] largely served as the source of funds for invention from 1986 until some point near the end of government involvement, somewhere into 1993-95. Even then, NSF continued to fund frontier computer science.

The R&D subsidies from the government do also seem to fit a view of sagacious choices among the portfolio of projects by program managers who were forward-looking; aiming at long-term risky gains that private industry avoided tackling. Before any inventive academic or well-funded laboratory in a private firm had invested much in anything more than a few theoretical sketches and visionary statements, in the 1970s the U.S. military's R&D arm, the Defense Advanced Research Projects Agency ("DARPA"), hired program managers to initiate and develop packet switching,[7] accelerating its earliest incubation as a viable technology. A particular implementation of packet switching, initially worked out in the 1970s, became the foundations for the protocol designs and processes underlying what we today recognize as the internet.

What were DARPA's program officers searching for in the 1970s when it began funding what became the internet? An ideal technical solution that would move data between computer systems. A system that could enable the exchange of data and communication between computing systems without frequent human intervention would save the military time and personnel expenses, and help realize new strategic capabilities. Coordinating the

---

[6] Later these allocations became the object of considerable political interest and misinterpretation. *See generally* Wiggins, *supra* note 5 (providing an overview of Al Gore's role in securing funding for NSF).

[7] Packet switching is a method of communicating data within networks. Data are grouped into "packets" with a header that directs the data to its destination. The remainder of the data is the "payload," which moves from origin to destination, where an application extracts the data. Packet switching technology underlies all internet communications today.

exchange, combination, and filtering of data between computer systems generated numerous logistical and organizational gains for military operations. Keeping communications functioning in spite of a blown/cut line, for example, has military value in hostile battlefield conditions.

One potential approach to these considerations, packet switching, held the promise to achieve these desirable attributes by allowing data to flow along multiple paths, unlike a circuit-switched telephone network in which calls follow a pre-set path programmed into central office telephone switches. Other potential attributes of packet switching also played a role. An inexpensive packet switching network could also cover large geographic distances, which could support the sharing of expensive computing resources over such distances. That too had self-evident military value. For example, military users in many locations–even potentially dangerous locations–could access databases housed in another (potentially safer) location.

Packet switching was but one of many DARPA projects on the frontiers of computer science.[8] While the demand for these innovative solutions was quite general, all the projects pushed the boundaries of computing at the time. Both "packet-switching" and "a network of networks" were budding theoretic concepts, lacking substantial prototypes. DARPA's administrators wanted innovative new designs for prototypes, and new processes for operating them. Those prototypes were the short run goal.

Another feature of the conventional economic narrative also appears in histories of the internet, namely, without government subsidy, no invention would have arisen. There was little or no private investment in internetworking. No other private entity would have undertaken the same efforts in internetworking–for example, to build a national backbone and supporting network–at least with an aim towards profiting from those efforts.[9]

A brief summary can illustrate. Close examination of the two largest and most capable firms in the U.S., AT&T and IBM, reveals they had no plans to deploy national networks in the 1980s. Summarizing book-length details, AT&T did not have such plans. That was so for numerous reasons related to the demands of its traditional business in telephony, the regulatory limits placed on its actions, and the outlook and perceptions that shaped managerial

---

[8] The development of packet switching receives attention from all the historians of the internet. *See generally*, ABBATE, *supra* note 4; NORBERG ET AL., *supra* note 4; WALDROP, *supra* note 4; ALEX ROLAND AND PHILIP SHIMAN, STRATEGIC COMPUTING: DARPA AND THE QUEST FOR MACHINE INTELLIGENCE 1983 – 1993 (2002).

[9] DARPA did attempt to seed a private packet-switching industry in the early 1970s, but these efforts did not get far.

attention to priorities.[10] After AT&T's management realized the error of its perceptions in the 1990s, in late 1995-96 it began to promote a nation-wide consumer-oriented dial-up service for the internet, which realized some commercial success for a short time. In other words, these actions were salutary for the development of the internet as a commercial service, but also quite late.

Another highly capable and wealthy firm, IBM, explored the area in one research division in the middle of the 1980s, and pursued it after winning a bid for government contract (discussed more in section IIIB). Later, this same division at IBM, with help from IBM's legal team, would make one daring attempt to dominate U.S. networking, and it would fail (also discussed further in Section IIIB). It too developed a national dial-up service in the early 1990s, but only for its business clients. IBM's other divisions, who sold to all of IBM's private customers, largely ignored what the researchers were doing, and management in most parts of IBM continued to push proprietary versions of local networking equipment until the firm experienced its existential crisis in 1993-94. After restructuring its strategy between 1994 and 1996, IBM began promoting services using non-proprietary networking technologies, such as the World Wide Web.[11] In other words, the entire corporation switched approaches, which was salutary for the internet's development as a commercial service, but, like AT&T, it also came quite late.

Summarizing, even with some optimism, contemporaries in the 1970s and 1980s, and even into the early 1990s, could not have, and did not, believe that any firm would provide non-proprietary internetworking services in the U.S. for a long time, at best.[12]

Finally, as a further boost to this conventional narrative, the invention and deployment of the internet also seems to have resulted in technological advance that underpinned impressive and widespread economic growth. The privatization of the internet is associated with the boom in economic growth in the late 1990s, and the timing appears to be more than coincidence. The privatization of the internet backbone finished in June of 1995. Netscape's

---

[10] This is an extensive story. *See generally* GREENSTEIN (2015), *supra* note 1, at Chapter 2 and 3; ABBATE, *supra* note 4; NORBERG ET AL., *supra* note 4 (explaining the early development of packet switching and explanations for AT&T's lack of interest). *See also* Greenstein (2015), *supra* note 1, at 224-227 (describing its dial-up service).

[11] *See* GREENSTEIN (2015), *supra* note 1, at 77-82 (detailing IBM's early involvement in NSF internet); 272-282 (providing an analysis of its change in strategy).

[12] Other forward-looking efforts at internetworking, such as Minitel in France, were outside the U.S., and largely ignored within the U.S. Efforts to build national electronic mail services in the U.S. – from IBM, Lotus Notes, Compuserve, and others, also largely emerged in the 1990s, building on earlier efforts within BBS systems, and the internet eventually displaced them. *See* GREENSTEIN (2015), *supra* note 1, at 138-148 (adding further details).

IPO took place in August of 1995, as did the rollout of Windows 95 with Internet Explorer 1.0. By December of 1995, Microsoft announced its change in direction, and its intention to invest heavily in the internet, publicly signaling the beginning of what later observers labeled "the browser wars." Only a few months later, more than a thousand dial-up internet service providers ("ISPs") would offer service throughout the U.S., and that continued to grow for years. These events catalyzed adoption of the internet in millions of households and business establishments over the next decade.

Economic growth exploded for several years thereafter. An investment boom ensued in the carrier industry, as did an investment boom in private establishment use, as did sophisticated business uses for the internet. IT consulting industries grew rapidly in size to help. This widespread activity served as the engine behind more than three percent growth per annum between 1995 and 2002, and sometimes four percent. That uninterrupted growth was the highest sustained economic growth rates experienced in the U.S. since the 1960s, and, as of this writing, that rate of growth has not arisen in two successive years the two subsequent decades. In other words, it appears that the privatization of the internet, and its subsequent growth, caused a boom in economic growth and prosperity, with foundations in technologically-enabled new investments.

Summarizing, the experience with the internet appears consistent with the conventional economic narrative. Moreover, it also appears consistent with the view that government-subsidized technical innovation can yield substantial economic growth.

What is inadequate about the preceding comparison of the conventional narrative and the historical facts? While an outline of facts is consistent with the narrative, the conventional narrative contains a retrospect bias that oversimplifies the innovation process. In addition, it compresses events into a simple narrative. Both result in overlooking the role of motivation and governance.

B. *Motivation for Invention*

When applied to the history of the internet, the conventional narrative contains a retrospective bias. It presumes the later outcomes were intended consequences, and grafts motives onto DARPA's managers that were not present at the time of the decisions. Specifically, the conventional economic narrative presumes that because an economic boom followed invention, the anticipated economic benefits from invention motivated DARPA's funding. That is, at best, a misleading way to characterize the motivation that led to funding the inventive activity.

While decision making at DARPA was forward-looking, it was also parochial in its orientation. DARPA had a mission, to serve the military. That outweighs every other consideration. Broadly, and for a variety of reasons related to its origins, DARPA's mission was to develop radical new concepts and operations to transform military operations through development of new technologies.[13] The potential value to the military was sufficient motivation for such funding, and in the case of internetworking technology, there were plenty of military use-cases to justify developments.[14]

Laws such as the Mansfield Amendment of 1973 also proscribed the mission.[15] Bluntly stated, the Mansfield Amendment of 1973 expressly limited appropriations for defense research (through ARPA/DARPA) to projects with direct military application. To be sure, this is an elastic boundary, and allows for quite a broad range of subsidized activities. It does not preclude funding R&D that leads to benefits for non-military purposes. Whether those non-military uses arise or not, however, was largely irrelevant to the decision to fund R&D for the military. In short, while funders of federal R&D vaguely justified some inventions with visions of what large scale deployment would practically entail, scant evidence suggests DARPA's decision makers used economic reasoning.

Economic policy analysis presumes decisions use a forward-looking cost/benefit analysis. That does not preclude making a cost/benefit calculation of the costs and gains from invention of the internet, but that calculation's historical validity only applies to calculations done with the benefit of hindsight, and should be explicitly acknowledged as retrospective.[16] It would be historically inaccurate as an *ex ante* characterization of forward-

---

[13] The initial impetus for Congress to establish DARPA came from the Sputnik crisis, and originated out of concerns that the U.S. military lacked proper institutions to retain an innovative edge. *See generally* NORBERG ET AL., *supra* note 4; WALDROP, *supra* note 4.

[14] *See* NORBERG ET AL., *supra* note 4; WALDROP, *supra* note 4 (discussing criteria for assessing research are discussed in both. For example, Licklider's three criteria for funding research still sound prescient today: "1. The research must be excellent research as evaluated from a scientific or technical point of view; 2. The research must offer a good prospect of solving problems that are of interest to the Department of Defense; 3. The various sponsored efforts must fit together into one or more coherent programs that will provide a mechanism, not only for execution of the research, but also for bringing to bear upon the operations in the Defense Department the applicable results of the research *and* knowledge and methods that have been developed in the fields in which the research is carried out.").

[15] *See* NORBERG ET AL., *supra* note 4 (stressing that DARPA's funding of packet switching research in the 1960s and 1970s met concerns about whether the funding was relevant to military mission, as required by the Mansfield Amendment of 1973. The research anticipated enhancing the "command and control" capabilities of commanders increasingly reliant on their computing resources).

[16] *See* GREENSTEIN (2015), *supra* note 1, at 125-29 (making this argument during the discussion of the cost/benefit of the government subsidies that resulted in the invention of the commercial Internet).

looking motivation for subsidizing R&D at DARPA.[17]

Why care about this retrospective bias? Because it is more accurate to say DARPA's actions were "mission-driven." R&D that arises from fulfilling a specific mission can have *unintended economic consequences* when the technology becomes deployed in an unanticipated or unexamined application with little relationship to the mission. It is also more appropriate to ask why outcomes succeeded *in spite of the lack of foresight.* As discussed Section III, these unintended consequences make the policies for governance of technology transfer particularly important for understanding the creation of value in private markets. In addition, it suggests a lesson: In designing policies intended to replicate successful subsidy programs of the past, one should always take into account the complex motivations that shaped those subsidy programs, and the likelihood that different complex motivations will shape the results from subsidies in the future, leading the future to diverge from past experience. It also implies that *without attention to unanticipated applications,* mission-driven R&D will not tend to lead to new applications with economic consequences outside of military uses. Such observations are missing from the conventional economic narrative. This lesson also refocuses the general question about technologies that have unanticipated economic benefits: What made the technology and institutions so resilient and adaptable in the presence of unplanned circumstances?

C. *Not a Single Invention*

The second retrospective error arises from compressing a long series of inventive actions into one. While convenient for narrative expediency, compression misleads when discussing policy lessons from the internet. Particularly in common retelling, compression tends to focus attention on DARPA's initial funding, while overlooking the importance of later actions. It also overlooks some of the characteristics of the internet that made it so adaptable, which, as the prior paragraph just noted, is central to understanding the impact of this technology (and others developed by government agencies with a mission-orientation).

Begin with a simple fact, and one made by many historians of the internet. Unlike many other breakthrough technologies, the internet did not originate as one epiphany in the head of one lone innovator genius, who doggedly developed an invention after a period of sustained prototyping, leading in a linear direction from idea to invention to refined prototype to commercial

---

[17] *See* Shane Greenstein & Frank Nagle, *Digital Dark Matter and the Economic Contribution of Apache*, 43 RESEARCH POL'Y 623 (2014) (attempting to calculate such a cost/benefit and unsurprisingly finding the gains far exceeded the costs of invention).

product. Like many other major technical breakthroughs, the internet is not, and never has been, one single idea, or one technology with a fixed set of characteristics and features. It has undergone considerable evolution from its initial development as later innovators added new improvements, experience yielded new insight that redirected priorities, and new use-cases merited further refinements. In this case, the improvements came from many contributors over many years.

As the evolution is extremely well-documented by many technical historians, there is no need to belabor the observation. A little detail, however, can go a long way for this essay's purposes. It is useful to divide the internet's development into four periods.

1. *Initial prototyping.* The first set of frontier inventions took place during the period in the 1970s and early 1980s, when DARPA was the sole funder of inventive acts and operations, and the basic prototypes for packet-switching were first engineered. So too was the specific implementation at DARPA that grew beyond a small set of prototypes, albeit the result was not technically straightforward at the time. As a simplified label for what resulted, many call this suite of invention and operations by the name "TCP/IP," the specific design for protocols, though contemporaries built much more around TCP/IP to make it viable. The internet still uses a descendent of TCP/IP today. Books can be, and have been, written about these inventions, and the events that spawned them.

2. *Refinement of the network by the National Science Foundation (NSF).* In the middle of the 1980s, parts of the TCP/IP-based Internet were transferred to NSF, which chose to continue to use TCP/IP protocols and related processes.[18] Under NSF governance, the Internet acquired a range of new refinements to the protocols, and new institutions for supporting and routinizing them – much of which NSF and research university administrations paid for.[19] With both NSF and Department of Defense ("DOD") funding, further innovation took place in the domain name-server system ("DNS"), and BGP, the protocol that implemented "best-effort routing," which enabled multiple servers and pathways for data. This was also the period where the Internet Engineering Task Force became established, which still operates today. Its mission, institutionalizing the

[18] *See* ABBATE, *supra* note 4 (explaining how DARPA transferred part of the internet to NSF because, in part, many civilian participants were frustrated by the challenges getting military clearances, etc., and NSF's leadership foresaw benefits to the U.S. academic research community).

[19] *See* ABBATE, *supra* note 4 (providing a detailed explanation. Until the NSFNET came into existence, there was only one network and one backbone, and BBN operated it. The scale was limited, and, in contrast, NSF anticipated supporting a much large network. Eventually the NSFNET therefore introduced additional backbones and regional carriers.).

evolution of protocol development for TCP/IP, came with the blessing of both the DOD and NSF, as well as their funding. At the time of these actions, nobody was forecasting with any particular confidence about whether the network would scale much beyond its core community of researchers. And that lack of confidence manifest as "chaos" about the direction of change, about which there was no agreement.[20] Altogether, these actions helped turn the Internet into a living decentralized and geographically-dispersed organization, capable of supporting hundreds of thousands of users, and, eventually, millions of students.

3. *Initiation of privatization.* During the early 1990s (and drawing on developments from the late 1980s), a third round of innovation ensued, and much of it was driven by the needs of privatization. Even at this late moment, nobody was forecasting the wide breadth of impact that privatization would have on the economy, nor was anybody planning for it. Rather, the focus was pragmatic, and oriented towards issues with daily operational processes. A private market could give rise to multiple backbone providers. The most important invention for this circumstance built upon BGP, and was an institutional one, which established routines for routing tables held at multiple locations, updated from a single source.[21] A large debate (further described in Section IIIB) surrounded the practices for data-exchange in a privatized system, where, to achieve national interoperability of communications, competing firms had to cooperate, and, at first, some were reluctant to do so. Initially several industry providers adopted practices that enabled multiple parties to act as non-monopoly carriers of data for the Internet, eventually hurt by, and then helped by NSF's policies for privatizing the internet.[22] This was also the beginnings of the pricing of data carrier services. Those institutions would continue to undergo evolution after the Internet privatized and began to explode as a commercial network, so it is inaccurate to say the government funding *solely* invented these processes.

4. *National deployment.* Fourth, and not trivially, in the early 1990s, Tim Berners-Lee invented the World Wide Web, and then began to deploy it as

---

[20] *See* Janet Abbate, *Privatizing the Internet: Competing Visions and Chaotic Events, 1987-1995*, 32 IEEE ANNALS HIST. COMPUTING 10 (2010) (providing a characterization of the many points of view behind this chaotic period).

[21] *See* DAVID CLARK, DESIGNING AN INTERNET (2018) (explaining that NSF switched from the routing protocol Exterior Gateway Protocol ("EGP") and replaced it with Border Gate Protocol ("BGP"). The EGP protocol presumed a known pathway for connecting systems. BGP enables fully decentralized routing. To internet veteran David Clark, making this change was one of the earliest technical signs of the pending arrival of commercial network and the retirement of NSFNET.).

[22] The privatization of the internet backbone, which permitted private and public users to both use internet protocols and share assets for doing so, would have been very difficult to grow without these inventions.

> a use of the internet as a non-for-profit open system. That expanded the functionality of the internet in ways that made it far more appealing to non-research users. It began to become widely adopted in the early 1990s, and it would spread even further as the internet privatized. Importantly, other university participants began to modify the Web with the invention of better webservers and browsers. At the University of Illinois National Center for Supercomputing Applications ("NCSA") a team developed the Mosaic Browser, which became the source for both Netscape and Internet Explorer (described in Section IIID). The University of Illinois also was the source of the web server that became the antecedent to Apache, the most popular web server for the next two decades (again, described in Section IIID). To summarize a long process, university researchers created much of these inventions, most received U.S. funding from NSF for their R&D, and, afterwards, private investors picked up the innovative activity, taking the innovations to market, where it sold to users.

What broad point emerges from recognizing this general sequence? Most important, observers make an error by being too breezy in common conversation by stating, "DARPA funded the invention of the Internet." NSF deserves much credit, and justifiably deserves top billing with DARPA. Seen from today's perspective, the invention of the Internet was not a single act, and had no single supporting organization behind the funding that led to the development of what firms and buyers use today. Its two-decade long development under government auspices was complicated and nuanced, involving multiple funders, mixing operation-oriented and research-oriented missions. Its primary use cases also changed over time, as did the composition of users. The orientation of innovations and refinements changed too, as did the identities of the primary innovators.

Why does that matter for deriving lessons aimed at technology policy from the conventional economic narrative? For one, a project of this scale, scope, and length did not happen on its own. It required managerial attention over multiple decades and different levels of technical complexity and policy complication. Indeed, as described in Section IIA, a crucial feature of DARPA's success resided in stating a clear mission for its efforts, even as the identity and goals of its stewards changed. The same is so for NSF, who played a crucial role after DARPA. The conventional economic narrative does not direct any attention at this accumulation of features, nor how government managers nurtured that accumulation.[23]

---

[23] *See* Greenstein (2011), *supra* note 1 (explaining a number of institutional features and practices encouraged accumulation. Many of these practices later became the foundations for norms and practices of open source.).

Said another way, underinvestment in governance could have diminished the impact of the internet, and (as described in detail in Section III) was essential for its prosperity. It is also rather obvious that the program managers showed extraordinary competence and judgment. Managers had to work with (sometimes) minimal oversight from their agency heads, and (sometimes) direct intervention from Congress.[24] The conventional economic narrative overlooks these aspects, and does not provide guidance for future R&D policy about how to invest in such capabilities (and which sections III and IV stress).

II. LEAD USERS

The two retrospective biases take attention away from another pattern, well-known to historians of government use of frontier technology. Namely, the U.S. military and NASA served as a "lead user" in the many IT technologies in the 1960s and 70s.[25] "Lead-user" frameworks are a natural candidate for explaining aspects of the experience with the internet. It is important to appreciate because, as demonstrated several times in this section, it also yields policy lessons that differ from the conventional economic justification for subsidizing R&D.

A. *Lead Users at DARPA*

The "elevator pitch" for lead-user frameworks goes like this: a lead user faces needs before these needs have reached any other potential user. As a result, the lead user is highly motivated to address those needs with pioneering research and with inventive technologies, even prior to their development by market suppliers. Even if providers offer prototypes, in such settings the supplies from providers rarely, if ever, provide full functionality without modification, so users find that they must invent some of the technologies required for achieving the desired functionality.[26]

If the lead user succeeds in inventing the basis for a general-purpose

---

[24] *See* NORBERG ET AL., *supra* note 4; Abbate, *supra* note 20 (discussing the inescapable tension between oversight and discretion at DARPA, and explaining the logic for why DARPA opted for giving program officers considerable discretion).

[25] *See* KENNETH FLAMM, TARGETING THE COMPUTER: GOVERNMENT SUPPORT AND INTERNATIONAL COMPETITION (1988); *see also* KENNETH FLAMM, CREATING THE COMPUTER: GOVERNMENT, INDUSTRY AND HIGH TECHNOLOGY (1989) (both exploring these themes with extensive analysis of many case studies).

[26] *See* ERIC VON HIPPEL, THE SOURCES OF INNOVATION (1988) (identifying with the framework offered by this sentence. This and related ideas have long been found in studies of early diffusion and adoption).

technology, particularly at an early moment in its development, lead users typically engage in "co-invention" with suppliers of general-purpose technologies. That activity aims at adapting the supplied goods to the user's perceived needs. Such activity seeks to take a general-purpose technology, and invent complementary prototypes and processes to yield value in specific circumstances and for a variety of specific use-cases. Additionally, lead user activity typically faces an array of challenges affiliated with the discontinuities implementing co-invention, especially when it alters existing organizational practice, and requires unusual efforts to jump-start wide-scale use by other users within the organizations.[27]

The lead user framework illuminates numerous crucial details of events. To begin, by the early 1970s, the U.S. military was already one of the largest buyers and users of computer equipment and systems in the world. In this era, each computing system was typically an island unto itself. None of these could communicate with another computer, nor pass files electronically between them in any automated way. As already noted, it is rather easy to make the case that the U.S. military faced issues with its own computing facilities and operations that no other user had yet encountered on the same scale, and those issues, by themselves, provided sufficient motivation to fund R&D to alleviate the issues.

An important feature of the lead-user framework in the private sector also yields important insights here, namely, the skunk works operates outside of normal operations. A skunk works is what large organizations in the private sector often formed when they pursue activities affiliated with being a lead user. A *skunk works* is an organizational home for frontier development projects.[28] Housed away from the main operations of an organization, sometimes in secret or with organizational barriers, and often with top

---

[27] For an empirical example of co-invention at early adopters, *see generally* Timothy Bresnahan & Shane Greenstein, *Technical Progress and Co-Invention in Computing and in the Use of Computers*, BROOKINGS PAPERS ON ECON. ACTIVITY: MICROECONOMICS 1-78 (1996). This builds on the framework first introduced in Timothy Bresnahan & Manuel Trajtenberg, *General Purpose Technology: Engines of Growth*, 65 J. OF ECONOMETRICS 83, 83-108 (1995). A general presentation of the framework of co-invention can be found in Timothy Bresnahan & Shane Greenstein, *The Economic Contribution of Information Technology: Towards Comparative and User Studies*, 11 J. OF EVOLUTIONARY ECON. 95, 95-118 (2001).

[28] *See* BEN R. RICH & LEO JANUS, SKUNK WORKS; A PERSONAL MEMOIR OF MY YEARS AT LOCKHEED (1994) (explaining that the phrase, skunk works, originated from a project for the Air Force at a division of Lockheed Martin, where it described projects to engineer new airplanes. A special team pursued these projects, physically located away from regular operations. The division had called itself the "Skonk Works" after a phrase from Al Capp's *Lil' Abner* cartoon – the skonk works was a "secret laboratory" that operated in the backwoods. The label became well known throughout the industry, in part because it was considered humorous and saucy. *Lil' Abner's* publisher eventually asked Lockheed Martin to change it, and "skunk works" emerged from there.).

management support for these barriers, a skunk works typically tackles development projects of value to the future of the organization. With rare exception, such projects do not directly connect to short term operational or service missions.

Is it possible to view DARPA itself as the military's skunk works? Yes, to some extent, and to some extent no. The similarities are apparent in the discretion given to program officers, who held discretion to depart from routine operations, and did not measure their gains against short term operational goals. They could pick research stars to fund, hold them to informal understandings, and permit the researchers to pursue open-ended goals in their prototyping. The program officers often asked for broad proposals, picked lead researchers, made general agreements with them about the long term goals, funded their labs with uncommonly large amounts of money, and gave them large amounts of discretion to pursue those goals in the manner they saw fit.[29] In exchange for this funding, the researchers were required to attempt ambitious projects, participate in specific conferences, document and share their results with each other, and contribute to the training of a new generation of researchers, among other things.

DARPA's program for fostering innovations in computing departed from a key aspect of the skunk works practiced among military contractors, however, in the way it used new locations.[30] While some private firms located their skunk works in locations distant from operations to shield it from short term thinking, DARPA did more than just separate the location of the skunk works from the location of operations. It *administered* from D.C. to researchers geographically dispersed at many locations in research organizations and universities across the country, and did so out of necessity. DARPA sent money for projects organized by key researchers, who maintained their laboratories. Money also went to contracting research organizations.[31] Dispersed geography mattered in several ways. Innovative improvements arose and accumulated in different places, accommodating a diversity of viewpoints, and yielding a variety of lessons. Collectively the program began accumulating improvements from a diversity of sources.

That geographic dispersion also exaggerated another key challenge for any skunk works, monitoring progress. Precisely because a skunk works seeks to break with established processes to facilitate experimentation and protect

---

[29] *See* NORBERG ET AL., *supra* note 4, at 1 (describing how program offices used their discretion).

[30] *See* NORBERG ET AL., *supra* note 4, at 17-19 (discussing the challenges of sourcing projects from geographically dispersed group of researchers).

[31] Such as BBN (in Cambridge, MA), the Rand Corporation (in Santa Monica, CA), and Stanford Research Institute (in Menlo Park, CA).

it from the objections of other organizations or their parent entity, a skunk works faces numerous challenges benchmarking progress of its researchers against existing procedures (which may provide benchmarks of increasing irrelevance). Its challenges are even greater when the participants in the skunk works create inventions for needs that most potential users have not yet even recognized, and reflect a diversity of opinions about the best future use-cases. Then no established practice serves as a benchmark.

Within DARPA, program officers directly performed the monitoring. Many program officers were technically sophisticated enough to follow specific advanced developments. In fact, DOD program officers often did the evaluation themselves or with a small set of consultations, and not necessarily using informal evaluation by peers. Some even contributed inventions to the efforts.

Despite the geographic dispersion, participants shared a sense of identity about the whole project, and the researchers were encouraged to share innovations with one another. Indeed, a set of processes emerged for commenting on one another's projects, and became the basis for the open processes (still in use today). Loosely coupled to one another through their common funding source, they shared scientific and engineering goals. Program officers encouraged this sharing.[32]

Comparisons with skunk works yield one additional insight about learning from experience. As the projects within a skunk works mature, it typically mixes engineering prototyping with expected operational challenges. This too occurred in the early years. The first and second generation of Internet researchers[33] got ideas from their own experiences and their own needs. Because inventers were also users, they were motivated to develop working prototypes into operational pieces that they and others could employ. Their experience introduced them to issues associated with refining and maintaining workable versions of their inventions in a functioning and operational network — and not just any network, but a network they developed and used.

---

[32] *See, e.g.*, NORBERG ET AL., *supra* note 4, at 18-19; ROLAND & SHIMAN, *supra* note 8, at 2-4 (both building coherent scientific communities around nascent technologies was an explicit part of the mission of every program officer in this era).

[33] *See* Steven D. Crocker, *The Origins of RFCs*, *in* RFC 1000 - REQUEST FOR COMMENTS REFERENCE GUIDE (J. Reynolds & J. Postel eds., 1987), https://tools.ietf.org/html/rfc1000, accessed March 2, 2020 (explaining early internet research and RFCs). *See also* Barry Leiner et al., *A Brief History of the Internet, Version 3.32*, THE INTERNET SOC'Y, (Dec. 10, 2003), http://www.isoc.org/internet/history/brief.shtml (showing that there is no clean line between generations, but this is convenient language to use. "The first generation" of internet researchers grappled with engineering, creating the first packet switching applications and prototypes, and demonstrating the viability of the concepts. The second generation contributed to the existing infrastructure, and, along with the first generation, built applications and scale.).

The integration of innovations into immediate operation shaped the consensus about innovations and helped determine whether suggestions for new protocols merited attention. As improvements arose, routine processes embedded those improvements. If installation administrators did not think the innovations useful, they did not implement the proposals, nor use them. If they used the suggestion, the inventions were refined and began to accumulate additional improvements.

In the short run, mixing inventive activities with operational activities also oriented innovation. Although using a common network, each group of researchers began working in its own direction, with its own working prototypes, for its own use as well as use by others. Due to their common affiliation with DARPA and common use of the network (which became known as the DARPANET), the researchers began to make their prototypes interoperate with each other.

One illustration can help develop the insight in the importance of interacting with operations. Early Internet innovators quickly developed several applications with high value - file transfer, predecessors to what we today recognize as instant messaging, and electronic communication that became electronic mail.[34] Arguably, electronic mail was not the central innovation of the skunk works. Yet, every participant employed it, and its pragmatic value was recognized by participants. Many people made important contributions to the e-mail design in the 1970s and 1980s, and by the end of the decade all participants in the Internet made use of it. Another lesson from the experience with e-mail application innovation is that its usefulness was apparent at the time to the many participants in the DARPANET, but not to the sponsoring federal agency. As stated by Bob Kahn, DARPA "would never have funded a computer network in order to facilitate e-mail" because other goals were more paramount, and person-to-person communication over telephones appeared sufficient.[35]

The spread of e-mail highlights the essential paradox of a skunk works: protecting participants from operational concerns helps them point towards long term needs. Protecting participants from short term assessment and formal review also permits them to co-invent in unanticipated directions.

---

[34] *See* Craig Partridge, *The Technical Development of Internet Email*, 3.2 ANNALS OF THE HIST. OF THE COMPUTING 3, 3-29, (2008); *Descriptions*, LIVING INTERNET HIST. (July 2009), http://www.livinginternet.com/e/e.htm (both providing extensive documentation of how subsequent technical improvements built on one another, beginning with an early project at the RAND Corporation in Los Angeles).

[35] *See* Stephen Segaller, NERDS: A BRIEF HIST. OF THE INTERNET 105 (1998) (explaining that the challenges of building a sound and pragmatic internetwork received the focus of most of the researchers, and the applications were not regarded as a high priority, even though these applications were useful and raised the value of internetworking).

However, at an early stage virtually nobody in an organization except the most technically sophisticated manager is able to monitor and assess whether the invention has succeeded in moving in a useful direction. In this case, it took talented program officers to manage a skunk works.

To summarize, the lead-user framework provides a useful set of observations for interpreting events during the earliest days of the Internet within DARPA. It provides insight into how the DARPA's mission translated into invention, and how its organizing principles replicated architectures found in other innovation organizations. It also reinforces the observations made in Section II that participants invented for their own parochial reasons, and with little foresight about the extent of its future impact on economic outcomes outside of the military.

B. *NSF as a Lead User*

The lead-user framework predicts that changes in identity of the organization funding the operations could change the direction of invention activity. If the operational purpose changes, so too could the learning that arises from operations, and the direction of innovation motivated by that learning. Once again, this insight about the direction of innovation would *not* arise from a conventional economic narrative for understanding subsidized R&D.

It is crucial to distinguish between NSF's funding for basic science in computer science, and its operations to support science. Funding for research did continue in the 1980s, and that activity falls within the standard economic narrative, and NSF *did* subsidize a variety of research and researchers in internetworking. It is, however, insufficient for understanding why NSF's stewardship of the NSFNET's operations brought about such a large improvement in the technology's ability to scale, which became crucial to its privatization and its high economic value.

The handover of DARPA's network to NSF potentially enhanced NSF's mission to support research.[36] NSF would take on managerial responsibilities for many aspects of the operations. While it handed operational responsibility for the backbone to the (winning) bidder, IBM/MCI and its Michigan based academic partners, responsibility for many other parts of the network resided with the universities, who supported interconnection with the growing network, and use by local students, faculty and researchers.

More to the point, the insight helps explain why the internet changed

[36] *See* ABBATE, *supra* note 4 and Abbate, *supra* note 20 (both discussing how these were complex events and involved many unexpected consequences and challenges.).

when it transferred to NSF stewardship. In 1985, DARPA handed over control of part of the network to NSF for a number of reasons. It opened the network to the many civilian researchers interested in using it. By then, the community of innovators had evolved into a loose confederation of researchers from many locations, so this administrative change partly ratified what had already begun to happen informally. A new source of funding also introduced a new budgetary process, a new outlook about the future, and new set of priorities for a different set of operational needs.

Three overlapping needs at NSF became most salient at the outset. As with DARPA's motivation, much of NSF's investment was aimed at the creation of an electronic communication network among researchers. One application for communications also became focal: Administrators envisioned that packet switching would enable the movement of files between supercomputer centers and many universities. Second, NSF had aspirations for resource sharing. Supercomputers were expensive fixed investments with no geographic mobility. NSF initially aimed to use the internet to permit many researchers to connect with those supercomputers, enhancing use of the capacity without physical presence, and making greater use of the capacity and sharing the huge computing power they embodied.

A third aspiration for NSF concerned scaling for widespread use, and this aspiration would eventually have large consequences. It would require NSF to sample from a diversity of circumstances across the entire range of universities and colleges in the U.S., and accommodate these circumstances and test across them. NSF aimed to build a routine and reliable network infrastructure, making it easy to spread to every place of higher learning in the U.S. – universities, community colleges, and research institutes.[37] NSF eventually adopted a program to encourage connections to every university and college in the U.S., spreading connectivity far outside the small set of elite research-oriented universities on the frontier of internetworking.

NSF accomplished these three goals with the help of additional Congressional outlays. After the initial setup for supercomputers, the priorities for the third mission changed subtly, aiming towards investment aspiring to give a wide range of participants–students, faculty, and administrators–a taste for what the Internet could do to help them in their work, namely, transmit electronic communication, data files, news, and other

---

[37] *See, e.g.*, Karen Frazier, *Building the NSFNet: A Partnership in High Speed Networking: Final Report 1987-1995*, MERIT NETWORK, INC. (1995), https://www.merit.edu/wp-content/uploads/2019/06/NSFNET_final-1.pdf (providing an extensive description of NSF's aims and accomplishments).

messages over long distances.[38]

The expanding goal required a system that would handle traffic of many orders of magnitudes greater than anything done to that point. It also required investment in routine administrative processes to support widespread use, which motivated development of easy-to-use software for facilitating student use. That led to many co-inventions to make electronic mail, file transfer, and (eventually) browsing accessible to non-technical users. Many universities trained their students in the internet, developed processes for enabling remote access (e.g., by dial-up modem), and permitted discretion to develop applications (such as email) that motivated adoption later.[39]

To summarize, the lead-user frameworks yield insights into many salient actions during the deployment of the internet, and these differ from the insights generated by the conventional economic narrative. Most important, the lead-user frameworks provide insight into the direction of innovation. Moreover, these actions improved the ability of the internet to scale for use by non-technical users, which turned out to be crucial for why the internet yielded such a large economic impact when it privatized. In short, lead-user frameworks fill in crucial gaps in this historical narrative, and, therefore, are likely to do so in any future effort.

III. GOVERNANCE DURING TECHNOLOGY TRANSFER

How did DARPA, and then NSF, generate a rich portfolio of unexpected discoveries around the internet instead of an accumulation of pointless incremental contributions? As already noted in Section II, governance of innovative activity played a key role. This next section focuses on a different set of governance issues, during the transfer of technology to private users.

A. *Channels for Technology Transfer*

Governance at NSF begins from its charter, which both specifies its mission and the limits to that mission. By the 1980s, NSF had a long history of living with a policy of "Acceptable Use" for any asset it subsidized with a grant, where "acceptable" meant it served a purpose in higher education.

---

[38] *See generally* Abbate, *supra* note 20, and GREENSTEIN (2015), *supra* note 1, at Chapter 3 (explaining how the change in mission arose gradually. As the network grew to enormous scale it became difficult for any single person to grasp how it deployed to so many locations and altered practice.).

[39] *See, e.g.*, GREENSTEIN (2015), *supra* note 1, at Chapter 5 (providing additional details about the scaling of this network for private use with the addition of competitive and independent ISPs).

Broadly, those issues perennially raised tension in computer science research, since NSF's funding often had direct consequence for firms, and for workforce training in frontier technologies. The emphasis on "acceptable uses" also created a set of issues when NSF sought to "transfer" the internet to private industry for reasons numerous explained in this section.

It is well-known today, as it was in the late 1980s, that moving an operation out of government stewardship and into private hands can raise many issues. The acceptable use policies of NSF complicated the resolution of these issues because they limited the experience of users. That broad problem, in turn, undermined the ability of Steve Wolff, the manager of NSF's network from 1986 to 1995, as well as managers elsewhere who participated in the NSFNet, to forecast the appeal of new applications for users outside the university.[40]

To understand the problem, recognize that "technology transfer" can occur through a number of channels. The elevator pitch for technology transfer recognizes four distinct channels: giving away assets; licensing intellectual property; moving knowledge with moving people; and generating technological gains as part of procurement. The fourth channel had played an important role historically,[41] but only the first three played crucial roles during the transfer of the internet into private hands:[42]

1. *Give away technology.* In the case of tangible assets, governments can give its assets to private owners at no cost to the owners. In the case of software, it can place the code on a shareware site. In the case of new discovery, its researchers can explain the discovery in an academic journal accessible to anyone.

2. *Use a license.* Technology also can leave as part of a license for a fee, either exclusively for the highest bidder, or at a low charge to many licensees to encourage deployment. It can be protected in patents (and, occasionally, with copyright or related forms of formal intellectual property), and can be

---

[40] *See* ABBATE, *supra* note 4, at 197 ("In 1990, NSF manager Stephen Wolff began discussing the idea of privatizing the internet with interested members of the internet community, holding workshops and soliciting comments from network experts, educational groups, and representatives of other government agencies.").

[41] *See* FLAMM, *supra* note 25 (documenting the importance of procurement for the development of computing in the 1950, 60s, 70s and part of the 80s, especially at the military and NASA). Arguably, the sentence in the text is an oversimplification, because procurement of the super computers and the services to build the internet during the NSF era of stewardship also played a crucial role in the internet's development.

[42] *See, e.g.*, ABBATE *supra* note 4; Abbate, *supra* note 20; GREENSTEIN (2015), *supra* note 1, at 72-80 (both explaining how if procurement played a role, it did so in the allocation of managerial responsibility for the NSF backbone, and arguably, in the bids to develop equipment for the internet).

licensed through actions typically governed at a university technology transfer office.

3. *Move with people.* Technology can leave in someone's head. It can walk off the premises when a student graduates (e.g., sometimes with training that aides a private firm), or walk out the door when a professor or post doc leaves (e.g., sometimes to start a business, or take a job).

Why care about these channels? For one, the choice among these is NOT cost-neutral or revenue-neutral for self-interested firms who receive the benefits. Second, the resolution of the transfer also can have major consequence for the value of invention, in general, and for specific firms with market interests whose value depends on the government transfer, in particular. That leads to the third observation: when such transfers concern technologies with anticipated high value, the absence of good governance permits the transfer to become potentially sloppy, corrupt, and error-prone.[43] This leads to the biggest issue behind technology transfer: when a technology cannot explore many valuable applications (e.g. prototypes for electronic commerce) because it violates "acceptable use," how do administrators know in advance, which of the channels will lead to the highest value? Because "acceptable use" limit the use cases to guide them, they can make only educated guesses.

None of these observations are news (at a broad level) to experts in technology commercialization. They do, however, fall outside the conventional economic narrative, and provide a distinct set of lessons from the challenges facing those who sought to derive value from NSF internet. After more than two decades of government subsidized R&D, the decisions for transferring technology contained the potential to make those innovations more or less valuable to society. Governance of technology transfer had to play a crucial role. Again, appreciating these observations leads to distinct insights for policy that the conventional economic narrative would not generate.

Rather than take the reader through all the well-documented events, the discussion in this section provides several examples to illustrate the broad points. As with prior examples, the changing features of the internet further complicated these issues. By the late 1980s, the research-oriented internet had accumulated numerous capabilities affiliated with software to make it easier to use. Numerous advances accumulated, and, in particular, a set of

---

[43] *See* LINDA COHEN & ROGER NOLL, THE TECHNOLOGY PORK BARREL 77-364 (1996) (developing this theme with extensive study of several examples of government subsidized technical inventions that crossed into commercial markets).

software improvements from Tim Berners-Lee altered the common experience just as privatization of the internet got underway. Berners-Lee created a viable system for hypertext that worked on top of the internet. Tim Berners-Lee worked for CERN, based in Switzerland. He innovated a form of hypertext, which he called the World Wide Web.[44]

At the time of privatization in the first half of the 1990s, the full scope of the web was unsettled. Even though later observers distinguish between the "web" and "the internet layer," such distinctions were less clear to contemporaries at the time those events took place. Indeed, Berners-Lee initially sought to get endorsement for his hypertext software from the Internet Engineering Task Force ("IETF"), and make it a standard part of internet protocols. Given the ambiguity, for the purposes of this discussion, the discussion will treat it all as part of the internet subsidized by government. This section's discussion also will take a similar approach to tools built directly on top of the web at the same time, such as the browser, the webserver, and the search engine.

B. *Giving Away Assets and Non-exclusivity*

The transfer of the internet to private hands succeeded in having a large economic impact, in part, because it escaped "exclusivity." That is, the process of privatization did not result in ownership and management of the backbone by a single organization who monopolized key assets. Instead, the backbone left government ownership in such a way to seed competitive carrier markets. While that might seem like an obvious public goal in retrospect, it was easier said than done. NSF did not possess regulatory authority to mandate actions common in other communications services–such as simple reporting requirements, or minimal geographic coverage–and, similarly, it did not have authority to compel actions that fostered competitive entry, nor could it levy fines for lack of compliance with rules. As it happened, the initial design of the privatization of the backbone, when first proposed by NSF, did not contain any mechanism to insure the rise of competitive markets.[45]

---

[44] *See* GREENSTEIN (2015), *supra* note 1, at Chapter 4 (providing the full story). The Web is several inventions bundled together to give the user the experience of hypertext. Berners-Lee had convinced his supervisors the software had the potential to be useful for CERN. His first example was the office directory in hypertext, which was a use inside one organization. After making it available on shareware the most popular uses began to linking across organizations.

[45] *See generally* ABBATE, *supra* note 4, at 197, for further explanation. Steve Wolff's decision to privatize the backbone in itself illustrates another important lesson about governance. Wolff, the then-director of the NSFNET, recognized that there was no technical reason why the government had to operate the internet backbone. He asserted that private firms could provide

Summarizing a long set of events, when the U.S. government initially proposed to privatize the Internet backbone and related equipment, IBM, one of the providers of the NSFNET, tried to make a deal that removed any obligation to IBM for interconnecting with anybody prior to privatization, and, in addition, legally required that they not interconnect with any carrier carrying traffic that supported for-profit activity. IBM's lawyers tried to have the legal rules interpreted in such a way that IBM would have been the sole national backbone provider in the U.S. prior to the official moment NSF withdrew from owning the Internet backbone. From there, it aspired to disadvantage any potential rival and build its business into the dominant provider of backbone services after privatization.[46]

IBM almost succeeded, but ultimately failed after its efforts gained publicity and generated outrage. Eventually the Government Accounting Office and then-Congressman Rick Boucher, intervened to change NSF's charter to short-circuit the legal maneuvers of IBM's lawyers.[47] As that was happening, IBM's actions so angered other data carriers, it motivated several to establish the Computer Internet Exchange ("CIX"), which initiated the first data-sharing practices for competing carriers.[48] Along with the pressures placed on it, the CIX example, in turn, motivated NSF to redesign its privatization efforts, including data-sharing as part of its final plan. That plan fostered a competitive backbone industry at the outset of the transfer.

---

services as efficiently, or more so, than government-managed sub-contractors. He initiated a series of steps aimed at what would be a transfer of technology out of exclusive government management and use. There is a broad lesson illustrated within this decision: when a technology reaches a point where private firms can operate it, the transfer does not necessarily happen on its own. It requires government managers who recognize this opportunity, and it may even require active nurturing from government officials, as it did in this case. As it happened here, Wolff had the support of the NSF's management, but he encountered considerable resistance from other internet stakeholders in the research community.

[46] *See* GREENSTEIN (2015), *supra* note 1, at Chapter 3 (providing a full rendition). *See also* Rajiv C. Shah & Jay P. Kesan, *Fool Us Once, Shame On You – Fool Us Twice, Shame on Us: What We Can Learn from The Privatizations of the Internet Backbone Network and the Domain Name System*, 79 WASH. U. L. REV. 89, 108, 113 (2001) (providing a different take on the events).

[47] *See* Segaller, *supra* note 35 (recounting partially Boucher's role in opening the internet to commercial use). *See also* Shah and Kesan, *supra* note 46, at 113-14 ("After the hearings, Congressman Boucher introduced a bill to remove the NSF's AUP. This bill was amended later to allow commercial use of the network as long as it would increase the networks' utility for research and education.").

[48] *See* GREENSTEIN (2015), *supra* note 1, at Chapters 3-5 (detailing how because of the NSF's "acceptable use" policy, there had been little experimentation with deploying the internet for commerce, and nothing related to exchanging data between otherwise competing firms. There also was little understanding about its cost structure outside of an academic environment. Relatedly, there was only experience with incentives to build routes for existing research institutions, and virtually none with entrepreneurial incentives building routes for new users, such as private users.).

The rise of a competitive backbone played an important role in creating value on the internet in the late 1990s, as it encouraged a competitive supply of access.[49] To summarize, society was strangely fortunate that IBM attempted and failed to be the sole national backbone provider. Events would have differed had IBM succeeded, and NSF would not have planned for competitive data interchange had IBM not catalyzed others by making any attempt at all.[50]

C. *Conflicts Between Shareware and Ownership*

Another example of unexpected management challenges during technology transfer occurred outside the U.S. at the European Organization for Nuclear Research ("CERN") in the 1990s.[51] Not long after Berners-Lee made the World Wide Web available on shareware, he foresaw the need for a standards organization or consortium to govern the evolution of the protocols, and he approached the IETF for that purpose. Frustrated by the initial reception, and seeking to respond to some concerns about the property rights, he asked CERN to renounce any property rights on the World Wide Web. Management at CERN agreed, and in retrospect, it helped foster adoption of protocols by assuring users that no private firm would monopolize the direction of new protocol development.

Along with Berners-Lee's open practices, the lack of a single owner also fostered generativity in follow-up innovation. However, one must think about this properly: CERN's management agreed to give up property rights because of the parochial conflict with its mission, not because it was strategically anticipating how to foster technically-led economic growth.

The attitude of CERN's management turned out to be fateful for the web in one other respect – the location of a consortium to guide the Web. As it turned out, after several frustrating meetings at the IETF, Berners-Lee concluded he could not work with the IETF, and would need to establish a standards-oriented organization, which he would lead. CERN's managers were clear, however, that such a consortium or standards organization fell outside their mission, and CERN would not house such an effort. Berners-Lee eventually moved to MIT in 1994, where the model of a consortium was

---

[49] *See* GREENSTEIN (2015), *supra* note 1, at Chapters 4 and 5 (providing the description of the rise of competitive carrier industry).

[50] *See* GREENSTEIN (2015), *supra* note 1, at 80-90 (providing the full story and linking IBM to the creation of CIX and the revision of the NSF privatization plan).

[51] This example also serves as a counterexample to the tendency to believe all inventions came from within the U.S.

well known. There he established the World Wide Web Consortium, and it still resides there today.

Reiterating, the organization that subsequently governed the most important software invention of the 1990s, could not, and did not, settle in the heart of Europe because managers at CERN did not expand their mission's scope beyond its parochial outlook. The institutional practices and flexible outlook of the US research community attracted the software designer to the US.

D. *Conflicts Between Licensing and Increasing Adoption*

Mosaic first appeared at the National Center for Supercomputing Applications (NCSA) at the University of Illinois in 1992, with funding from NSF for NCSA. While others had invented browsers, the core team at NCSA, principally Mark Andreesen and Eric Bina, gained permission to imitate and improve upon these browsers with many new features. They also developed server software to facilitate wider use. This project was just one of many projects at the NCSA, and arguably, not NCSA's most important project when first proposed. It quickly grew into an ambitious and imaginative attempt to help students use the web.[52]

Widespread adoption in 1993-94 led the University of Illinois to initiate a program to foster private use. While the University showed flexibility and administrative agility in fostering such use, it ended up making inconsistent policy.

Initially following standard practices at many universities, the licensing offices claimed ownership of the software (under Baye-Dole) and began a licensing program. This program upset Andreesen, who was offered a job as part of the efforts to grow and maintain the software after he graduated in December, 1993. He left Illinois for the West Coast, and returned in April 1994 with Jim Clark to recruit all the key programmers, who, days later, left the University and started their own firm, Mosaic Communications Company ("MCC"). Perhaps the programmers would have left in any event, but it is fair to say they did not leave on good terms.

By this point, the University, through an intermediary, had begun to license Mosaic. Eventually more than a hundred firms signed up under this license program. That intermediary sued MCC for violation of copyright

---

[52] For the story of the development of the browser, *see* GREENSTEIN (2015), *supra* note 1, at Chapter 4 (explaining that the browser was necessarily an unexpected invention). The web had not yet grown at the time of the founding of NCSA. It would have taken uncommon prescience to anticipate such an application, and the NSF (sagely) had policies in place to permit such developments.

due to the use of the name "Mosaic." In response, MCC changed their name to Netscape. This was consistent with its earlier decisions not to use existing code, and to program their browser from scratch, so as to avoid any intellectual property claims from the same intermediary. While this tussle over a name had little commercial consequence, the founders of Netscape, already on bad terms with the university's leadership, had little positive to say in public about their alma mater. The legal tussle over copyright made little difference, but, ironically, that may have been to society's benefit. Netscape soon became a catalyst for significant economic changes. Had the lawsuit slowed down Netscape in a significant way, would it have had as much impact? There is no way to know.

Later events made matters even more ambiguous. The intermediary eventually licensed the software to Microsoft in January of 1995. Microsoft became the final licensee, and, to the surprise of no analyst following the industry, in a few months Microsoft's actions rendered the actions of the other hundred licensees as valueless. In a few months more, Microsoft began to compete with the firm founded by the University's own students.

Cataloguing the inconsistencies would take pages, but a simple summary will do here. Money and diffusion both motivated the university, but did not work in the same direction. Money potentially had little to do with the university's mission to diffuse invention to participants in society and to society's benefit. After settling a lawsuit, the university's licensing deal with Microsoft netted the university more than twenty million dollars. While large for the university, and helpful in negotiating with state legislative oversight committees in Springfield, Illinois, it was a pittance in comparison to the private strategic value at Microsoft, which, arguably, ran at least to the hundreds of millions.[53] The value to society from diffusion of the browser was even higher. Should the university have negotiated a better contract, or did it meet its mission by negotiating with major adopter? To be clear, there was no easy answer to the inherent conflicts between actions that support diffusion, societal impact, and money-making.

Neglected during the ensuing ruckus, the server software, which was necessary to make the browser useful, laid on University shareware sites in late 1994 and early 1995. The NCSA did not attempt to license it, and, for all intent and purposes, neglected managing it for almost a year. Private

---

[53] *See* GREENSTEIN (2015), *supra* note 1, at Chapter 4 and 11 (providing the full explanations about the creation of the browser and the subsequent "browser wars.") The license saved Microsoft time. The strategic value from that was large, though calculating a precise monetary value to this strategic gain would be virtually impossible. The irrefutable evidence of the benefit to those months was the priority the CEO placed on the project, and the enormous resources Microsoft would devote to "catching up with Netscape."

server web masters became frustrated, and eventually took matters into their own hands, developing improvements to meet their private needs. By the time the university hired a new person to steward the server software, the users had formed an open source organization, Apache, and embarked on a journey to becoming the most commonly used web server software in the world. Recognizing that the situation had escaped their control, the university wisely chose not to take any further action, and instructed their new webmaster to stop. Ironically, the university's neglect helped society adopt and make good use of the product.

E. *Licensing with Different Conceptions About Value*

As another example of the ways transfer policies can change the value of technology, this next example chronicles the efforts of Larry Page, who proposed an algorithm, later called Page-Rank. Page and classmate Sergey Brin implemented this algorithm in the summer of 1995. Notably, the original grant application to NSF, which funded Page's work for his advisor, and awarded by NSF in 1994, did not promise anything like Page-Rank, or any other specific or general indexing tool for the Web. The grant aimed at developing tools for digital libraries. Fortunately for society, NSF had policies that permitted grantees to respond to new opportunities, and, wisely, did not literally bind Page's and Brin's advisors to the precise scope of promises in their NSF application for funding.[54]

Stanford (under Baye-Dole) obtained a patent for Page-Rank, and, following standard practice, tried to find licensees. The licensing office could not find anybody in the Valley to take the deal, including the most high-profile firms at the time.[55] Frustrated with the response but encouraged by positive experiences with a prototype widely used on campus, Brin and Page decided to (temporarily at first) quit their dissertation writing, and, instead,

---

[54] That has not deterred NSF from boasting about funding this researcher. *See* GREENSTEIN (2015), *supra* note 1, at 365-371 (explaining that NSF justifiably lists Google's search engine as a product of federal research, but that misses interesting historical circumstances which led to its creation, which nobody ever promised to NSF and was not formally required by NSF as part of their grant).

[55] *See* GREENSTEIN (2015), *supra* note 1, at 365-371 (detailing how there has been a lot of Monday morning quarterbacking about why this deal did not occur). Arguably, Stanford asked for too much money, and/or it approached firms who did not appreciate the significance of the inventions. Was there any price at which a deal could have resulted? Did the management appreciate what the patent contained? Complicating this discussion further, another patent, developed by a graduate student at Cornell and taken out at roughly the same time, covers many similar inventions. For a number of reasons, he concluded that developing a business in the U.S. was not possible. He moved home to China, and began the firm, Baidu, which became the largest search engine in China.

started a new business in 1998, which they named Google. One thing led to another, and they never returned to finish writing their dissertations, which would have led to their PhDs.

Which channel would have made society better off? This example used both licensing and human mobility, and the latter became the channel to accomplish what the licensing did not accomplish. Google's search engine eventually changed the world. Today, Google is the third most valuable business on the planet. Had the university's licensing program succeeded, Page and Brin would not have founded their firm, and society might not have seen the growth of Google, or anything similar. That certainly would be a different world than today.

Summarizing the broad point across all the episodes, all of these episodes illustrate ways in which the value of technology depended on the governance of the transfer of technology from universities to private hands. The governance shaped the realized value, either by settling conflicts when one channel came into conflict with another, or by determining outcomes when unexpected events altered the perceived value of using one of those channels. More broadly, with money on the line, these transfers were not easy to govern, the economic tradeoffs were non-obvious in advance, and unintended consequences determined salient features of the outcomes. Governance of technology transfer had to play a role. It was unavoidable.

Summarizing the forward-looking lessons is challenging, because these episodes do not collectively generate a general solution to policy conflicts when universities or not-for-profit laboratories seek to transfer technology. It was (and still is) quite difficult to articulate general solutions for technology transfer policy in advance of events. That does, however, suggest several principles for forward looking technology policy in such situations. One observation is obvious: all these episodes suggest the need for managerial humility in the face of the unknown, and contingent planning for agile policy actions in the face of the unexpected. In addition, these examples suggest that the situations with the highest value encountered issues when they adopted routine processes for incremental technical inventions (with less value at stake), and failed to anticipated and/or adjust and adapt to the inconsistencies of the policies that emerged due to the high stakes. Moreover, real time decision making had enormous value in each of these episodes, so good outcomes depended crucially on the intervention of many "honest policy wonks," who showed good judgment at just the right moment.[56]

---

[56] *See* GREENSTEIN (2015), *supra* note 1, at Chapters 2-5 (providing extensive discussion about the role of "honest policy wonks" from which this conclusion emerges).

Finally, it is worthwhile to reiterate the broader point. The conventional narrative neglects technology transfer, its governance, and the inevitable impact of the decisions during the transfer from public to private hands. That suggests the conventional narrative is grossly misleading to imply that invention alone is sufficient for creating value. Transfers played a crucial role in creating value from the internet, and surely will play a crucial role in the creation of value for any sufficiently ambitious program to subsidize invention. Moreover, such technology programs must play an inevitable and crucial role when the value arises from unexpected applications of technologies developed under a mission-orientation, because such settings necessarily need explicit efforts to deploy inventions to users other than the earliest users. The conventional economic narrative offers too sanguine and too incomplete a view of government sponsored R&D in these circumstances.

CONCLUSION

While the conventional economic narrative remains consistent with invention of the internet, this essay shows why that narrative provides incomplete insight into several crucial features of the experience. To understand how government created the internet, and why the experience created such high value, an analyst needs more than the conventional economic narrative. An analyst needs to appreciate the role of lead-users and good governance of technology transfer.

These insights have several far-reaching implications for forward-looking technology policy. For one, these observations suggest that supporting invention and prototyping with only money–*sans* any policy for deployment–may not be sufficient for nurturing useful early stage use of government-sponsored R&D. Deployment and learning from operations may be required to motivate further invention. In addition, while the government can act as a lead user in areas that touch on government functions, such as the military, the value of that learning for non-government users may or may not play any role in funding decisions. It may be necessary to pass stewardship to non-governmental owners to generate learning about new uses, and to assess the relevant needs of non-governmental users. Once again, there must be policies for transferring this learning in order to gain the full value from government-sponsored R&D.

It is worthwhile to conclude with a note about government actions in creating and subsidizing innovation, with considerable attention paid to defense. This essay suggests value depends on many factors over which the military has little control, and potentially even less interest. Will passing some technologies into private hands create economic value? It is hard to say

that it will in any given situation, but in the absence of good governance, it probably will not. That is not an assuring conclusion. Even if the R&D succeeds in creating breakthrough technologies, the value from decades of federal investment depends on whether some "honest policy wonk" shows good judgment at the right moment.

As the conventional economic narrative would counsel, future risks are not a reason to defer from undertaking inventive projects, as the government can manage risks with a proper portfolio, and can internalize the gains from the otherwise diffuse benefits enjoyed after the inventions. Rather, this essay contains a set of cautionary lessons that point in a different direction. Events can and do stray outside the conventional economic narrative, and that can and does shape the level of economic value from the technology's private use. Such straying occurred in the canonical case of the Internet. If it happened there, it surely will happen elsewhere. This means it will be challenging to, once again, recreate high-impact technological inventions with government subsidies for R&D. It also means the likelihood of experiencing a good outcome will rise with appropriate investments in policy instead of their neglect. Most of all, a good outcome arises from government actors' co-investment in administrative processes and policies to nurture the creation of technically-enabled economic value.

ARTICLE

INNOVATION OR JOBS? AN INCONVENIENT TRUTH ABOUT PUBLIC FINANCING FOR "INNOVATION"

CAMILLA A. HRDY†

Public finance—whether in the form of grants, subsidies, or tax credits—is increasingly being cast as the panacea to either a world of IP and all its foibles, or a world in which innovators have insufficient incentives to undertake risky research. The idea is that, rather than supporting innovation through the gifting of exclusive rights like patents, government can use taxpayer dollars to support research and development activities directly. This article casts doubt on the notion that public finance can ever provide a suitable alternative for incentivizing innovation. It makes this point by examining financial subsidies currently offered by U.S. state governments. Each year, state governments across the U.S. purport to award billions of dollars in public financing for "innovation." But it turns out these so-called innovation incentives typically have little to do with encouraging novelty or inventiveness. They are in reality designed to promote politically attractive goals: principally, the goal of job creation. This article identifies the phenomenon—essentially, jobs programs dressed up as innovation incentives—and reveals why it could be highly problematic for innovation policy. By diverting investment towards subject matter that is labor-intensive, these incentives may end up encouraging developments that are the opposite of "innovative," in the ordinary sense of the word. Those who support relying more heavily on public finance as an innovation policy tool need to confront

† Associate Professor of Law and Director of Faculty Research & Development, University of Akron School of Law; Affiliated Fellow, Information Society Project, Yale Law School. Thank you for valuable insights from Rick Bales, Christopher Beauchamp, Bruce Boyden, Dan Brean, John Duffy, Mike Gentithes, Ryan Holte, Olena Ivus, Julia Knight, Vera Korzun, David Lund, Adam Mossoff, Michael Munger, David Orozco, Michael Risch, Ted Sichelman, Maxwell Stearns, James Stern, Alexander Tabarrok, Saurabh Vishnubhakat, Steven Yelderman, and Todd Zywicki. With thanks to the Center for Protection of Intellectual Property for hosting a Works in Progress Conference on July 9-10, 2018, and thanks to the George Mason Law and Economics Center Workshop for Law Professors on Public Choice Economics, held at George Mason University on November 1-3, 2018. Thank you for phenomenal research assistance from Jennifer Brendt-Kangas at Akron Law. Thank you also to Christopher Yoo, Michael Abramowicz, and the organizers of the University of Pennsylvania 2020 Journal of Law & Innovation Symposium, Rethinking Innovation Policy: The Role of the State, Friday, January 24th, 2020.

the reality that, when taxpayer money is on the line, political goals may well trump the desire to reward truly innovative endeavors.

"*For an advanced economy such as the United States, innovation is a wellspring of economic growth.*"

–The White House, 2015[2]

"*Voters want jobs, which are hard to deliver.*"

–The New York Times, 2018[3]

INTRODUCTION

In 2014, an Ohio company that designs software to improve employee training received a $750,000 loan from the state of Ohio.[4] The company, Xcelerate Media, which is still in business, markets customized software that helps clients reduce the costs of employee training to make their workers more productive.[5] The loan was awarded through the "Innovation Ohio Loan Fund."[6] As its name suggests, the Fund is ostensibly intended to provide assistance to innovative companies that are "developing next generation products and services[.]"[7] The Innovation Ohio Loan Fund is not unique. Nearly all U.S. states offer some form of direct financing for private sector companies that are engaged in "innovation," "research," or "technology development."[8] At the national level, certain federal research agencies, such

---

[2] NAT'L ECON. COUNCIL & OFFICE OF SCI. & TECH. POLICY, A STRATEGY FOR AMERICAN INNOVATION 2 (2019), https://obamawhitehouse.archives.gov/sites/default/files/strategy_for_american_innovation_october_2015.pdf.

[3] Emily Badger, *Why Cities Can't Stop Poaching From One Another,* N.Y. TIMES (June 8, 2018), at B1 (discussing research that suggests cities use financial incentives to "pick up votes by offering giveaways").

[4] *See 2014 Loan Report Compliant List*, OFF. OF THE OHIO TREASURER, http://ohiotreasurer.gov/Documents/CMS/Loan-Report-2014-Compliant-List.pdf (last visited Apr. 3, 2020).

[5] *See What We Do*, XCELERATE MEDIA, https://www.xceleratemedia.com/whatwedo. (last visited Apr. 3, 2020).

[6] *See* OFFICE OF THE OHIO TREASURER, *supra* note 4.

[7] *See generally* OHIO DEP'T OF DEVELOPMENT, INNOVATION OHIO LOAN PROGRAM: PROGRAM GUIDELINES & APPLICATION PROCESS (2011), https://development.ohio.gov/files/otf/IOF%20Guidelines.pdf.

[8] *See generally* Camilla Hrdy, *Patent Nationally, Innovate Locally*, 31 BERKELEY TECH. L. J. 1301, 1324 (2017) ("[I]ntellectual property rights are not the only incentive government can use to spur investment in innovation. Governments also use innovation finance: public financing for innovation drawn from public revenues.") (citing SUZANNE SCOTCHMER, INNOVATION AND INCENTIVES 242-243 (2004) ("[A] single innovation may be funded in two ways: by the public

as the Department of Defense (DOD), offer similar money awards through the Small Business Innovation Research (SBIR) program.[9]

Collectively, these programs represent a form of public innovation finance: government financing for innovation[10] that is funded through taxation of the general populace.[11] Within the intellectual property (IP) field, public finance is increasingly being cast as a viable alternative to IP.[12] These scholars (whose ranks include the author) concede the importance of innovation for improving standards of living and economic growth, and see a need for government incentives to support high quality intellectual production.[13] However, they also posit that government has many non-IP incentives that it could use to replace or at least supplement IP in order to avoid IP's well-known costs, such as deadweight loss and restrictions on future endeavors.[14] Non-IP alternatives discussed to date, to name just a few, include prizes for solving known problems,[15] grants to pursue research in

---

sector out of general revenue, and through proprietary prices under an intellectual property regime.").

[9] *See* Camilla Hrdy, *Commercialization Awards*, 2015 WIS. L. REV. 13, 52 (2015) ("At the federal level, large research agencies like the Department of Defense (DOD), the Department of Energy (DOE), and the Department of Health and Human Services (HHS), are required to offer Small Business Innovation Research (SBIR) awards for small businesses (under 500 employees) that are developing inventions with commercial potential that fall into the agencies' research areas and similar Small Technology Transfer Research (STTR) awards for small businesses that partner with research institutions.")

[10] The article's definition of "innovation" is not confined to a new and nonobvious invention suitable for the patent system. *C.f.* 35 U.S.C. §§ 102, 103. Rather, it allows for a much broader range of new ideas or practical applications of new ideas that might add value to a firm's activities or to the economy as a whole. *See* CHRISTINE GREENHALGH & MARK ROGERS, INNOVATION, INTELLECTUAL PROPERTY, AND ECONOMIC GROWTH 4 (2010).

[11] *See* Hrdy, *Patent Nationally, Innovate Locally*, *supra* note 8, at 1324-1328 (defining innovation finance, and comparing innovation finance to intellectual property in terms of efficiency and fairness).

[12] *See, e.g.,* Lisa Larrimore Ouellette, *Patentable Subject Matter and Nonpatent Innovation Incentives*, 5 U.C. IRVINE L. REV. 1116, 1145 (2015) ("The state provides financial transfers to innovators through a vast array of nonpatent incentives, and it could provide more.").

[13] The conventional view is that, absent incentives, firms will under-invest in innovation as a result of the difficulty of appropriating the full value of their new ideas. *See infra* notes 104-106.

[14] For a recent discussion of these critiques see, e.g., Ted Sichelman, *Patents, Prizes, and Property*, 30 HARV. J. L. & TECH. 279, 279-284 (2017).

[15] *See* Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 119 (2003) ("[T]]he newest generation of scholars to challenge the foundations of intellectual property law has not called for simple abolition of intellectual property rights, recognizing the importance of the innovation incentives that these rights provide. Instead, they have considered the alternatives of prize or reward systems, in which the government would provide some form of monetary compensation instead of patent or copyright protection."). *See generally, e.g.,* Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525 (2001);

high-salience areas,[16] tax incentives for conducting research,[17] public venture capital,[18] funding for key utilities like broadband,[19] support from charitable foundations,[20] and even insurance for prescription drugs.[21] The idea is that, rather than supporting innovation through the gifting of exclusive rights like patents, the government can use taxpayer dollars to support these outputs and activities directly. Why grant private monopolies on knowledge when government can just pay for what is needed and let new ideas and information flow freely into the public domain?

However, this article throws an unfortunate wrench into the notion that public finance could provide a suitable alternative to exclusive rights like patents. By assessing innovation incentives programs offered by U.S. state governments, this article reveals that, despite their titles, many of these "innovation" incentives are designed to promote politically attractive goals

---

Michael Burstein & Fiona Murray, *Innovation Prizes in Practice and Theory*, 29 HARV. J. L. & TECH. 401 (2016).

[16] *See* Amy Kapczynski, *The Cost of Price: Why and How to Get Beyond Intellectual Property Internalism*, 59 UCLA L. REV. 970, 972 (2012) ("The field is constructed around one particular institutional approach to sustaining the production of scientific and cultural goods: exclusive rights. Yet it is not at all obvious that IP is categorically superior to other institutional approaches. Other approaches not only are possible, but also, in many cases, already play an important role in our creative ecosystem. Consider a brief example from the scientific arena. In the United States, about one-third of all research and development (R&D), including more than 80 percent of basic R&D, is funded by government and nonprofit sectors. The results are often disseminated not under property rules, but under norms of open scientific exchange. This institutional approach, which we can call government contracting, is both ubiquitous and familiar. It is employed when government agencies make grants or contract for research, in the manner commonly done by the U.S. National Institutes of Health (NIH) or by the U.S. Department of Defense."); *see* W. Nicholson Price II, *Grants*, 34 BERKELEY TECH. L. J. 1, 3 (2019) ("Grants play a key role in innovation policy.").

[17] *See, e.g.*, Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents–Prizes Debate*, 92 TEX. L. REV. 303, 321-323 (2013) (discussing the two verticals of tax incentives for R&D and other innovation activities, the ability to expense research expenditures and tax credits for certain levels of research spending are highlighted).

[18] *See* Hrdy, *Commercialization Awards*, *supra* note 9, at 67-68.

[19] *See* Hrdy, *Patent Nationally, Innovate Locally*, *supra* note 8, at 1376 ("Dozens of cities across the country are setting up municipal broadband networks. Since broadband, lab space, and research parks all involve a physical location, it is not controversial to suggest local governments should at least partly finance them.") (citing Olivier Sylvain, *Broadband Localism*, 73 OHIO ST. L.J. 795 (2012)). *See also* Christopher Yoo, *U.S. vs. European Broadband Deployment: What Do the Data Say?*, U of Penn, Inst. for Law & Econ. Research Paper No. 14-35, 23-27 (June 3, 2014) (comparing U.S. coverage for broadband to other countries, and noting cases such as Sweden where government subsidies were used to support broadband deployment).

[20] *See generally* Peter Lee, *Social Innovation*, 92 WASH. U. L. REV. 1 (2014).

[21] *See generally* Rachel Sachs, *Prizing Insurance: Prescription Drug Insurance as Innovation Incentive*, 30 HARV. J. L. & TECH. 153 (2016).

that having nothing to do with novelty or inventiveness. Principally, the main goal of such innovation incentives appears to be job creation.[22]

For example, take the Innovation Ohio Loan Fund mentioned above. Upon closer inspection, the program's self-professed goal is to "finance projects that will . . . creat[e] high-value jobs, increased tax revenues and improve the economic welfare of the State."[23] Applicants' research projects are evaluated in part based on the "[n]umber of high-value jobs to be created as a result of the successful commercialization of a new product."[24] Any company receiving a loan must continue to demonstrate a "commitment to create or retain jobs to the State of Ohio[.]"[25]

Although many commentators have observed the political economy risks inherent in using public money to finance innovation, the risks have been both under-stated and understudied.[26] This article proves that at least some existing programs that purport to use public money to reward innovation, come with serious job creation requirements. It's actually quite simple. You can't get money unless you bring jobs to the jurisdiction (or credibly promise to do so).[27]

Mixing innovation policy and political economy comes with all kinds of risks. But if the goal is really "innovation"—as in the creation of something new or at least moderately new[28]—then the tendency to reward job creation is especially pernicious. There is no inherent reason to denigrate the notion

---

[22] *See infra* Part I; *see also* Appendix.

[23] *See* OHIO DEP'T OF DEVELOPMENT, *supra* note 7, at 2.

[24] *Id.* at 6.

[25] *Id.* at 3.

[26] For prior observations of the issue, see, e.g., Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 248-249 (1994) ("[T]here is reason indeed to believe that the patent law approach is preferable to a legislative approach that involved industry by industry subsidies or other market advantages, especially in view of the rent-seeking and pork barrel features of any legislative approach[.]"); Abramowicz, *supra* note 15, at 122 ("Political considerations might interfere, and the ideal formula or procedure might be altered to benefit a key legislator's constituency or district."); Hemel & Ouellette, *supra* note 17, at 327 ("Government-set rewards also raise the significant risks of politicization, rent-*seeking*, and mismanagement[.]"); Daniel Hemel & Lisa Larrimore Ouellette, *Innovation Policy Pluralism*, 128 YALE L. J. 544, 576 (2018) ("government-set rewards like grants and prizes may diverge from social value due to failures of the 'political market.'"); *see also* B. Zorina Khan, *Inventing Prizes: A Historical Perspective on Innovation Awards and Technology Policy*, 89.4 BUSINESS HISTORY REVIEW 631, 653-654 (2015) (reviewing empirical studies based on samples of prizes and exhibits at international fairs and concluding that "the awarding of prizes tended to be proportional to the number of exhibitors and did not necessarily serve as a proxy for inventive quality or quantity.").

[27] *See infra* Part I.C.

[28] It is admittedly difficult to provide an objective definition of innovation, but some component of novelty is key. *See infra* Part I.C.

of subsidizing employment for its own sake.[29] But the reality is that innovation can have a severely negative impact on employment for certain individuals; for certain sectors of the economy; or within certain regions. This phenomenon is often referred to as technological unemployment.[30] True, a lot of recent research pushes back on the simplistic idea that "innovation kills jobs."[31] The more nuanced story is that innovation creates new and better jobs in the long-run, even if it takes away certain jobs as they become "antiquated."[32]

But without coming out one way or the other on the age-old technological unemployment debate, we can surely agree that using public money to reward both innovation and jobs, at the same time, is problematic. On its face, it creates a contradiction in policy goals.[33] In the best case, rewarded companies are *both* innovators and job creators; but it is unlikely that the money will ever go to the best example of either. From an innovation policy perspective, the ironic result could be that government creates incentives to implement labor-generating technology, rather than to invest in generating new ideas. At the least, the public is simply being misled about what these incentives, and their tax dollars, are really designed to do.[34]

The observations in this Article are of importance for at least two different groups of people. First, state and local government law scholars, as well as state and local politicians themselves, have expressed concern for some time about the enormous amount of money states and cities spend each year

---

[29] *See, e.g.,* OREN CASS, THE ONCE AND FUTURE WORKER: A VISION FOR THE RENEWAL OF WORK IN AMERICA 166-167 (2018) (proposing government subsidies for those who work); *see also* Cynthia Estlund, *What Should We Do After Work? Automation and Employment Law*, 128 YALE L.J. 254, 312-313 (2018) (discussing "wage subsidies" and other affirmative subsidies for low-wage work funded through general tax revenues); Camilla A. Hrdy, *Intellectual Property and the End of Work*, 71 FLA. L. REV. 303, 350-362 (2019) (discussing strategies to promote job creation in the face of automation). *C.f.* Lochner v. New York, 198 U.S. 45, 76 (1905) ("[T]he state . . . may not unduly interfere with the right of the citizen to enter into contracts that may be necessary and essential in the enjoyment of the inherent rights belonging to everyone, among which rights is the right . . . to live and work where he will, to earn his livelihood by any lawful calling, to pursue any livelihood or avocation.'").

[30] For a thorough review of the literature on "technological unemployment," see generally Hrdy, *Intellectual Property and the End of Work, supra* note 29, at 309.

[31] *See* Dennis Crouch, *Hrdy: A Response to 'Innovation Kills Jobs'*, PATENTLY-O (March 15, 2018), https://patentlyo.com/patent/2018/03/response-innovation-kills.html ("innovation, and thus intellectual property, both create and eliminate jobs. Historically, we have had more of the former than the latter.").

[32] *See, e.g.*, ROBERT ATKINSON & STEPHEN EZELL, INNOVATION ECONOMICS: THE RACE FOR GLOBAL ADVANTAGE 280-281 (2012) (arguing that in fact "[i]f economies want to create jobs, innovation—including innovation that drives efficiency and productivity—is a key way to do so.").

[33] *See infra* Part III.

[34] *See infra* Part III.

on business subsidies.[35] They should be interested to see the disparity between how these programs are framed, and what they actually do. Second, as mentioned above, within the IP field, many scholars have been exploring alternative mechanisms for promoting innovation besides exclusive rights like patents.[36] They—we—must come face-to-face with what these programs seek to accomplish in the real world. Both groups should begin to think about the broader innovation policy impacts of programs that divert money to job creation.

The article proceeds as follows. Part I shows that U.S. state programs ostensibly designed to support "innovation" in fact lack a coherent notion of what innovation is and are at least partially directed towards the goal of job creation. Part II explores hypotheses for this conflation of innovation and job creation incentives by drawing on public choice theory. It begins from the perspective of federalism, probing whether states, as governments of small jurisdiction, might have special reasons to reward job creation as part of their innovation policies. But it argues the phenomenon is more pervasive, extending to national programs as well. A more broadly applicable hypothesis, instead, is that the design of these programs is the result of rent-seeking by interest groups, and responsive pandering by politicians. This can theoretically occur at any level of government.[37] Part III explores the impact of this situation. While the article recognizes the possibility that these incentives are in the public interest, and merely "kill two birds with one

---

[35] For example, in her book reflecting on her experience as governor of Michigan, Jennifer Granholm described her attempts to keep jobs in the state and attract new businesses into Michigan using a combination of tax incentives, breaks, credits and regulatory waivers, but ultimately concluded that this strategy resulted in a "state-versus-state competition" for jobs that did nothing to help Michigan outcompete Mexico, China, and Korea. *See* JENNIFER M. GRANHOLM AND DAN MULHERN, A GOVERNOR'S STORY, THE FIGHT FOR JOBS AND AMERICA'S ECONOMIC FUTURE 74 (2011). *See also, e.g.*, Peter D. Enrich, *Saving the States from Themselves: Commerce Clause Restraints on State Tax Incentives for Business*, 110 HARV. L. REV. 377, 380-381 (1996) (arguing that the accelerating use of state tax incentives to attract and retain businesses is costly and unproductive and that the Supreme Court should interpret the Commerce Clause as restraining state tax incentives that seek to promote in-state business at the expense of other states); NATHAN M. JENSEN & EDMUND J. MALESKY, INCENTIVES TO PANDER: HOW POLITICIANS USE CORPORATE WELFARE FOR POLITICAL GAIN 58-82 (2018) (arguing that state business incentives are best understood as attempts by politicians to achieve electoral success at little political cost, and that politicians tend to provide too many and too generous incentives); Max Schanzenbach & Nadav Shoked, *Reclaiming Fiduciary Law for the City*, 70 STAN. L. REV. 565 (2018) (arguing cities should be subject to fiduciary duties when selling public assets and pursuing privatization, more generally.).

[36] *See, e.g.*, Hrdy, *Commercialization Awards*, *supra* note 9, at 17 (assessing commercialization awards as an alternative way for government to encourage commercial risk taking in technology development).

[37] *See generally*, MAXWELL L. STEARNS ET AL., LAW AND ECONOMICS: PRIVATE AND PUBLIC 655-684 (2018).

stone," the more likely possibility is that they are detrimental to innovation policy. By diverting investment towards subject matter that is in fact labor-intensive, these incentives may end up encouraging developments that are the opposite of "innovative," in the ordinary sense of the word. Part IV turns the tables a bit, and questions whether there is really something structural about the mechanism of public financing, versus exclusive rights, that makes such incentives more vulnerable to the tendency to pursue near-term political goals. Perhaps IP is not quite as immune to these pressures as we sometimes think.[38] The article concludes with general observations and suggestions for further research.

I. INCENTIVES FOR "INNOVATION" THAT ARE REALLY INCENTIVES FOR JOB CREATION

This paper analyzes an important segment of innovation finance programs: state financing for private businesses that is ostensibly intended to promote "innovation." It shows many of these programs are in fact geared towards job creation rather than production of scientific knowledge or new information.

A. *Programs Assessed*

The thirty-five programs assessed in the article consists of state money financing in the form of grants, loans, or equity directed towards "innovation," "technology" or "technology development," or "research." The programs are usually directed at private companies, but may also be available for individuals and/or institutions, depending on the program.

The award amounts provided by each program vary significantly. For instance, the InnovateMass fund, operated by the Massachusetts Clean Energy Center ("MassCEC"), offers awards in the amount of $250,000.[39] Meanwhile, the Innovation, Development, and Entrepreneurship

---

[38] *See infra* Part IV.

[39] InnovateMass provides "grant funding of up to $250,000 per project and technical support for projects that are developing new clean energy technologies or innovative combinations of existing technologies that demonstrate a strong potential for commercialization while providing significant measurable clean energy, clean water and/or climate benefits." *Request for Proposals: InnovateMass*, MASS. CLEAN ENERGY CTR. (April 17, 2018), http://files.masscec.com/2%20-%20InnovateMass%20VI-b%20RFP.PDF

Advancement ("IDEA") Funds, operated by the Missouri Department of Economic Development, offer awards of up to $3 million.[40]

There are also significant differences in how states select funding recipients and in their review criteria. Some states solicit only within specific fields, industries, or clusters. Others permit any type of inventions to qualify. For example, the Innovation Ohio Loan Fund (IOF Loan) provides loans from $500,000 to $1,500,000 to existing Ohio companies "within certain Targeted Industry Sectors": "Advanced Materials, Instruments, Controls and Electronics Power and Propulsion, Biosciences, Information Technology."[41] Meanwhile, Florida's Innovation Incentive Program makes "long-term investments in industry clusters that are critical to Florida's future of economic diversification."[42]

Importantly, the article does not assess all possible forms of U.S. state incentives that provide financing for innovation. There are a multitude of state incentives that might be available for companies investing in innovative technologies. Programs *not* assessed include: subsidies targeting job creation, but that *do not* purpose to support innovation[43]; research tax incentives rather

---

[40] The IDEA Fund contains four different programs, each designed for different stages in a company's progress. Funding increases with each stage. TechLaunch provides pre-seed funding. Individual awards, which come in the form of equity or convertible debt, will not exceed $100,000. The Seed Capital Co-Investment Fund and the Venture Capital Co-Investment Fund provide up to $500,000 and $2,500,000, respectively, in the form of equity or convertible debt. Lastly, the High-Tech Industrial Expansion Fund provides *up to $3,000,000*, typically in the form of a secured low-interest loan. *Missouri Idea Funds*, MISS. TECH. CORP., available at https://www.missouritechnology.com/docs/idea-funds/idea-one-pager.pdf?sfvrsn=2

[41] *Innovation Ohio Loan Program: Program Guidelines & Application Process*, OH. DEP'T OF DEV., https://development.ohio.gov/files/otf/IOF%20Guidelines.pdf (Last updated Feb 9, 2011).

[42] *Strategic Business Development*, THE FLORIDA LEGISLATURE: GOVERNMENT PROGRAM SUMMARIES, available at http://www.oppaga.state.fl.us/government/print.aspx?prog=6112 (last updated June 9, 2019).

[43] For example, the Idaho Opportunity Fund is a discretionary grant program with the goal of serving as a "deal closing fund" to "strengthen Idaho's competitive ability to support expansion of existing Idaho businesses and recruit new companies to the state, ultimately creating new jobs and economic growth in Idaho." However, the fund does not claim to have innovation or technology as criteria for receiving funding. Eligible projects include, for instance, construction of new sewer systems, renovations to infrastructure, or environmental hazard mitigation. *Business Incentives Manual 2018*, IDAHO DEP'T OF COMMERCE (2018), https://commerce.idaho.gov/content/uploads/2017/09/Business-Incentive-Manual-2018.pdf.

than direct money financing[44]; and incentives that use other structures besides direct government-to-company financing, such as "funds of funds."[45]

B. *Methodology in Selecting Programs*

In order to identify state innovation programs to assess, I initially consulted a proprietary dataset operated by the Council for Community and Economic Research (C2ER), a nonprofit organization focused on "excellence in research for community and economic development."[46] I then independently visited program websites. I also independently searched the internet for state sponsored websites discussing programs.

I selected only those programs that referenced "innovation" or a derivative of "innovation", "technology", or "research", in that order. I looked first at titles of the programs, but also included programs that referenced one or more of these key words in the criteria for financing.

For states with multiple qualifying programs, I included only one representative program for purposes of efficiency and space. I chose the program utilizing the word "innovation" or some derivative first.

I ended up with thirty-five programs from different states. Some programs I identified were discontinued or altered while my research was still in progress. I note when this occurred and, in some cases, cite to archived websites. It is likely that this obsolescence will continue to occur, so some of the programs assessed herein may no longer exist by the time of readership.

---

[44] *See* MICHAEL D. RASHKIN, RESEARCH AND DEVELOPMENT TAX INCENTIVES: FEDERAL, STATE, AND FOREIGN 275-532 (2007); *see also, e.g.*, LEGIS. ANALYST'S OFFICE., AN OVERVIEW OF CALIFORNIA'S RESEARCH AND DEVELOPMENT TAX CREDIT (2003) (concluding that "state-level subsidization of R&D activities is difficult to justify because spillover effects cannot be confined to within a state."); Geosyntec Consultants, Inc. v. United States, 776 F.3d 1330, 1334 (11th Cir. 2015) ("The [federal] research tax credit was enacted … to incentivize American industry to invest in research.").

[45] Some states, many in conjunction with the federal SBIC program, provide funding for third party investment funds that fund innovative companies. For example, the Florida Fund of Funds program invests in private venture capital funds that target qualifying investment opportunities within Florida, with a specific focus on investments that contribute to Florida's economic development and that "[f]oster the creation, retention, and growth of companies and jobs in Florida[.]" *About Fund of Funds*, FLORIDA OPPORTUNITY FUND, http://www.floridaopportunityfund.com/About.asp. The effect of a fund of funds is arguably similar to direct state-to-company financing with a private sector matching requirement. However, a fund of fund does not entail a state entity directly selecting which companies to finance. So I exclude these.

[46] *By-Laws*, THE COUNCIL FOR COMMUNITY AND ECONOMIC RESEARCH, https://www.c2er.org/about/C2ER_Bylaws_-_06-09-2006.pdf (last updated June 9, 2006).

C. *Key Findings*

The table in the Appendix provides a list of all state programs considered, and summarizes key information about them: state, program name, provider, stated policy objective, and job creation requirements, if any. This section discusses the key findings.

1. A Baseline Definition of True "Innovation"

As a threshold matter, in order to decide how well the state programs I'm about to describe promote "innovation," we need to define the term. Innovation is accepted as an important public policy goal for many reasons, not least because innovation improves standards of living and reduces costs, leading to consumer surplus (savings), and has been shown to be correlated with economic prosperity across nations and over time.[47] But "innovation" can be conceptualized in a variety of different ways. Indeed, as two IP scholars recently observe, "innovation" lacks a uniform definition, even within the field of intellectual property law, and could reasonably mean many things, ranging from advancement of scientific and technological knowledge (patent law's traditional conception), to economic growth, to improved social welfare more broadly.[48]

IP scholars, legislators, and economists tend to zoom in on patent law, because patent law has comparatively clear minimum standards for what

---

[47] *See, e.g.*, JOSH LERNER, THE ARCHITECTURE OF INNOVATION: THE ECONOMICS OF CREATIVE ORGANIZATIONS 16 (2012); INTELLECTUAL PROPERTY AND THE U.S. ECONOMY: 2016 UPDATE, UPDATING INTELLECTUAL PROPERTY AND THE U.S. ECONOMY: INDUSTRIES IN FOCUS 1 (2012) ("Innovation, the process through which new ideas are generated and put into commercial practice, is a key force behind U.S. economic growth and national competitiveness.").

[48] *See* Camilla A. Hrdy, *Challenging What We Think We Know About "Market Failures" And "Innovation"*, WRITTEN DESCRIPTION (March 17 2020), https://writtendescription.blogspot.com/2020/03/challenging-what-we-think-we-know-about.html (discussing Brett Frischmann & Mark McKenna, *Comparative Analysis of Innovation Failures and Institutions in Context*, 57 HOUSTON L. REV. 313, 321-322 (2019).)

counts as "innovation."[49] Patent law's novelty[50] and nonobviousness[51] principles, in particular, insist that to count as an innovation, a product or a process has to be new or at least relatively new within the jurisdiction.[52] While by no means the only way, or even the best way, to measure innovation, patents are often used as a proxy for the amount and value of innovation, in a variety of fields.[53] Patents usually reward technological experimentation, like that done in a laboratory and related to science and engineering. But patents can (and in some instances do) reward market experimentations, such as introduction of a product that has never been tested in the market—so long as some degree of novelty and nonobviousness are involved.[54]

---

[49] *C.f.* 35 U.S.C. §§ 101, 102, 103 (2011).

[50] Section 102 requires inventions to meet the Act's "novelty" standard. 35 U.S.C. § 102 (2011) ("A person shall be entitled to a patent unless", among other things, "the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention . . ."). *See generally* Sean B. Seymore, *Rethinking Novelty in Patent Law*, 60 DUKE L.J. 919 (2011); *see also* Dan L. Burk & Mark A. Lemley, *Inherency*, 47 WM. & MARY L. REV. 371, 374 (2005) ("[T]he inherency cases are all ultimately about whether the public already gets the benefit of the claimed element or invention. If the public already benefits from the invention, even if they don't know why, the invention is inherent in the prior art.").

[51] In modern U.S. patent law, an invention has to be more than novel. It also must be not "obvious" to a person having ordinary skill in the art. 35 U.S.C. § 103 (2011); *see also* Graham v. John Deere Co. of Kansas City, 383 U.S. 1 (1966). The general idea is that patents shouldn't be available for something that is relatively easy, cheap, or very low risk, and that would be generated anyway without an extra incentive. Robert P. Merges, *Uncertainty and the Standard of Patentability*, 7 HIGH TECH. L.J. 1, 2–3 (1992) (suggesting patents' incentive value should be judged on whether the existence of a patent system causes the marginal inventor to undertake R&D whose technical and commercial success is highly "uncertain" at the outset); Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 YALE L.J. 1590, 1593-94 (2010) (interpreting nonobviousness as assessing whether an incentive is needed to induce the activity).

[52] Patent law does not necessarily need to require novelty on a universal level. Camilla A. Hrdy, *State Patent Laws in the Age of Laissez Faire*, 28 BERKELEY TECH. L.J. 45, 56 (2013) (discussing early policymakers' interest in patents for imported inventions); Edward Walterscheid, *Patents and Manufacturing in the Early Republic*, 80 J. PAT. & TRADEMARK OFF. SOC'Y 855, 860–78 (1998) (explaining complex origin of U.S. patent law's requirement of novelty). Only in 2011 did the U.S. Patent Act fully eliminate its own domestic bias. Prior to 2011, inventions that were known or used in a foreign country were not necessarily preempted by that prior art from qualifying for a U.S. patent. *See* Margo A. Bagley, *Patently Unconstitutional: The Geographical Limitation on Prior Art in a Small World*, 87 MINN. L. REV. 679 (2003).

[53] *See, e.g.*, Peter Lee, *Social Innovation*, 92 WASH. U. L. REV. 1, 6 (2014) (noting "[p]atent law's pervasive focus on discrete inventorship, novelty, and traditional categories of technology neglects other significant expressions of human ingenuity.").

[54] *See* Michael Abramowicz & John Duffy, *Intellectual Property for Market Experimentation*, 83 N.Y.U. L. REV. 337, 339 n. 4 (2008) (urging broader notion of innovation that would include "market experimentation," such as the commercial test of a new product, as distinguished from

Economists, meanwhile, although they might well use patents to proxy for innovation,[55] actually conceptualize innovation differently—as new ideas, or the practical applications of new ideas, *that add economic value to a firm's activities in the form of higher profits.*[56] This could mean introduction of a patentable *or unpatentable* process that leads to greater productivity (lower cost per output), or the introduction of patentable *or unpatentable* new products that consumers are willing to buy (e.g. a cancer-fighting drug or an improved toy water gun).[57]

That said, even under this definition, with its focus on productivity and economic growth, some component of novelty would be required. This could mean novelty at the level of scientific advancement. But it could also mean novelty at the level of the relevant product market, region, or potentially even just within a single firm. Otherwise there would be little value added.[58]

2. Divergent Standards for What Counts as "Innovation"

The innovation finance programs considered in this article do not typically utilize a strict standard for what counts as "innovation." Needless to say, none of them uses precisely the same standard as patent law. Although several programs view ownership of patents or other intellectual property as

---

merely "technological experimentation, which could occur in a laboratory and which would test feasibility as a matter of science and engineering.").

[55] *See generally,* Petra Moser, *Innovation Without Patents: Evidence from World's Fairs*, 55 J.L. & ECON. 43, 44 (2012) ("[E]mpirical analyses typically use counts of patents per year as a measure of innovation."); *see also* David S. Abrams, Ufuk Akcigit, & Jillian Popadak, *Patent Value and Citations: Creative Destruction or Strategic Disruption?* (Nat'l Bureau of Econ. Research, Working Paper No. 19647, 2013) ("Over the last several decades, a number of pioneering efforts were made to overcome the challenges inherent in measuring the value of innovation. Given that patent records contain a wealth of information on each patented invention as well as citations to previous patents, patent counts and citation-weighted patent counts have become popular proxies for the value of innovation.").

[56] GREENHALGH & ROGERS, *supra,* at 10.

[57] *Id.*

[58] *See, e.g.*, Stuart Graham, Cheryl Grim, Alan Marco & Javier Miranda, *Business Dynamics of Innovating Firms: Linking U.S. Patents with Administrative Data on Workers and Firms*, 27 J. OF ECON. & MANAGEMENT STRATEGY 372, 374 (2018) ("Innovative firms are believed to play an important role . . . introducing *new* products or services that satisfy a previously *unmet* need or processes that provide existing goods and services in *new* and more efficient ways.") (emphasis added); INTELLECTUAL PROPERTY AND THE U.S. ECONOMY: INDUSTRIES IN FOCUS 1, U.S. PATENT AND TRADE OFFICE (2012) ("Innovation, the process through which *new* ideas are generated and put into commercial practice, is a key force behind U.S. economic growth and national competitiveness.") (emphasis added).

signals of the technical or commercial merit of the applicant's project,[59] the defining characteristic of an innovation is *not* the novelty or inventiveness of the subject matter as compared to what is already known publicly or known within an industry.[60] There is virtually no assessment of questions like "is an incentive actually needed to induce this activity," as might occur in patent law's" obviousness" component.[61]

A quick look at Arkansas' innovation finance program illustrates the problem. The Arkansas Science & Technology Authority's "Technology Development Program" supplies cash awards of up to $100,000 to "qualified applicants" for "technology development projects."[62] The Authority defines "technology development" as "the evolution of innovative products and processes."[63] The Authority then explains how this process occurs, categorizing several stages of development, from the "laboratory/workshop stage . . . usually before a working prototype i[s] developed," to the "late startup/scaleup stage . . . during which limited production an[d] market testing of products are paramount."[64]

Allusions to "laboratory," "prototype," and "market testing" impart the notion that there will be significant uncertainty as to success, necessitating testing. Yet the observer is left unclear as to precisely what it means for a product or service to be "innovative" enough to obtain funding from the state of Arkansas. Totally new to the jurisdiction? New to a firm only? New *and*

---

[59] For example, the Alabama Innovation Fund includes in its review criteria "[p]otential creation of patentable or other intellectual property capable of successful commercialization[.]" *Alabama Innovation Fund*, ALABAMA EPSCOR, available at https://web.archive.org/web/20190802014124/http://alepscor.org/alabama-innovation-fund/ The New Hampshire Granite State Technology Innovation Grant's review criteria includes assessing whether the company has the potential to "[c]reate a patentable or licensable technology[.]" *Criteria for selecting NHIRC Projects*, NEW HAMPSHIRE INNOVATION RESEARCH CENTER, available at http://www.nhirc.unh.edu/succes-criteria.html.

[60] Patent law, in contrast, views novelty as a, if not the, defining feature of an innovation. *See e.g.*, 35 U.S.C. § 102 (2011). *See* Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123, 169 (2006) ("The patentee cannot capture that which is already in possession of the public, as is the case in assessing the novelty and obviousness of an invention."); Seymore, *supra* note 50, at 930 ("A bedrock principle of patent law is that a patent cannot issue if it would remove technology that is already in the public domain.").

[61] Nonobviousness in patent law is intended to ensure incentives are awarded only for those innovations "which would not be disclosed or devised but for the inducement" of an incentive, whether it be a patent or a prize. Abramowicz & Duffy, *supra* note 51, at 1593-94 (quoting Graham v. John Deere Co. of Kansas City, 383 U.S. 1 (1966)).

[62] *Technology Development Program Rules*, ARKANSAS SCIENCE & TECHNOLOGY AUTHORITY, available at https://www.arkansasedc.com/docs/default-source/s-t/tdp_rules08.pdf?sfvrsn=f30f323f_2.

[63] *Id.* § 2.2.1.

[64] *Id.*

nonobvious? Just generally creative? Can a restaurant researching a new food dish get funding? What about a medical technology firm developing a diagnostic tool using well-known methods? We do not know from the definitions provided.

True, "innovation" is often discussed in public policy and in academic literature with reference to a qualifying activity, such as such "research and development," rather than with reference to the result.[65] Research and development tax incentives, for example, can be offered based on research that is undertaken well before a winning result is achieved.[66] For these incentives, merely engaging in research that is "directed toward" an as-yet-unknown end goal of achieving novelty is what matters, not whether it is actually achieved.[67] But at the end of the day, these programs must care about the results. It would not matter, for innovation policy, how much "research" a company does, if the end result is well-known or obvious or otherwise valueless. So it should be somewhat alarming that these state awards have no real benchmark for what qualifies as research, let alone the end result to be achieved.

Most states are like Arkansas in this respect—except they do not say nearly as much about what activities, let alone what outputs, qualify for funding. They use the term innovation, and related adjectives such as "new

---

[65] For example, Lewis Branscomb and Philip Auerswald describe a five-stage model for the process of innovation, from basic research, to early-stage technology development, to marketing and production. LEWIS BRANSCOMB & PHILIP AUERSWALD, BETWEEN INVENTION AND INNOVATION 32-34 (2002).

[66] Hemel & Ouellette, *supra* note 17, at 333-334.

[67] For instance, when companies apply for a federal research and development tax credit, their expenditures must be undertaken in pursuit of activities that fall within the statutory definition of "qualified research" as defined in the Internal Revenue Code. *See* 26 U.S.C. § 41(d) ("The term 'qualified research' means research . . . which is undertaken for the purpose of discovering information—(i) which is technological in nature, and (ii) the application of which is *intended* to be useful in the development of a new or improved business component of the taxpayer, and (C) substantially all of the activities of which constitute elements of a process of experimentation for a purpose [such as a new or improved function].") (emphasis added); *see also* Evan Wamsley, *The Definition of Qualified Research Under the Section 41 Research and Development Tax Credit: Its Impact on the Credit's Effectiveness*, 87 VA. L. REV. 165, 173 (2001) (discussing case law in which courts held taxpayer's research did not qualify for research tax credit because it "amounted to 'more or less routine modification of a commercially-available software package,' thus falling short of the standard, even if 'evolutionary' research is allowed to qualify.") (quoting United Stationers v. United States, 163 F.3d 440, 445 (7th Cir. 1998), cert. denied, 527 U.S. 1023 (1999)).

and innovative"[68] or "next generation."[69] They may reference activities that are believed to occur during the process of innovation, such as "basic research, applied research, or some combination of both."[70] But ultimately they provide no strict criteria for what standards the applicants must meet in terms of the outputs sought or achieved.

The District of Columbia provides one of the most striking examples. It suggests that the standard is just not very high—or, by way of foreshadowing, that innovation isn't the principal goal. The District of Columbia's Innovation Finance Program gives no set definition of innovation in the ordinary sense. Its target appears to be general entrepreneurship. The fund provides capital for "start-ups and emerging companies that seek financing alternatives to traditional commercial financing." Investor companies must "[d]emonstrate a track record of positive return on investment . . . ."[71] Applying this standard, the District of Columbia gave a financial award to a new Indian restaurant, described as offering "new fast casual Indian food"; and a new "neighborhood grocery store," Good Food Markets. The Indian

---

[68] The Maine Seed Grant, operated by the Maine Technology Institute (MTI), provides the following information about "Eligible Projects" that may qualify for Seed Grants of up to $25,000. The guidelines states that Seed Grants will be available for "specific projects leading to the development of new and innovative products, processes or services that may include" among other things, "R&D activities such as proof of concept work, prototype development, field trials, prototype testing, pilot studies." This indicates only that the state expects the applicant's project to be "new and innovative" and to involve "R&D activities." *Seed Grant Application Instructions*, ME. TECH. INST., at 4 (Apr. 30, 2018), https://www.mainetechnology.org/wp-content/uploads/2015/05/Seed-Grant-Application-Instructions-rev-APR-2018.pdf.

[69] The Innovation Ohio Loan Fund, discussed in the introduction, provides loans to companies that are "developing next generation products and services." The program guidelines indicate that "[e]ligible projects include those related to industry, commerce, distribution or research activities," and that allowable uses of the state loan include, among other things, "[c]reating and protecting intellectual property including costs of securing appropriate patent, trademark, trade secret, trade dress, copyright or other forms of intellectual property protection for an eligible innovation project or related products or services." It further stipulates that "[r]etail projects are **ineligible** for the IOF Loan." OHIO DEP'T OF DEV., *supra* note 7, at 2-3.

[70] The Montana Board of Research and Commercialization Technology invests in "research and commercialization projects" (and reports having about $800,000 available to grant in fiscal year 2019 for such projects). The Board states that it seeks to reward the applicant who "[d]evelops or employs an innovative technology[,]" but provides no further definition of innovative. The application must contain

> [a] description of whether the grant is to be used for basic research, applied research, or some combination of both. Applied research is defined as research that is conducted to attain a specific benefit or solve a practical problem, and basic research is defined as research that is conducted to uncover the basic function or mechanism of a scientific question. MONT. BD. OF RESEARCH AND COMMERCIALIZATION TECH., *Request for Proposals: Research and Commercialization Projects*, at 1, 3 (Dec. 14, 2017) (on file with author).

[71] *DC BizCAP - Innovation Finance Program*, DC.GOV: DEP'T INS., SEC. & BANKING, https://disb.dc.gov/page/dc-bizcap-innovation-finance-program (last visited Apr. 1, 2020).

restaurant received a $100,000 investment. The grocery store received a $50,000 investment.[72]

How is an Indian restaurant or a grocery store an innovation? The answer requires reformulating our definition. Under patent law's traditional standards, there is no question these fail. Under broadened criteria, such as attention to "market experimentation," an incoming Indian restaurant or even a grocery store might qualify. After all, a new Indian restaurant in a town that lacks an Indian restaurant is "new" and maybe even "inventive" from the perspective of that town and the relevant market of dining options.[73]

But I suspect that this funding may not actually be rewarding technological or commercial risk-taking at all. Or at least this isn't the primary goal. Instead, these programs have more parochial goals.[74]

3. Job Creation as the Ultimate Criteria

The criteria of the studied programs that stands out most prominently is that nearly all of them take into account the potential impact of the applicant's project on jobs in the state. Importantly, not all programs targeting innovation assess job creation.[75] But a significant number of them (around twenty of the programs listed in the Appendix) do so expressly.

For example, the Alabama Innovation Fund supports what it calls a "Research Program" that provides awards to universities in the state in "a competitive review process that determines the most meritorious proposals."[76] The projects are reviewed based on the following criteria:

---

[72] *District Announces Innovation Finance Program Investment in Rasa Indian Grill*, DC.GOV: DEP'T INS., SEC. & BANKING, https://disb.dc.gov/release/district-announces-innovation-finance-program-investment-rasa-indian-grill (last visited Apr. 1, 2020).

[73] For the argument that commercial risk-taking is a form of innovation that should be rewarded under patent law, see Abramowicz & Duffy, *supra* note 54.

[74] For similar conclusion based on assessment of Michigan technology financing fund, see Bo Zhao & Rosemarie Ziedonis, *State Governments as Financiers of Technology Startups: Implications for Firm Performance*, 49 RES. POL'Y (forthcoming May 2020), at 4-8, available at http://ssrn.com/abstract= 2060739.

[75] For example, the North Dakota Department of Commerce explicitly states that the Small Business Technology Program, which provides favorable loans of up to $50,000 for "[a]ny start-up primary sector business in [the] technology field," "[d]oes not have a job requirement." This is in contrast to other North Dakota Department of Commerce financing programs. In total, the North Dakota Department of Commerce's Development Fund offers six separate business financing options, including the Small Business Technology Program. Two other programs, the North Dakota Development Fund and the Revolving Rural Loan Fund, do set loan amounts "based on job creation." *NDDF Programs*, ND.GOV: ECON. DEV. & FIN., https://www.business.nd.gov/development_fund/NDDFPrograms/#ND%20Small%20Business (last visited Apr. 2, 2020).

[76] *Alabama Innovation Fund*, *supra* note 59.

1. Strength of the partnership between university and private business;
2. Potential creation of patentable or other intellectual property capable of successful commercialization;
3. Probability to stimulate further research and development within the state;
4. *Possibility of future job creation;*
5. Expertise of the research team in fields;
6. Research team experience with similar projects *that led to successful commercialization and job creation;*
7. Technological, economic, human and intellectual property resources available to research team;
8. *Positive contribution to State's economy.*[77]

As can be seen, several of these criteria, such as the potential to generate intellectual property and expertise of the research team, resemble what one would expect from a state alleging to be investing in some new innovation.[78] But the rest of the criteria—possibility of future job creation and positive contribution to the state's economy—have little to do with the technological merit or novelty of the project. They are instead about enhancing the economic well-being of the state, in particular by creating jobs for residents.

Several other examples illustrate a similar procedure. The Arkansas Technology Development Program provides that the applicant for funding must include a "statement of economic impact (e.g. potential job creation, export potential, value added to existing products)," and answer the following questions: "Will the product impact Arkansas economy? Does it have job creation potential? …"[79]

The TEDCO Seed Investment Fund, intended to support Maryland companies, provides that the company's product must "incorporate[] a novel

---

[77] *Id.* (emphasis added).

[78] *See, e.g.*, Darian M. Ibrahim, *Financing the Next Silicon Valley*, 87 WASH. U. L. REV. 717, 736-39 (2010) (discussing the optimal role of state-sponsored venture capital in encouraging local investment in innovation).

[79] ARKANSAS SCIENCE & TECHNOLOGY AUTHORITY, *supra* note 62, §§4.1.2.10, 5.4.

and proprietary technology" and must have "the potential to grow the Maryland economy and create jobs."[80]

The New Hampshire Granite State Technology Innovation Grant Program provides that it "was created in 1991 by the New Hampshire Legislature to support innovations through industry and university collaborations, thereby increasing the number of quality jobs in the state." The program criteria for selecting projects includes answering the question "Will this project: Create jobs?"[81]

The Utah Technology Commercialization & Innovation Program explicitly requires the granting agency to consider potential for job creation, providing in its guidelines that "3 (b) Each proposal shall receive the best available outside review. (4) (a) In considering each proposal, the office shall weigh **technical merit**, the **level of matching funds from private and federal sources**, and the **potential for job creation and economic development**."[82]

Even if some programs do not expressly provide that job creation is to be considered, the granting agencies may still do so in practice. For example, Rhode Island provides Innovation Vouchers, which are awarded by the Rhode Island Commerce Corporation. The Innovation Vouchers consist of grants of up to $50,000 for small businesses. The grants are to be used to purchase "fund an internal R&D project."[83] The Rhode Island Commerce Corporation website states that "[g]rants can be applied to

1. support for commercialization of a new product, process, or service
2. access to scientific, engineering, and design expertise
3. scale-to-market development of your innovative idea"[84]

The website says nothing about job creation potential.

---

[80] *Seed Investment Fund*, TEDCO, formerly available at http://tedco.md/program/seed-funding-program/ (archival capture of website on file with author).

[81] *Research Partnership Opportunities*, U.N.H., https://innovation.unh.edu/research-opportunities (last visited June 13, 2020). *See also* Success Criteria, N.H. INNOVATION RES. CTR, http://www.nhirc.unh.edu/succes-criteria.html (last visited June 13, 2020).

[82] *TCIP Grant Open for Applications*, UTAH GOVERNOR'S OFF. ECON. DEV., https://business.utah.gov/tcip/ (last visited Apr. 2, 2020); *Technology Commercialization & Innovation Program: Guidelines for Review of Applications for Grant Funding*, UTAH GOVERNOR'S OFF. ECON. DEV. 1 (Sept. 13, 2016) https://business.utah.gov/wp-content/uploads/2018/01/TCIP-Application-Review-Guidelines-FINAL-September-2016.pdf.

[83] *Innovation Incentives*, R.I. COMM. CORP., https://commerceri.com/innovation-incentives/ (last visited Apr. 2, 2020).

[84] *Id.*

However, a review of the successful projects suggests that job creation potential was at least sometimes considered. For example, the Rhode Island Commerce Corporation recommended in January 2016 that defense electronics company Applied Radar, Inc. receive $10,000.00 for an Innovation Project entitled "Lean Manufacturing for Catalog Microwave Electronic Components & Systems Derived from Defense R&D." The project goal was "to establish a lean manufacturing facility to support catalog sales of microwave electronic systems and components derived from an established defense R&D business." As described by the Rhode Island Commerce Corporation, the development of "lean manufacturing" would "lead to increased efficiencies and improved quality, furthering [the company's] sales and value proposition to customers, *and leading to increased jobs* and taxable commercial activity."[85] Thus, even though the project's job creation potential was not a written criterion for obtaining funding, the granting agency nonetheless considered it.

II. WHY IS THIS HAPPENING?

The crux of these findings is that innovation incentives offered by U.S. states are not necessarily going towards true innovation, or at least not only or primarily that. They are being directed at recipients who promise to create jobs. Why are these innovation incentives designed this way? This part tackles these questions through the lens of public choice theory.[86]

A. *Is It Just the States?*

One tempting hypothesis is that maybe it's just the states. Hypothetically, it could be that U.S. states are more likely than the federal government to pursue job creation rather than true innovation, because states are limited in jurisdiction and thus cannot internalize the benefits of funding on inventions and ideas that can be copied and used outside the jurisdiction.[87]

At a conceptual level, this hypothesis is highly compelling. An important piece of public choice theory deals with the issue of jurisdiction. Given that laws are passed in response to the demands of constituents within a particular

---

[85] *Innovation Voucher Award Fact Sheet*, R.I. COMM. CORP. 1 (Jan. 25, 2016) https://commerceri.com/wp-content/uploads/2018/03/Innovation-Voucher_Summaries_20160125.pdf.

[86] Broadly speaking, "public choice theory" refers to the application of economic principles in order to explain how political behavior and the incentives of politicians, voters, and interest groups shapes laws and regulations. *See* STEARNS ET AL., *supra* note 37, at 655-684.

[87] For this argument, see Camilla Hrdy, *Patent Nationally, Innovate Locally*, *supra* note 8.

polity, the jurisdiction that best internalizes the costs and benefits of its regulations should be responsible for crafting them.[88] For example, because national security benefits everyone in the country, it makes sense for politicians responsive to everyone to take charge on this issue. Why? Because those who benefit should pay. If smaller units of government were responsible, they might not take action, given that national security benefits everyone in the country, not just their voters.

With this insight, it makes sense that states would require recipients of funding for innovation to provide localized benefits like job creation. It would be difficult for small governments to capture the full value of innovations, in the sense of new ideas and new applications of ideas.[89] So when states do fund innovation, we might expect them to attach conditions that aid local constituents in more concrete ways.[90]

Yet I don't think federalism, on its own, is the end of this story. My research suggests the states are not the only ones that consider job creation potential when ostensibly promoting "innovation." The federal government does so too. At the federal level, federal research agencies like the Department of Defense (DOD) offer similar innovation awards for companies through programs like the Small Business Innovation Research (SBIR) program.[91] A review of an SBIR-granting agency's solicitations shows at least some of these agencies motivated by a job creation goal.

---

[88] *See* STEARNS ET AL., *supra* note 37, at 991-998. *See also* ROBERT COOTER, THE STRATEGIC CONSTITUTION 105–09 (2000) (discussing national versus local public goods and implications for optimal allocation of governmental authority).

[89] Hrdy, *Patent Nationally, Innovate Locally*, *supra* note 8, at 1357 ("Federally funded research is limited to those cases in which innovation produces such significant national benefits that states alone are not . . . willing to fund it . . . ."); *see also* Brian Galle & Joseph Leahy, *Laboratories of Democracy? Policy Innovation in Decentralized Governments*, 58 EMORY L. J. 1333, 1335 (2009) ("State and local governments can be thought of as inventors without patents: because anyone can steal their new ideas, what incentive have they ever had to invent?").

[90] Hrdy, *Patent Nationally, Innovate Locally*, *supra* note 8, at 1336 ("The explicit goal of U.S. state innovation incentives is to spur jobs and business activity *in the region*, potentially at the expense of others.").

[91] In SBIR, Congress mandates that certain federal agencies set aside a portion of their funding to provide competitive research grants to small businesses. *See* 15 U.S.C. § 638(f). Each of these agencies then operates its own SBIR program, and solicits submissions for SBIR awards, with significant freedom. SBIR's guiding statute merely lays out a general definition of qualifying activities, providing definitions of "research," "research and development," and "commercialization." *See id.* § 638(e)(5) (defining "research" as "any activity which is (A) a systematic, intensive study directed toward greater knowledge or understanding of the subject studied; (B) a systematic study directed specifically toward applying new knowledge to meet a recognized need; or (C) a systematic application of knowledge toward the production of useful materials, devices and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements . . . ."). Then SBIR-granting agencies

For example, the National Science Foundation (NSF) is certainly an agency we would think would be interested in idea-generating research. The NSF operates an SBIR program, called "America's Seed Fund," which provides seed funding for qualifying small businesses.[92] According to the Seed Fund's "Peer review guidelines", "[a]ll proposals are reviewed under the NSF merit review criteria," which include three separate criteria: "the quality of research **(intellectual or technical merit)**, . . . its potential impact on society **(broader impacts)**, and commercial potential of the project **(commercial impact)**."[93] The first peer review criterion is the only one that hints at a traditional notion of innovation in the patent law sense.[94]

The NSF/SBIR Seed Fund's solicitation—where funding applicants go to see whether their project fits into the agency's specific criteria—provides further details. For example, for projects falling within the "Chemical And Environmental Technologies" topic, the NSF's solicitation states that the proposed project must involve "novel, discontinuous, disruptive innovations and be built on a firm framework involving chemistry and chemical engineering approaches."[95] Yet the Solicitation also states that the project must have "*the strong potential to catalyze and accelerate U.S. job creation* through scalable business growth."[96] Job creation potential is also a stated criteria for other specific sub-topics supported by the NSF.[97]

---

may then further refine this definition of qualifying activities to meet their goals. *See* Hrdy, *Commercialization Awards*, *supra* note 9, at 52-53.

[92] NSF SBIR: AMERICA'S SEED FUND, https://seedfund.nsf.gov (last visited Apr. 2, 2020).

[93] *Peer Review Guidelines*, AMERICA'S SEED FUND, https://seedfund.nsf.gov/resources/review/peer-review/ (last visited Apr. 5, 2020).

[94] "The Intellectual Merit criterion," the guidelines state, "encompasses the potential to advance knowledge." *Id.* This criterion considers questions such as, "[w]hat is the potential for the proposed activity to advance knowledge and understanding within its own field or across different fields (Intellectual Merit)?" and "[t]o what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?" *Id.* The "Broader Impacts" criterion asks questions such as, "[w]hat is the potential for the proposed activity to benefit society or advance desired societal outcomes (Broader Impacts)?" *Id.* "The Commercial Impact criterion focuses on the potential of the activity to lead to significant outcomes in the commercial market." *Id.* It considers questions like, "[i]s there a significant market opportunity that could be addressed by the proposed product, process, or service?", and "[d]oes the company possess a significant and durable competitive advantage, based on scientific or technical innovation, that would be difficult for competitors to neutralize or replicate?" *Id.* This suggests "innovation" here is meant in the sense of commercial innovation that might lead to economic profits for the recipient. That's not inherently problematic, if we accept a broader definition of innovation as including non-technical features of a business that lead to greater profitability.

[95] *Solicitation Topics & Subtopics*, AMERICA'S SEED FUND (Mar. 2018), https://seedfund.nsf.gov/assets/files/applicants/combined-topics-03-2018.pdf (last visited June 13, 2020).

[96] *Id.* at 12 (emphasis added).

[97] For instance, the sub-topic, "Human-Centric Industrial Technologies," seeks proposals

A much more prominent instance of the federal government conflating innovation and job creation goals can be seen in the "National Innovation Act." This Senate bill, drafted in 2005-2006, would have created a federal "Innovation Acceleration Grants Program" to "support and promote innovation in the United States." Though it never passed, the National Innovation Act strikingly resembled the state programs assessed above. The bill expressly defined "innovation" as "a process for incremental or significant technical advance or change, which provides enhancement of measurable economic value . . ." It referenced job creation multiple times, asserting that the legislation would "ensure that as innovations occur, America is poised to reap the benefits via the creation of new jobs and investment . . ." The bill further stated that, in evaluating proposals for funding "the Executive agency shall consider the extent to which the program funded by the grant met the goals of quality improvement and job creation."[98]

This all suggests that, for at least some federal programs, job creation is as much a goal as it is for equivalent state agencies. This casts doubt on federalism as the sole explanation for why so-called innovation subsidies would go towards job creation.

B. *The Rent-Seeking Story*

A second hypothesis, which could theoretically apply at both the state and the federal level, is that these programs are the result of rent-seeking and responsive pandering by politicians to appease disparate interest groups.[99] Public choice theory is skeptical of the notion that legislation and regulations are the result of selfless and beneficent regard for the public interest.[100] Rather, it views laws and regulations as the product of rent seeking by firms

---

"aimed at combining the reach of the internet with a new ability to directly connect and seamlessly integrate the modern industrial landscape . . . . Such proposals may aim at (but are not limited to) *development of innovative technologies that would promote creation of entirely new types of industrial jobs requiring complementary human-digital workforce . . .*" *Id.* at 5 (emphasis added). *See also id.* at 19. (referencing a job-creation goal in another NSF-SBIR subtopic, "Emotional Intelligence (EI) Enhancing Educational Innovations[.]")

[98] National Innovation Act, S. 2390, 109th Cong., 2d Sess. (2006), https://www.congress.gov/bill/109th-congress/senate-bill/2390/text.

[99] For a compelling argument in this regard with respect to business subsidies, *See generally* NATHAN JENSEN & EDMUND MALESKY, INCENTIVES TO PANDER: HOW POLITICIANS USE CORPORATE WELFARE FOR POLITICAL GAIN (2018) (arguing that a major reason for government incentives is "pandering" to voters).

[100] *See* STEARNS ET AL., *supra* note 37, at 656-60.

and individuals. Rent-seeking is defined as seeking rents (loosely, profits) by obtaining some benefit that would not exist in a naked market.[101] A common way to seek rents is by lobbying for favorable legislation.[102] The Wilson-Hayes Matrix[103] predicts that lawmakers are more likely to support special interest legislation, such as business subsidies for particular industries, if they confer benefits on small, well-organized interest groups, while imposing the costs on large, widely distributed groups.[104]

Applying these concepts, the innovation finance-come-job creation programs assessed in this article could be interpreted as the result of rent-seeking by two large interest groups: companies who receive money through the programs, and workers who get jobs at those companies.[105] On this view, innovation subsidies are simply the outcome of a two-sided transaction: government benefits in exchange for political support.[106] On the "demand side," firms seek financial awards (rents) by spending resources on lobbying and influence and by representing themselves as "innovators" in some way.[107] On the "supply side," legislators appease and garner support from industry by fashioning "innovation" incentives that fit the bill. They also get to claim credit for funding a public good ("innovation"), just as they would for funding a bridge or a highway.[108] Meanwhile, the other large interest group at play here are workers in the region who might be hired by those companies, or fired or not hired if the companies leave or never arrive. By attaching job creation requirements to the innovation incentives, legislators make the expenditure of public money more politically palatable to a broader segment of the population. Giving a boon to workers can be interpreted simply as

---

[101] Economic rents are defined as a return on an activity in excess of the opportunity cost of the income-producing asset. Profit is a similar concept. But rents take into account opportunity cost. *Id.* at 423.

[102] *Id.* at 423-24.

[103] *Id.* at 659-67 (summarizing JAMES O. WILSON, POLITICAL ORGANIZATIONS 332-37 (1973); MICHAEL T. HAYES, LOBBYISTS AND LEGISLATORS: A THEORY OF POLITICAL MARKETS (1981).)

[104] *Id.* at 659-60.

[105] To be clear, I have no evidence to support or refute this interpretation. I have not spoken with the drafters of these programs or those who work with them.

[106] *Id.* at 19-20 (viewing politics and the legislative process as an exchange model in which voters, interest groups, and lobbyists offer support to elected officials who in exchange agree to give them the government benefits they seek).

[107] *Id.* at 660 (applying this theory to explain tariffs and business subsidies), *Id.* at 661-62 (discussing "demand side" of the model).

[108] *Id.* at 665-66 (discussing "credit claiming").

"conflict avoidance"[109] or alternatively as "logrolling."[110] The point is that, from the politicians' perspectives, they presumably prefer to make as many voters happy as possible in order to achieve political success. As with natural selection, only the politicians who play the game get re-elected.[111]

Meanwhile, there are few voices to object. The main population who must bear the costs of these innovation incentives/job subsidies are general taxpayers. While they are the ones who actually pay for the programs, most taxpayers will not benefit, or at least not directly, from either the promised innovation or the promised job creation, unless they happen to work for one of the rewarded companies. General taxpayers are also widely dispersed and so unlikely to organize in opposition.[112] They thus experience a sort of "forced riding," paying for benefits that they don't themselves directly experience.[113]

An apt analogy can perhaps be drawn to the financing of sports stadiums. The taxpayers "including those who could care less about sports, pay and pay" for massive sports stadiums that only some well-organized interest groups actually want.[114]

III. A PROBLEM FOR INNOVATION POLICY

Not all rent-seeking is bad. For example, the race to obtain patents from the government in order to exclude others from a certain invention is a form of rent-seeking.[115] But the patent system also brings benefits in the form of new inventions. Likewise, here, there could possibly be a major upside to the rent-seeking activity depicted above.

It's not hard to tell a salubrious story about the effects of incentives that both incent innovation and jobs, at the same time. At least in theory, government can offer subsidies that do two things that are good for public policy: pay for innovation and pay for high quality, high paying jobs. The story would go like this. Innovation is undeniably a laudable public policy

---

[109] *Id.* at 666-67 (noting that successful legislators avoid conflicts between constituents by bargaining with adversely affected groups).

[110] *Id.* at 31-32 (defining logrolling as where "private interests attach unrelated narrowly focused private benefits to larger public-regarding legislation")

[111] *Id.* at 665.

[112] *Id.* at 660 (noting consequences of widely distributed costs).

[113] On forced riding, *See id.* at 17-18.

[114] Gregory Bresiger, *Stadium Socialism*, THE FREE MARKET 17, NO. 11 (Nov. 1999) (quoting Jesse Ventura, Governor of Minnesota).

[115] *C.f.* Michael Abramowicz, *The Uneasy Case for Patent Races over Auctions,* 60 STAN. L. REV. 803, 862 (2007) ("Rent seeking is an activity in which the competition for rents, for example from an exclusive government franchise, dissipates the benefits of those rents.").

goal.[116] Job creation is also a laudable public policy goal, especially in an age of increasing automation.[117] What is more, some research suggests innovation and jobs can actually complement each other, because wages in the innovation sector tend to be higher.[118] So if government is going to subsidize work, why not subsidize jobs in the innovation sector? It's hard to deny incentives can have this effect. For example, the software company mentioned in the introduction that received an "Innovation Loan Fund" went on to create both a software program (perhaps a somewhat new one, presumably a commercially viable one), and 33 jobs, 24 of which jobs were retained—just as the company initially promised.[119] Whether the jobs will stay in the long term, and whether the government paid too much per job, are separate, hugely important issues.[120] But in theory at least, it can work.

The final part of the story is the concept of "spillovers." Some assert that, when companies locate in a region and hire local, the whole community benefits when companies buy local products and workers spend in shops, restaurants and yoga studios. So it's not just the 24 jobs that came to Ohio

---

[116] *See*, e.g., LERNER, *supra* note 47, at 16; *see also* GREENHALGH & ROGERS, *supra* note 10, at 17–23.

[117] As Oren Cass of the Manhattan Institute puts it in his recent book laying out a socioeconomic agenda in favor of the "future worker," "If society wants more from the labor market, it must consider paying for it." OREN CASS, THE ONCE AND FUTURE WORKER: A VISION FOR THE RENEWAL OF WORK IN AMERICA 56 (2018); *see also* Cynthia Estlund, *What Should We Do After Work? Automation and Employment Law*, 128 YALE L. J. 2 , 254 (2018) (asking "Why not affirmatively subsidize human labor and job creation?"); And *see* Camilla A. Hrdy, *Intellectual Property and the End of Work*, 70 FLA. L. REV., 303 (2019) (proposing using intellectual property law to promote job creation).

[118] *See, e.g.,* ENRICO MORETTI, THE NEW GEOGRAPHY OF JOBS 72-97 (2012) (showing that people living in "brain hubs"—metropolitan areas with higher shares of college-educated workers and often higher shares of patents—have higher salaries., making "between $70,000 and $80,000 a year, or about 50% more than college graduates in the bottom group."). *See also* INTELLECTUAL PROPERTY AND THE U.S. ECONOMY: 2016 UPDATE, UPDATING INTELLECTUAL PROPERTY AND THE U.S. ECONOMY: INDUSTRIES IN FOCUS, 2012, at ii, 19 ("Private wage and salary workers in IP-intensive industries continue to earn significantly more than those in non-IP-intensive industries. In 2014, the average weekly wage of $1,312 was 46 percent higher (up from 42 percent in 2010) than for workers in non-IP-intensive industries[.]").

[119] *Award and Recipient Compliance List by Ohio Treasurer*, OHIO TREASURER, http://ohiotreasurer.gov/Documents/CMS/Loan-Report-2014-Compliant-List.pdf.

[120] *See, e.g.,* Kasia Tarczynska, *Show Us the Local Subsidies: A Second Evaluation of City and County Online Disclosure Practices of Economic Development Subsidy Programs*, GOOD JOBS FIRST (Mar. 2017), at 19-38, available at https://www.goodjobsfirst.org/hide/show-us-local-subsidies-second-evaluation-city-and-county-online-disclosure-practices-economic (estimating the performance and cost per job of various local subsidies). For recent discussion among experts about the complexities involved in subsidizing employment, see the transcript of the Brookings Institute's and the Hamilton Project's joint panel, *From Job Guarantees to Wage Subsidies: Exploring Policy Options to Promote Employment*, THE HAMILTON PROJECT (Dec. 6, 2018), http://www.hamiltonproject.org/assets/files/120618-BROOKINGS-JOBS.pdf.

because one company got a grant from the government. It's the economic activity, and other jobs, that those 24 workers support.[121]

There is, however, a major problem. Providing incentives for companies to both generate innovation and to create jobs is a strategy that is at best inconsistent. At worst it is contradictory, a snake eating its own tail. The reason is that innovation and jobs are not necessarily compatible goals, and in fact may be directly inimical to one another. Some of the most important innovations in history, from the cotton gin to the computer, have not been job creators. They have been labor-saving; they increase productivity by reducing the human labor required to achieve a given task.[122] Indeed, some commentators argue that the most important threat to human work today is automation: where technology replaces paid human workers by performing human-like tasks.[123] Technologies are increasingly capable of performing tasks that would otherwise be done by paid humans. The range of automation technology runs the gamut of tasks we perform in our daily lives, from childcare to collecting and analyzing data.[124]

Although the long-run effects of innovation on employment have historically been positive, the short-term effects for people in the here and now can be very bad, especially for certain types of occupations.[125]

To give an example, in 2012, a robotics startup called Momentum Machines invented a machine that can make "400 made-to-order hamburgers in an hour. . . . [T]he robot can slice toppings, grill a patty, and assemble and bag the burger without any help from humans." This could allow a burger restaurant to "replace two to three full-time line cooks" and save "up to $90,000 a year in training, salaries, and overhead costs." The company is now opening a restaurant using the machine—and presumably higher fewer line cooks as a result.[126]

---

[121] MORETTI, *supra* note 117, at 55-63 (discussing the "multiplier effect" associated with technology sector jobs). *See also, e.g.,* CASS, *supra* note 29, at 162 (explaining the argument in favor of subsidies for work in order to generate local spillovers).

[122] *See* Hrdy, *Intellectual Property and the End of Work, supra* note 29, at 303, 309-327.

[123] *See id.* at 312-315, 319-322.

[124] *See generally* Darrell M. West, *What Happens if Robots take the Jobs? The Impact of Emerging Technologies on Employment and Public Policy*, CTR. FOR TECH. INNOVATION AT BROOKINGS 1, 2-6 (2015).

[125] *Id.* at 315-318 (citing, *e.g.,* David Autor, *Why Are There Still So Many Jobs? The History and Future of Workplace Automation*, 29 J. ECON. PERSP. 3, 3-4 (2015) (discussing a variety of reasons why there are still jobs despite increasing improvements in automation)).

[126] *See* Melia Robinson, *This Robot-Powered Restaurant Could Put Fast Food Workers out of a Job*, BUS. INSIDER (June 30, 2016), https://www.businessinsider.com/momentum-machines-is-hiring-2016-6. *See also Food Robotics Feeding Latest Kitchen Automation Solutions*, NANALYZE (Dec. 12, 2019), https://www.nanalyze.com/2019/12/food-robotics-kitchen-automation/.

As I showed in prior work, a large number of the patents filed with the U.S. Patent & Trademark office look something like this. They are "labor-saving" in the sense of reducing the costs of achieving some output. Labor-saving patents include, to name just a few, patents on the cotton gin during the Industrial Revolution, patents on the automated teller machine in the 1980s, and patents on self-driving cars today.[127]

When seen in this light, it is hard to justify a policy of funding both innovation and job creation at the same time, let alone within the same program, with respect to the same applicants. A program that is ostensibly rewarding innovation, but that comes with job requirements, has real potential to distort investment away from true innovation, and to actually create incentives for companies to invest in labor-generating applications. A simple example illustrates this.

Imagine a small software company run by about five people that is developing new automation software that makes the workplace more productive. Assume the software company seeks financing from Ohio's "Innovation Loan Fund." If the software company succeeds, this would mean negative impacts for human workers, who would eventually be replaced by the software. In contrast, imagine that another applicant is a large manufacturing company deploying tried-and-true methods to manufacture steel in ways that require hundreds, potentially thousands, of humans to function. Given that the software company is deriving a way to mechanize tasks that would otherwise be done by people, a state like Ohio that is really worried about job creation should probably choose *not* to grant this software company an award. After all, Ohio's Innovation Loan Fund specifically requires a "commitment to create or retain jobs to the State of Ohio . . . ." The official would thus be forced to weigh the project's intellectual merit against its economic merit, and might well select the manufacturing company that promises to bring more jobs to the state of Ohio. This is so even if she knows the software company is the one doing the more groundbreaking research.

The famous quote by Milton Friedman comes to mind. The anecdote goes that, while visiting a worksite where a new canal was being built, Friedman was shocked to see that, instead of modern tractors and earth movers, the workers had shovels. He asked why there were so few machines. The government bureaucrat explained: "You don't understand. This is a jobs program." To which Milton replied: "Oh, I thought you were trying to build

---

[127] Hrdy, *IP and the End of Work*, *supra* note 29, at 334-335 (citing exemplary labor-saving patents).

a canal. If it's jobs you want, then you should give these workers spoons, not shovels."[128]

In a world where innovation incentives are actually jobs programs, companies would be given incentives direct investment away from job-displacing "shovels," and towards job-generating "spoons." At best, companies might be led to invest in highly innovative, job-generating technologies. For instance, imagine a company that is developing a new self-driving car that requires two humans to be sitting in the car in order to operate it. Maybe this is the type of innovation voters want: new technologies deliberately designed to be inefficient.[129] But I don't think this is what IP scholars are thinking about when they propose innovation prizes and the like.

IV. IS INTELLECTUAL PROPERTY ANY BETTER?

A final question is whether there is something structural about public financing, as opposed to intellectual property, that makes it vulnerable to the temptation to reward job creation. There are some reasons to think this is the case.

With IP rights, taxpayer money is not directly used to finance innovation. Instead, users themselves pay in the form of higher prices due to the existence of exclusive rights.[130] In addition, with IP, government plays very little role in deciding which innovations get support. The government merely reviews innovations (in the case of patents) for the criteria of novelty, nonobviousness, etcetera, without weighing the public benefits or harms of the technology in terms of metrics like employment.[131]

In their influential article, *Beyond The Patents-Prizes Debate*, Professor Lisa Ouellette and Professor Daniel Hemel crystallize these points into a

---

[128] Stephen Moore, *Missing Milton: Who Will Speak for Free Markets?*, WALL ST. J. (May 29, 2009), https://www.wsj.com/articles/SB124355131075164361. Thanks to T.J. Chiang for drawing this anecdote and quote to my attention.

[129] Notably, the result will be not dissimilar to the types of distortions we could see from a "robot tax." Companies might choose not to utilize robots instead of people in order to avoid the tax. *See, e.g.*, Ryan Abbott & Bret Bogenschneider, *Should Robots Pay Taxes? Tax Policy in the Age of Automation*, 12 HARV. L. & POL'Y REV. 145, 146–47 (2018)

[130] As Professor Suzanne Scotchmer explained, the innovations that are covered by IP rights, whether video games or pharma drugs, are ultimately financed directly by users of the innovation rather than general taxpayers. In contrast, innovation finance mechanisms like procurement and prizes draw on general taxpayer revenues to finance innovations that benefit some taxpayers but not others. SCOTCHMER, *supra*, at 38; *see also* Hemel & Ouellette, *supra* note 17, at 307-308.

[131] Hemel & Ouellette, *supra* note 17, at 307-308. *See also* Hrdy, *IP and the End of Work, supra* note 29, at 329-330 (comparing early version of patent utility doctrine with modern hands-off approach).

useful framework.[132] They observe that incentives for innovation differ on three dimensions. First, an incentive can be "market set," meaning companies decide which innovations to pursue and by how much, or "government set," where government decides what to award and how much to value it. Second, an incentive can be awarded *before* success, like a grant or a tax credit, or only *after* success is achieved, like a prize or a patent. Third, incentives differ in terms of who pays—general taxpayers or only the specific users or other direct beneficiaries of the innovation. The former we might call "everyone-pays"; the latter are "user-pays."[133]

The public financing mechanisms studied in this article are both government-set—with government officials responsible for choosing and valuing winners—and funded from general tax revenues. They are "everyone pays." These features seem to be precisely what makes these incentives vulnerable to the rent-seeking pressures discussed above.[134] If everyone in the jurisdiction is paying for the programs, government has to explain and justify the programs and particular funding decisions to taxpayers. Responding that government is "creating jobs," and pointing to specific recipients who are job generators, sounds really good. We see it when government finances stadiums; so why shouldn't we see it when government finances innovation?

In contrast, with IP rights, users are paying for exactly what they want; and market actors, not government actors, are deciding what types of innovations to supply. It just isn't necessary to justify every patent given out; and government has little control over what types of inventions go forward.

To make this concrete, take my situation. I am a taxpaying resident of Akron, Ohio, who pays the taxes that support the Innovation Ohio Loan Fund. I certainly care what government does with my tax money. "Job creation," especially in a region like Akron, sounds like a meaningful, public-facing goal, worthy of public support. But I don't have to be convinced that the public will benefit from every patented invention. (This is fortunate, since many of them are silly.) Instead, if I want a patented product, I just pay more for it, assuming I can afford it, and only if I want it.

---

[132] Hemel & Ouellette, *supra* note 17, at 307-308.

[133] *Id.*

[134] Nicholson Prize observes that a similar critique is often leveled at research grants, generally. *See* Price, *supra* note 16, at 13 (noting that a common critique of grants is that "leaving funding decisions in the hands of bureaucrats may result in cronyism, favoritism, and political pressure shaping the process of grant funding and scientific progress.").

This logic supports the conclusion that IP might be shielded from some of the pressures that otherwise hound government officials charged with spending public money.

That said, we should not be led into a nirvana fallacy. It isn't clear that IP law itself is really immune to the impulse of legislators to reward job creation, simply by virtue of the fact that it utilizes a user-pays and market-set mechanism.[135] I am just not sure it is. A quick review of the legislative history surrounding recent amendments to two of the major federal intellectual property regimes — patents and trade secrets — shows that legislators talk about job creation when they grant IP rights too.

The message from the federal legislators who passed patent reform in 2011 is that patents create jobs. In a representative quote, Senator Leahy stated to his colleagues that strengthening the patent system would, among other things, "create jobs ...."[136] The Obama White House made similar assertions that reforming the patent system would "help grow our economy and create good jobs."[137]

The public got a similar message in 2016 from the federal legislators who passed a new federal trade secret law. According to the Senate Report, "[b]y improving trade secret protection, the Defend Trade Secrets Act of 2016 [would] incentivize future innovation while protecting and encouraging the creation of American jobs."[138] Likewise, the House Report stated that a federal trade secret law would "equip companies with the additional tools they need to protect their proprietary information, to preserve and increase jobs and promote growth in the United States ..."[139]

Meanwhile, the U.S. Patent & Trademark Office (USPTO) has issued multiple reports asserting that "IP-intensive industries," those with more patents, copyrights, and trademarks for their size, create more jobs than other industries; and that wages in IP-intensive industries are forty-seven percent higher.[140]

---

[135] Hemel & Ouellette, *supra* note 17, at 345-350.

[136] Statement by Senator Leahy, March 8, 2011, 3 Patent Reform A Legislative History of the America Invents Act (William H. Manz ed., 2012).

[137] Administration of Barack Obama, 2011, Statement on Senate Passage of Patent Reform Legislation, March 8, 2011, 2 Patent Reform: A Legislative History of the Leahy-Smith America Invents Act (William H. Manz, ed.) 1 (2012).

[138] *See* S. REP. 114-220, S. REP. NO. 220, 114th Cong., March 7, 2016, at *3. "This same report found that trade secret theft has led to the loss of 2.1 million American jobs each year and that the illegal theft of intellectual property is undermining the means and incentive for entrepreneurs to innovate." *Id.* at *2.

[139] *See also* H.R. REP. NO. 114-529.

[140] *See* Hrdy, *IP and the End of Work, supra* note 29, at 306 (discussing INTELLECTUAL PROPERTY AND THE U.S. ECONOMY: 2016 UPDATE, (ECONOMICS & STATISTICS ADMINISTRATION/U.S. PATENT AND TRADEMARK OFFICE), 2016..

These words could be empty padding, just the type of rhetoric that inevitably accompanies any piece of legislation. But I think these words matter. They suggest that, when government creates incentives, whether through money or through exclusive rights, it tries at some level to give the people what it thinks the people want, and that goal affects how reward programs are structured. One of the things people want is jobs. But the reality is that the goals of innovation and jobs are clearly in tension, and at worst are simply incompatible. Whether the two should really be discussed together, as if they were best friends, is an open question that should be seriously examined.

CONCLUSION

Can public finance be used to support innovation, perhaps even in lieu of intellectual property laws like patents? Some have suggested the answer is yes.[141] But analysis of the public financing currently offered by U.S. state governments offers a note of caution. Despite their titles, many of these so-called "innovation" incentives have little to do with promoting novelty or inventiveness, and come with relatively stringent job creation requirements attached to them.

Why is this happening? One hypothesis is that states, as opposed to the national government, can't internalize the benefits of new ideas, so seek localized benefits to justify their expenditures.[142] But the answer may not just be localism. At least some federal innovation incentives also show a tendency to reward job creation versus true innovation. Instead, the more likely culprit is rent-seeking. On the demand side, companies seek rents in the form of business subsidies; on the supply side, pandering politicians supply them, but attach job creation requirements to make them more politically palatable.[143] While it's theoretically possible for innovation incentives to achieve both goals—innovation and jobs at the same time—there appears to be an inherent conflict here. Innovation and jobs have historically been seen as inimical to one another. Many famous inventions in the patent record, from steamboats to self-service kiosks, have been associated with some level of technological unemployment.[144]

---

[141] *See supra* notes 11-20.

[142] For this argument, *see* Camilla Hrdy, *Patent Nationally, Innovate Locally*, 31 BERKELEY TECH. L. J. 1301 (2017).

[143] *See* STEARNS ET AL., *supra* note 37, at 656-660.

[144] Hrdy, *IP and the End of Work, supra* note 29, at 334-335. I call this "technological un/employment," to emphasize the job creation, as well as the job loss, that can come with a new technology. *Id.* at 309-310.

The lesson is two-fold. For state policymakers, the lesson is that they should probably be quite wary about conflating innovation and job creation goals when designing incentives. At least, they should consider more transparency for taxpayers and greater candor in communicating their goals: be honest about the fact that these are (at best) jobs programs, instead of hiding behind labels like "Innovation Voucher," "Innovation Accelerator," "Innovation Incentive Program, or "Proof of Concept Fund."

For IP scholars, the lesson is that they should be mindful of the political realities in which a given incentives program is designed, and its impacts for innovation policy. This is true both for non-IP incentives and also perhaps with respect to IP itself. We tend to assume IP law is more resilient to rent-seeking for a variety of reasons—in particular because, with IP, innovation is not directly funded by general taxpayers.[145] Yet it is not clear there is anything truly special about the mechanism of exclusive rights that immunizes politicians from the impulse to reward short-term goals and tout the job creation potential of government programs.[146] IP scholars have hardly ignored political incentives and rent-seeking that shape IP systems. For instance, Dan Burk and Mark Lemley's book on patents argued that the U.S. Patent Office has been captured by hard-lobbying industry groups who urge stronger patent rights, and that this affects the scope of those rights.[147] It could be a good idea to consider more broadly how other political pressures, in particular the goal of job creation, shape IP systems as well.

---

[145] *See* Part IV.

[146] *Cf. Intellectual Property and the U.S. Economy: 2016 Update* (ECONOMICS & STATISTICS ADMINISTRATION/U.S. PATENT AND TRADEMARK OFFICE), 2016.

[147] DAN BURK & MARK LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT (2011). *See also, e.g.*, Landes & Posner, *supra*, at 408-409 (discussing lobbying for stronger patent and copyright terms).

APPENDIX

State	Program Name	Provider	Policy Objective	Job Creation Considered (Y/N)	Details of Job Creation Criteria	Website
Alabama	Innovation Fund	Alabama Department of Commerce	To "maximize the use of the State's economic development resources by leveraging annual research and development expenditures by public institutions of higher education to generate high technology resources which can be used to support economic development activities."	Y	Projects applying to the Research Program for funding are reviewed for several criteria including, "Possibility of future job creation" and "Positive contribution to State's economy."	http://alepscor.org/alabama-innovation-fund/ Program discontinued. Details on file with the author.
Alaska	Emerging Energy Technology Fund Grant Program	Alaska Energy Authority	To "promote the expansion of energy sources commercially available to Alaskans."	None indicated	"Projects can either: test emerging energy technologies or methods of conserving energy; improve an existing technology; or deploy an existing technology that has not previously been demonstrated in the state. EETF grants must be for demonstration projects of technologies that have a reasonable expectation of becoming commercially viable within five years. Energy technology can include technologies related to renewable sources of energy, conservation of energy, enabling	http://www.ak-ea.org/Portals/0/Programs/Grants%20and%20Loans/EEFT/EETFFactSheetApr2019.pdf?ver=2019-06-19-134404-843 http://www.ak-ea.org/Portals/0/Programs/Grants%20and%20Loans/EEFT/EETFProjectUpdatesFeb2016.pdf?ver=2019-06-21-112636-297

					technologies, efficient and effective use of hydrocarbons and integrated systems."	
Arizona	Arizona Innovation Accelerator Fund (AIAF)	Arizona Commerce Authority	"The goal of this program is to stimulate financing of small businesses and manufacturers, while fostering business expansion and job creation in the state of Arizona."	Y	Eligibility includes "potential to create or retain employment opportunities for Arizonans."	http://www.azcommerce.com/programs/arizona-innovation-accelerator-fund http://www.azcommerce.com/media/392619/AICFundProgram.pdf On file with author.
Arkansas	Technology Development Program	Arkansas Economic Development Commission/ Science & Technology Authority	"To assist in commercializing new technology-based products and processes through technology development activities."	Y	Application criteria include "job creation potential"	https://www.arkansasedc.com/docs/default-source/s-t/tdp_rules08.pdf?sfvrsn=f30f323f_2
California	Energy Innovations Small Grant Program	California Energy Commission	"The Energy Innovations Small Grant (EISG) Program provides up to $150,000 for hardware projects and $75,000 for modeling projects to small businesses, non-profits, individuals and academic institutions to conduct research that establishes the feasibility of new, innovative energy concepts."	N	No job creation goal or eligibility criteria indicated	https://energyarchive.ca.gov/research/innovations/

Colorado	Advanced Industries Accelerator Programs	Colorado Office of Economic Development and International Trade	"To support job creation and innovation…in one of Colorado's seven advanced industries," such as Advanced manufacturing, Aerospace, and Bioscience.	Maybe	Program goal includes to "support job creation"	https://chooseecolorado.com/doing-business/incentives-financing/advanced-industries/
Connecticut	Connecticut Bioscience Innovation Fund (CBIF)	Connecticut Innovations	To "speed commercializable bioscience breakthroughs to market."	Y	Application requires answering the question, "As a result of Bioscience funding, how many anticipated future jobs will this project create, and over what timescale?"	https://ctinnovations.com/obtain-funding/venture-solutions/connecticut-bioscience-innovation-fund/ ; http://ctinnovations.com/wp-content/uploads/2017/05/Revised-Bioscience-Fund-Academic-Full-App-v3.9-FINAL.docx

Delaware	Delaware Technical Innovation Program (DTIP)	Delaware Economic Development Office	To support "business research through funding transition grants that will bring innovative new products, jobs and revenue to Delaware."	Y, probably	For each grant, the Office collects records on Jobs to be created; Total jobs to be created and maintained	https://business.delaware.gov/wp-content/uploads/sites/118/2017/09/FY16CDF-Summary-Report-14Oct16.pdf
District of Columbia	District of Columbia Innovation Finance Program	Department of Insurance, Securities and Banking	To "assist small businesses and entrepreneurs who were adversely affected by the economic recession of 2008 and the credit crisis that followed."	Y, probably	Enhanced Investment available if certain economic development goals are met, e.g. business "hiring targets residents and [the] hard to hire."	https://disb.dc.gov/page/dc-bizcap-innovation-finance-program
Florida	Innovation Incentive Program	Florida Department of Economic Opportunity	"To ensure that sufficient resources are available to allow the state to respond expeditiously to extraordinary economic opportunities and to compete effectively for high-value research and development, innovation business, and alternative and renewal energy projects."	Y	Application must include: "The number of net new full-time equivalent jobs in this state the applicant anticipates having created as of December 31 of each year in the project and the average annual wage of such jobs."; "The total number of full-time equivalent employees currently employed by the applicant in this state, if applicable." ; There is also a (waivable) minimum wage requirement for the jobs: "The jobs created by the project must	http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0200-0299/0288/Sections/0288.1089.html

					pay an estimated annual average wage equaling at least 130 percent of the average private sector wage."	
Illinois	Invest Illinois Venture Fund	Illinois Department of Commerce and Economic Opportunity	To, for example, "[a]ccelerate the commercialization of research discoveries and growth of start-up companies in Illinois" and "[c]reate sustainable high-paying jobs"	Y	"Supports early stage companies which hold promise for job creation"	http://www.libertyville.com/DocumentCenter/View/12560/Invest-Illinois-Venture-Fund
Iowa	Iowa Innovation Acceleration Fund	Iowa Economic Development Authority	"[P]romotes formation and growth of businesses that engage in the transfer of technology to [facilitate] competitive, profitable companies that create high-paying jobs."	N	None indicated	https://www.iowaeconomicdevelopment.com/Entrepreneurial/SSBCIInnovation
Kentucky	High-Tech Pool Funding Resources	Kentucky Economic Development Finance Authority (KEDFA)	"To build and promote technology-driven and research-intensive industries by recruiting and retaining high-tech companies that produce jobs, new products and services, and develop new and improved processes."	Y	"In order to participate in this program, a company must create a minimum of seven new, high-tech full-time;(Kentucky resident);jobs within three years and maintain those positions for three additional years."	http://thinkkentucky.com/kyedc/pdfs/KBIFactSheet.pdf?21
Maine	Seed Grants	Maine Technology Institute	To "support entrepreneurs/companies who are engaging in Research and Development activities leading to commercialization or follow-on funding."	Y	Projects are assessed for "creation or retention of jobs"; awardees must have "definitive plans to create and/or retain quality jobs in Maine."	https://www.mainetechnology.org/wp-content/uploads/2015/05/Seed-Grant-Application-Instructions-rev-APR-2018.pdf

Maryland	Seed Investment Fund	Maryland Technology Development Corporation (TEDCO)	To "support certain types of Maryland companies in their effort to develop and commercialize new technology-based products"; to "increase the companies' valuation and lead to follow-on investment, sustainability, and job creation."	Y	The funded company must have "the potential to grow the Maryland economy and create jobs."	https://www.tedcomd.com/funding/seed-fund This program was discontinued. The prior eligibility criteria are on file with the author.
Massachusetts	InnovateMass	Massachusetts Clean Energy Center (MassCEC)	Purpose is to "accelerat[e] the success of clean energy technologies, companies and projects in the Commonwealth—while creating high-quality jobs and long-term economic growth for the people of Massachusetts."	Y, probably	Evaluation criteria include: "Demonstration of meaningful economic development impacts to the Commonwealth resulting from successful completion of the proposed project." A primary goal of MassCEC is "creating high-quality jobs and long-term economic growth for the people of Massachusetts."	http://www.masscec.com/innovatemass http://files.masscec.com/2%20-%20InnovateMass%20VI-b%20RFP.PDF
Michigan	Michigan Emerging Technologies Fund	Michigan Small Business Development Center (MI-SBDC)	"To encourage companies to pursue SBIR/STTR grants and contracts, increase Michigan's competitiveness in obtaining SBIR/STTR funds, increase commercial success of Michigan SBIR/STTR projects, and stimulate early stage technology investing activity in Michigan."	Y	ETF Award Recipients must provide yearly reports describing, among other things, the "number of jobs created" and the "number of jobs retained"	https://www.mietf.org/#/content/etf-guidelines
Minnesota	Innovation Voucher Award Program	Minnesota Department of	To "to help businesses purchase technical assistance and services	None required	Eligibility criteria state that "the business is not	https://mn.gov/deed/newscenter/social

		Employment and Economic Development	from Minnesota-based public higher education institutions and non-profit entities to assist in the development or commercialization of innovative new products and services."		required to have any employees"	-media/deed-developments/?id=1045-348705 This program was discontinued. The prior eligibility criteria are on file with the author.
Missouri	Missouri IDEA (Innovation, Development, and Entrepreneurship Advancement) Funds	Missouri Department of Economic Development	To "promote the formation and growth of businesses that engage in the transfer of science and technology into job creation."	Y	The High-Tech Industrial Expansion Fund (one of four IDEA programs) "supports industrial expansion efforts in Missouri that result in significant capital investment and high-paying jobs in its targeted biotech and high-tech clusters with an emphasis on those that leverage Missouri's rich agricultural history."	https://ded.mo.gov/financial-professional-services/incentives-financing/loans http://www.missouritechnology.com/docs/idea-funds/idea-one-pager.pdf?sfvrsn=2
Montana	Montana Board of Research and Commercialization Technology Trust Fund (MBRCT)	Montana Department of Commerce	To encourage "economic development through investment in research projects that" have "a clear path to commercialization."	None indicated	N/A	http://marketmt.com/MBRCT
Nebraska	Nebraska Research and Development (R&D) Grant	Nebraska Department of Economic Development	Offers "Nebraska businesses a matching competitive grant for research and development activities done in conjunction with a Nebraska college or university." Research	None indicated	N/A	https://opportunity.nebraska.gov/program/nebraska-academic-research-and-development-grant/

			"should be directed toward," inter alia, "[c]ommercialization of new projects" and "Improvement of existing processes that may provide a new source of revenue to Nebraska businesses."			https://opportunity.nebraska.gov/wp-content/uploads/2017/05/NEDED-Academic-RD-Grant-Guidelines.pdf
Nevada		Nevada Governor's Office of Economic Development (GOED); and Battle Born Ventures	Battle Born Ventures "cannot invest in Startups based outside of Nevada, or operating in industries outside of the target ones listed above, for instance, neither a Californian firm nor a retail store would fit our mandate." Battle Born Ventures, moreover, prioritizes "companies whose high-growth products and services have an enduring sustainable advantage over competitors, that have traction with customers, and that have teams with a proven track record in their industry."	None indicated; but there is an implicit requirement of job creation.	To the extent that Battle Born Ventures doesn't invest in companies based outside of Nevada, there is an implicit requirement of job creation or, at a minimum, job retention in Nevada.	http://www.diversifynevada.com/programs/technology-commercialization/
New Hampshire	Granite State Technology Innovation Grant	New Hampshire Innovation Research Center	To "support innovations through industry and university collaborations, thereby increasing the number of quality jobs in the state."	Y	Criteria for selecting projects includes answering "Will this project:" "Create jobs?"	http://www.nhirc.unh.edu http://www.nhirc.unh.edu/succes-criteria.html

New Jersey	Edison Innovation Fund	New Jersey Economic Development Authority	"The Edison Innovation Fund seeks to develop, sustain, and grow technology and life sciences businesses that will lead to well-paying job opportunities for New Jersey residents."	Y	Requirements for obtaining funding through an Edison Innovation Fund program includes: "Company must employ 75% of its W-2 employees in New Jersey or commit to growing 10 high-paying jobs over two years (minimum salary of $75k)."	https://www.njeda.com/technology_lifesciences/edison-innovation-fund; https://www.njeda.com/financing_incentives/technology_lifesciences/edison_innovation_fund/Edison-Innovation-VC-Growth-Fund-(1)
New Mexico	Innovation Vouchers	Technology Research Collaborative and the New Mexico Economic Development Department	"[T]o enable early stage science and technology companies to overcome business development barriers."	None indicated	N/A	https://gonm.biz/business-development/edd-programs-for-business/office-of-science-technology/new-mexico-innovation-voucher https://gonm.biz/uploads/documents/programs/Innovation_Voucher_Nov2018.pdf
New York	Matching Grants Leverage Program	Empire State Development's Division of Science,	"[T]o attract more federal R&D funding to support technology development	Y	Application requires applicant for grant to "Describe any potential economic	https://esd.ny.gov/doing-business-ny/innovatio

		Technology, and Innovation (NYSTAR)	and commercialization efforts in New York State."		impacts or opportunities this project may lead to (for example: anticipated jobs created/retained (both academic and private industry) ... Provide both short term (less than five years) and long term (up to 10 years) impacts especially if the project is in the early stages of development)…"	n-development-support https://esd.ny.gov/matching-grants-leverage-program https://esd.ny.gov/sites/default/files/MatchingFundsApplicationFormE.PDF
North Carolina	One North Carolina Small Business Program	North Carolina Department of Commerce, Office of Science, Technology, and Innovation	"[H]elps small businesses develop and commercialize innovative technologies to benefit the general population. In the process, it helps high-tech businesses attract more funding to the state—keeping home-grown technologies in North Carolina and creating more well-paying jobs."	None indicated, though a goal is to foster job creation	A stated purpose is to "foster job creation and economic development in North Carolina by increasing the competitive position of North Carolina small businesses in attracting SBIR and STTR grant funding . . ."	https://www.nccommerce.com/grants-incentives/technology-funds/one-north-carolina-small-business-program https://files.nc.gov/nccommerce/documents/NC-Science--Technology Grants-Management-Documents/SciTech/Solicitations/ONCSBP_Match_Solicitation_FY2019.pdf

North Dakota	ND Small Business Technology Investment Program	North Dakota Department of Commerce	"The Development Fund offers a number of flexible financing options for new or expanding primary sector businesses in North Dakota." ND Small Business Technology Investment Program lends to any start-up primary sector business in technology field	N, job creation is explicitly not considered	"Keeping pace with rapid changes in the technology arena and integrating those advances benefits all North Dakotans. North Dakota's IT industry contributes significantly to the state's overall growth and economic strength."	https://www.business.nd.gov/development_fund/NDDFPrograms/#NDDF https://www.business.nd.gov/development_fund/ https://www.business.nd.gov/technology/
Ohio	Innovation Ohio Loan Fund	Ohio Development Services Agency	"[P]romotes assistance to existing Ohio companies in developing next generation products and services within certain Targeted Industry Sectors"	Y	"[R]equires a commitment to create or retain jobs to the State of Ohio through the IOF Loan program." While there is not a specified dollar per job ratio, the number of jobs committed, as well as the annual payroll will be considered when determining the funding amount.	https://jobsohio.com/why-ohio/incentives/state-loan-and-grant-programs/innovation-ohio-loan-fund/ https://development.ohio.gov/files/otf/IOF%20Guidelines.pdf
Oklahoma	Accelerate Oklahoma! Fund	i2E; Oklahoma Center for the Advancement of Science and Technology (OCAST)	"[G]rowing innovative small businesses in Oklahoma and making a positive impact on the state's economy." "[T]o create more high paying jobs in Oklahoma while diversifying our economy."	Y	"The Accelerate Oklahoma! Program is designed to: invest in innovative startup companies that promise sustained revenue and increased employment."	https://i2e.org/about-i2e/; https://i2e.org/access-to-capital/
Pennsylvania	Keystone Innovation	Pennsylvania Department	Innovation Grants are to be used for the following	Y	"All grant recipients will be required to	https://dced.pa.gov/down

	Zone Innovation Grant Program	of Community and Economic Development	purposes: [t]o provide seed capital in the form of grants or loans for faculty and students to perform proof of concept efforts including business plan analysis, marketing analysis, prototyping, patent research and filing, intellectual property, licensing and royalty agreements and other uses to be approved by DCED upon request…" and "To provide seed capital in the forms of grants or loans for Keystone Innovation Zone companies that are licensing/ transferring technology from a Pennsylvania IHE, academic medical center and non-profit research institution."		provide semi-annual reports quantifying the progress toward accomplishing approved deliverables . . . The report template will include Innovation Grant impacts in the following areas… [including] Increased Employment . . . ."	load/innovationgrantguidelines-year-2009-archived-2/?wpdmdl=56043
Rhode Island	Innovation Voucher	Rhode Island Commerce Corporation	"Grants can be applied to: 1. support for commercialization of a new product, process, or service 2. access to scientific, engineering, and design expertise 3. scale-to-market development of your innovative idea"	Y	Rules and Regulations for the Innovation Voucher Program (870-RICR-20-00-4), 4.9C, state that a factor to be considered in in determining whether to award a voucher is the "potential for the Innovation Project to result in the creation of new full-time jobs[.]"	https://commerceri.com/innovation-incentives/ ; https://rules.sos.ri.gov/regulations/part/870-20-00-4
South Dakota	Proof of Concept Fund	South Dakota Governor's Office of Economic Development	Provides "up to $25,000 investments for eligible applicants to conduct research demonstrating the technical and economic feasibility of an innovation significantly enhancing the	Y	Application requires applicant to "Clearly identify the economic impact on South Dakota's economy in terms of job creation, partnerships with	https://sdreadytowork.com/about-us/public-records/proof-of-concept-fund/

			likelihood of commercialization of the innovation."		existing SD firms, etc."	https://sdreadytowork.com/wp-content/uploads/2019/06/South-Dakota-Proof-of-Concept-Application-2019.pdf
Utah	Technology Commercialization and Innovation Program (TCIP)	Utah Governor's Office of Economic Development	To "catalyze and enhance growth of technologies by encouraging interdisciplinary research activity and targeted areas, facilitating the transition of technologies out of the higher education to enhance job creation, and to support the commercialization of technologies developed by small businesses to enhance job creation."	Y	Assessment of job creation potential is mandated by statute: "In considering each proposal, the office shall weigh technical merit, the level of matching funds from private and federal sources, and the potential for job creation and economic development." Criteria for funding includes assessment of, *inter alia*, "Does the company's product, service, and market have a strong connection to leveraging the talent, industry, and other resources (the "cluster") within the state of Utah such that there is a strong probability that the company can grow in Utah, create jobs here, and stay here over the long haul?", "Is the sales model and technology scalable	https://business.utah.gov/tcip/ https://business.utah.gov/wp-content/uploads/2018/01/TCIP-Application-Review-Guidelines-FINAL-September-2016.pdf

					such that it could create rapid job creation in the state of Utah?" and "Why [sic] types of jobs are being created? Are they high-quality and high-paying jobs of the type we would like to create in Utah?"	
Vermont	ThinkVermont Innovation Grant Program	Vermont Department of Economic Development	"The ThinkVermont Innovation Grant Program is designed to fund projects in areas that have been identified as crucial to the growth needs of Vermont's small businesses."	Y	Areas that have been identified for funding include, among others, projects to "[p]rovide workforce training and recruitment [and to] [e]stablish or enhance a facility (co-working, makerspace, innovations center, etc.) . . . ."	https://www.thinkvermont.com/2018/10/25/innovation-grant-program/

ARTICLE

REGULATION AS PARTNERSHIP

JUSTIN (GUS) HURWITZ†

This article uses recent literature on Public-Private Partnerships (P3s) to argue that "Regulation as Partnership" is often a more productive approach to regulation than the more common adversarial and transactional approaches common to the contemporary regulatory environment. Partnerships, in which public entities engage the private sector to serve some government purpose (often to construct infrastructure) in exchange to some ownership interest derived from that purpose, have become popular since the 1980s. They are most often thought of as an alternative vehicle for financing public projects. But they primarily operate (and are most effective when) by aligning the incentives between the public and private project participants. This alignment of incentives stands in stark contrast to the often adversarial and transactional approach to much regulation – with regulation of the tech sector highlighted as an example in this article.

† Associate Professor of Law, Director of the Nebraska Governance and Technology Center, Co-Director of the Space, Cyber, & Telecom Law Program, University of Nebraska; Director of Law & Economics Programming, International Center for Law & Economics. This paper benefited from input from participants at the 2020 Journal of Law & Innovation Symposium on "Rethinking Innovation Policy: The Role of the State" and input and participants at and financial support from the 2019 Center for the Study of the Administrative State Roundtable on "Should Internet Platform Companies be Regulated?" Particular thanks to Justin McCully and Jackson Slechta for research assistance. J.D., University of Chicago Law School (2007); M.A. Economic, George Mason University (2010), B.A. St. John's College (2003).

INTRODUCTION

The story of regulation over the course of the 20th century, and continuing through today, can be understood as one of oscillation between two competing poles: primary reliance on market-based forces and primary reliance on prescriptive regulatory oversight. Neither of these approaches to regulation, especially in dynamic or fast-moving industries, has proven to be an entirely satisfactory approach to facilitating the growth of socially important industries while maximizing the social benefits of those industries. This article uses the growth of a different mechanism for coordinating control of private enterprise that has grown in prominence in recent decades – the Public-Private Partnership (P3) – as a lens to examine these traditional modalities of regulation.

We see the traditional modalities of regulation play out in the broad legal-political arc of the 20th century, from the *Lochner* era to the new deal, to post-war stagnation and growth of the regulatory state, to the deregulatory push that ushered Carter out of office and Reagan into office, to the dot-com boom-then-bust and the great recession. We see this in the arc of antitrust

and industrial organization, from the origins of public interest regulation in *Munn v. Illinois* through *Nebbia v. New York*, and from the original, literal, anti-trust antitrust act to rise of antitrust law's rule of reason, through the embrace of the Structure-Conduct-Performance paradigm and its rejection in favor of the consumer welfare standard, to contemporary discussions across the world arguing for a more regulatory antitrust policy. And we see this in more overtly regulatory contexts. Telecommunications regulation, for instance, went back and forth from the primacy of market-based principles in prior to the 1913 Kingsbury Commitment, to command-and-control regulation following World War I, to reliance on antitrust in the government's 1956 suit against AT&T, to regulation during the *Computer Inquiries* and through the introduction of microwave-based long-distance, to antitrust with the 1984 break-up of AT&T, to regulation designed to fade into competition in the 1996 Telecom Act, to the net neutrality debates of the past decade-plus.

More recently, governments have occasionally embraced a new regulatory paradigm: the public-private partnership (P3). P3s have been embraced in a variety of contexts, and generally involve a governmental entity contracting with private industry to co-provide a service or amenity more traditionally provided by the government. There are several models of P3s, along with several explanatory theories for them – but they generally involve some transfer of risk from the government to the private entity paired with some promise of long-term benefit for the private entity. For instance, in the 1980s HUD used P3s to encourage the development of urban housing by awarding management of housing projects to the companies contracted to build them. Over the course of the 1990s, P3s grew exponentially in popularity in both the United States and globally, with governments turning to private industry to capitalize and build all sorts of infrastructure projects in exchange for ongoing operating rights. And more recently, P3s are an important part of the cybersecurity toolkit – where governments lack the resources to secure their network infrastructure so partner with private industry to provide secured infrastructure, typically in exchange for long-term service contracts of some form of liability protection.

Public-private partnerships initially developed organically, largely as an evolution of more traditional government contracting and procurement needs. They were not designed as a form of regulation. But as they have grown in use and sophistication, P3s have developed their own governance practices and norms – they are a form of regulation.

The story of AT&T and government regulation of the telephone industry invoked above presents a curious example of the at-times partnership-like nature of regulation. The history of AT&T is checkered with collaborations

– both implicit and explicit – with its regulators. It was instrumental to the war effort during World War II, and its researchers and leadership moved frequently between high-level government and corporate positions. And many of the company's excesses and failures were tolerated so long as it kept regulators and the public satisfied that it was providing an overall satisfactory service to the communities it served. In both examples, it was tacitly understood that the fate of the company was intertwined with the fate of the country and, so long as its operation was beneficial to its regulatory overseers, those regulators would focus their attentions on maintaining the relationship over managing the affairs of the company.

In other words, throughout much of the 20th century the telephone network was operated as public-private partnership of sorts – albeit an implicit one with undefined terms governing the relationship. AT&T presents a possibly extreme example – but once you start looking for elements of partnership in the history of regulation examples abound. This paper considers the lessons that can be learned from governments' recent embrace of the P3 model and what insights from that model can be translated to how we think about regulation more generally.

This question isn't of merely historical importance. Regulators have experimented with various types of more cooperative, partnership-like, regulation in recent decades. In the environmental setting, for instance, the EPA experimented with "negotiated rulemaking" in the 1980s and 1990s, where industry and regulators collaborate on the drafting of regulations. Over the past decade, cybersecurity regulation has widely embraced public-private partnership models. And there is discussion of more collaborative forms of regulation in other areas, such as the regulation of online platforms and online speech. Lessons from experience with P3s yields valuable insights as regulators explore increasingly collaborative regulatory modalities.

In an abstract sense this article is about theories of regulation – whether regulation is necessarily adversarial or whether it can be thought of in more collaborative terms, in terms of partnership between regulators and those they regulate.

But this paper is really about how we regulate the technology industry, and how that industry approaches its regulators. It is prompted by the observation that regulation of AT&T over the course of the 20th century – in many ways a paradigm of, and precursor to today's, technology firms – had many characteristics of a partnership between AT&T and the government. To be sure, AT&T was no paragon of corporate virtue and its history is a case study in traditional modalities of regulation. At the same time, AT&T was an incredibly important firm that made great contributions to our nation –

and often did so in collaboration with regulators and with the public interest in mind.

This stands in stark contrast to regulation of today's technology industry. The relationship is fraught on both sides. Regulators approach the industry adversarially, and the industry approaches regulation transactionally. The industry has no sense of corporate "noblesse oblige" – no sense of duty to the public interest; and regulators view the industry's private interests not merely as not aligned with, but actively antagonistic to, those of the public interests.

The purpose of this article, therefore, is to explore the nature of regulation as partnership. It is not to put forth any groundbreaking new theory of regulation or to make contributions to the literature on public-private partnerships. The literature on P3s is developing rapidly and the field presents many open questions. There is, for instance, no consensus definition of what constitutes a P3. This paper will present a working definition and draw from existing literature to explore the characteristics of P3s. But to the extent that that literature leaves questions unsatisfactorily resolved, it is not the purpose of this paper to improve upon that status quo.

This paper proceeds in four parts. Part I discusses the traditional understanding and characteristics of regulation, focusing as regulation, in general, as a way of the government exerting control over private conduct and exploring different permutations of how this control may manifest. Part II introduces the public-private partnership model. This discussion considers the origins of the concept, examples of P3s, and the theoretical underpinnings of the partnership model. Part III focuses on the differences between regulation and partnership. And Part IV synthesizes the previous parts to consider regulation as partnership.

I. TRADITIONAL MODELS OF REGULATION

The *sine qua non* of regulation – at least, or perhaps especially, in the American tradition – is government power over private conduct, typically justified as being in the public interest. This power may manifest in many forms and is often characterized in various dichotomies: ex ante vs. ex post, adjudication vs. rulemaking, judicial vs. administrative enforcement, standards vs. rules, and in certain contexts antitrust vs. "regulation." The essential difference across each of these dichotomies is that the former allows private conduct in the first instance and relies on some form of limiting or corrective legal action after the fact where that conduct is deemed to be problematic; whereas the latter is inherently prescriptive, specifying in more concrete terms the expectations or limitations on private conduct.

A. *The Example of AT&T*

The history of telecommunications regulation in the United States is remarkably illustrative of each of these dichotomies. This history, and the government's regulation of and relationship with AT&T in particular, is used throughout this article as a framing example. Indeed, it is arguably the motivating example animating this article: although it is often thought of in terms of traditional regulation, the government's oversight of and relationship with AT&T during the 20th century had many of the characteristics of partnership. For instance, while the government largely specified the services that AT&T was required to offer, it largely left design, implementation, and operation of those services to AT&T's discretion. This is similar to the contemporary paradigm example of a P3, discussed in sections II.A.1 and III.B2, in which the design and operation of infrastructure projects are "bundled." Perhaps even more dramatically, senior AT&T leadership had longstanding and ongoing relationships with government, industry, and academia. This "skin in the game" on both sides od the public/private divide aligned the firm's and regulators' incentives in ways that that are both central to the purpose of the P3 model,[1] and that overcome the adversarial/transactional mindset that characterized much of the current regulatory landscape.[2]

Starting with Theodore Vail's ascent to control AT&T in 1907, the company began a string of acquisitions and competitor relationships in support of his vision of "one system, one policy, universal service" – that is, a unified telephone network that operated the same across all operators and allowed customers on any one network to call customers on any other network.[3] This coordination across the industry led to an antitrust investigation that culminated in a settlement with the government in 1913, the Kingsbury Commitment.[4] This settlement specified the range of

---

[1] *See infra* section II.B.2 and II.B.3.

[2] *See infra* section III.B.

[3] *See, e.g.*, Tim Wu, *How Theodore Vail Built the AT&T Monopoly*, SLATE (Nov. 7, 2010), https://slate.com/technology/2010/11/how-theodore-vail-built-the-at-t-monopoly.html; *see also* Adam D. Thierer, *Unnatural Monopoly: Critical Moments in the Development of the Bell System Monopoly*, 14 CATO J. 267, 272 (1994), https://www.cato.org/sites/cato.org/files/serials/files/cato-journal/1994/11/cj14n2-6.pdf; Kevin Granville & Tiffany Hsu, *AT&T Has Had Many Run-Ins With the Government*, N.Y. TIMES (June 12, 2018), https://www.nytimes.com/2018/06/12/business/dealbook/att-antitrust.html.

[4] *See* Letter from N.C. Kingsbury, Vice President, American Telephone and Telegraphy Company, to James C. McReynolds, Attorney General, United States of America (Dec. 19, 1913), available at http://vcxc.org/documents/KC1.pdf.

agreements that AT&T was allowed to enter into with its competitors – and thus began the era of telephone regulation in the United States. Over the next 40 years we saw the rise of the Interstate Commerce Commission (ICC) and then the Federal Communications Commission (FCC) as the government controllers of the regulated telephone monopoly, created by Congress with near plenary power to regulate the telephone industry.[5]

But these regulations were unable to keep apace of innovation in the industry. In the 1950s the Department of Justice began a second major antitrust investigation against AT&T, which culminated in another settlement in 1956.[6] And thus began another decadal period of regulation, during which the FCC struggled to prescribe the rules governing how AT&T could (or could not) enter into the newly-developing computer market and how new entrants into the telecommunications field could interconnect their new devices and networks with AT&T's regulated network. This again gave way to another Department of Justice antitrust investigation – the investigation that led to the 1984 break-up of AT&T.[7]

This ping-pong between ex post, standards-based, judicially defined, antitrust enforcement and ex ante, rule-based, agency defined, administrative action – a ping-pong match to which we shall return – continues today: through the advent of cable television and the introduction of the 1976 Copyright Act[8] and multiple Cable Acts,[9] through the revolutionary 1996 Telecommunications Act,[10] and through the development of the modern Internet and fights over net neutrality.[11] And this pong-pong captures the full range of the regulatory spectrum.

On both sides of this spectrum we see the exercise of government power. Where government power is the defining characteristic of regulation, enforcement is its characteristic instrumentality. The relationship between private actors and government regulators under any permutation of regulatory structure is akin to that between prosecutor and defendant. The role of the regulator is to constrain the conduct of the private actor. And the role of the private actor, on the other hand, is to structure its conduct within the constraints defined by, or in some cases to structure its conduct to circumnavigate the limitations imposed by, the regulatory authority. This is

---

[5] Thierer, *supra* note 3, at 271-280.

[6] Granville et al., *supra* note 3.

[7] *Id.*

[8] 17 U.S.C. § 107.

[9] *See, e.g.*, 49 USC § 609 (1984); 47 CFR §§76.905; 913; 921; 922 (1997).

[10] 47 USC § 609 (1996).

[11] In the Matter of Protecting and Promoting the Open Internet, 14-28 F.C.C. 15-24 (Fed. Comm'n Commission Feb. 26, 2015), available at https://www.fcc.gov/document/fcc-releases-open-internet-order.

a fundamentally adversarial relationship, and, as with many parts of the American tradition, it is an exceptionally legalistic one.

B. *Theories of Regulation*

Regulation – what it is and why it is used – can be a contentious topic. At its broadest, "regulation" means the control of one thing by another. In the legal context, this control is accomplished by some governmental body constraining private conduct through any number of means. But before considering the "how" of regulation it is necessary to consider the "why."

1. The Public Interest

The focus of law and regulation is often divided into private- and public-facing institutions.[12] Private law institutions focus on constraining bad conduct by, and facilitating desired interactions between, private actors. This is the role, for instance, of tort, contract, and property law.[13] Public law institutions, on the other hand, focus on socially-desirable activities that individuals cannot undertake – for whatever reason – on their own.[14] Such activities include the provision of public goods, such as national defense and public safety. Public goods generally will not be provided by individual actors due to free riding concerns: there is no way to exclude others from using them once they have been provisioned, which prevents any individual actor from recovering the costs of provisioning the good. As a result public goods are underprovisioned by private actors in society (compared to the socially-desired levels).[15] It is therefore only through a coordinating mechanism such as the government that public goods can be provisioned.

Public goods fall more broadly into the category of government activity characterized by market failure: conduct that individuals would engage in through ordinary market activities in an efficient market (so is known to be socially desirable) but for the existence of some obstacle. Government often intervenes in – regulates – private conduct in the face of market failure, with the ostensible purpose of overcoming or removing that obstacle in order to

---

[12] John C.P. Goldberg, *Introduction: Pragmatism and Private Law*, 125 HARV. L. REV. 1640, 1640 (2012).

[13] *Id.*

[14] *Id.* (defining "public law" as it stands in contrast to private law). The focus of public law as falling upon socially-desirable activities – that is, the public interest – is discussed in the section below.

[15] *See, e.g.*, Tyler Cowen, *Public Goods*, LIBR. OF ECON. AND LIBERTY (last accessed Feb. 17, 2020), https://www.econlib.org/library/Enc/PublicGoods.html.

bring about a more socially desirable outcome. The market failure justification for regulation, however, almost always runs headlong into a question: how does the government know why individuals are not engaging in a given activity that the government believes to be socially desirable? Is it because there is some market failure preventing the activity; or is it because the government is mistaken in the belief that the activity is, in fact, socially desirable?[16]

As a legal matter, the answer to this question – or, at least, to the question of when the state can regulate for the purported purpose of promoting socially-desirable outcomes – in US law is rooted in *Munn v. Illinois* (1876).[17] In *Munn*, the state of Illinois had regulated the prices that grain elevators could charge for the storage of grain. Having been found guilty of charging rates in excess of the maximum regulated rate, Munn, the owner of grain warehouses and elevators, challenged the Illinois law as a taking and violation of Constitutional Due Process.[18] The Supreme Court upheld the Illinois statute, explaining "when private property is 'affected with a public interest, it ceases to be *juris privati* only.'"[19] The court continued, explaining that "Property does become clothed with a public interest when used in a manner to make it of public consequence, and affect the community at large. When, therefore, one devotes his property to a use in which the public has an interest, he, in effect, grants to the public an interest in that use, and must submit to be controlled by the public for the common good . . . ."[20]

The approach of *Munn* proved unsatisfactory, giving rise to decades of uncertainty about what it meant for private property to be "used in a manner to make it of public consequence."[21] This approach certainly doesn't follow the market failure justification articulated above – it is potentially significantly broader than it.

This conundrum was resolved nearly 60 years later in *Nebbia v. New York* (1934).[22] In 1933, during the Great Depression era, New York enacted a law that set minimum prices for milk. Nebbia violated this law, selling milk at a price less than this regulated minimum.[23] As in *Munn*, Nebbia was charged

---

[16] This was a central question asked by Ronald Coase in his classic paper, *The Problem of Social Cost*. *See* Ronald Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 28-42 (1960) (critiquing the Pigovian tradition in economics).

[17] Munn v. Illinois, 94 U.S. 113, 113 (1876).

[18] *Id.* at 123.

[19] *Id.* at 126.

[20] *Id.*

[21] *Id.*

[22] Nebbia v. People of State of New York, 291 U.S. 502 (1934).

[23] *Id.* at 515.

with violating the price-regulation law and challenged it up to the Supreme Court. After lengthy discussion about the meaning of "affected with the public interest," the Court states plainly that "[t]hus, understood, 'affected with a public interest' is the equivalent of 'subject to the exercise of the police power'; and it is plain that nothing more was intended by the expression."[24] It continues that "[s]o far as the requirement of due process is concerned, and in the absence of other constitutional restriction, a state is free to adopt whatever economic policy may reasonably be deemed to promote public welfare...."[25]

Under *Nebbia*, which remains good law today, the state is effectively free to pass whatever regulation it determines to be in the public interest – and regulation is, effectively, in the public interest by virtue of the state deeming it worthy of regulation. *Munn* and *Nebbia* both deal with the narrower case of price regulation, but are generally understood as finding the "public interest," as demonstrated by the government's determination that regulation is necessary, is sufficient to demonstrate that regulation is, in fact, necessary. Unless that regulation runs afoul of narrow Constitutional protections – such as the First Amendment or a violation of the Takings or Due Process clauses – such regulations are evaluated under the most forgiving standard of review.

This (legal) answer to the question of "why regulate" seemingly differs from the economic and political answer to the question. It is predicated on the government's desire (or expressed need) to regulate, not on the demonstration of a market failure. An alternative framing is that it gives deference to the government to answer the question asked above, whether individual actors aren't engaging in given activity because there is a market failure instead of because it is not, in fact, socially desirable.

2. Rulemaking vs. Adjudication

In the canonical account, once the government decides to regulate it can proceed in one of two forms: through legislative-style rulemaking or judicial-style adjudication.[26] This basic dichotomy applies across regulatory modalities: it is seen in federal, state, and administrative regulation.

The essential difference between rulemaking and adjudicatory approaches to regulation is timing: rulemaking is an ex ante, legislative, approach to regulation, focusing on defining rules to govern future conduct, whereas adjudication is ex post, focusing retrospectively on past conduct. This basic

---

[24] *Id.* at 533.

[25] *Id.* at 537.

[26] *Cf.* SEC v. Chenery Corporation, 332 U.S. 194 (1947) ("Chenery II"); SEC v. Chenery Corporation, 318 U.S. 80 (1943) ("Chenery I").

distinction between regulation and adjudication has been generally recognized. And it is enshrined as a fixture of modern administrative law, which defines the actions of agencies in its terms.

Importantly both modes of rulemaking allow for the development of regulation, albeit in different ways. Rulemaking is clearly a form of regulation: legislatures or agencies imbued by legislatures with rulemaking authority enact rules that govern the conduct of private parties. Nominally, adjudication is not merely a mechanism for enforcing rules already in existence – one would be forgiving for thinking that it is only a mechanism for implementing existing regulations, and not itself a means of regulation. But in practice adjudication is itself a form of regulation: all rules inherently contain ambiguities, and adjudication allows for the ex post shaping of rules, or the application of existing rules to novel circumstances.

There is, however, an important difference between adjudication and rulemaking – one that echoes the limitations of the state's ability to regulate in the name of the "public interest," discussed above: due process. Due process requirements limit the scope of both rulemaking and adjudication. Rules cannot be issued arbitrarily; they must be issued by some formal legislative process that gives them legitimacy.[27] And rules generally cannot have retrospective effect.[28] It violates principles of due process for the state to hold parties liable for conduct that was only prohibited after the time of the conduct.[29] Adjudication is also bound by the constraints of due process, albeit in different ways. Adjudication is inherently backwards-looking, so frequently considers past conduct that was not clearly prohibited. The general standard for conduct is whether parties had fair notice that it might run afoul of existing law.[30] This is an inherently nebulous standard – but in a common-law system such as ours, in which judges are asked to adjudicate inherently ambiguous laws, it is a necessary accommodation to the administration of justice. While it does potentially encumber the strictest interpretations of

---

[27] *See* Bi-Metallic Inv. Co. v. St. Board of Equalization, 239 U.S. 441 (1915) and Londoner v. City and County of Denver, 210 U.S. 373 (1908). These two cases, generally discussed together, generally define the contours of the government's need to comply with the due process requirement of the 14th Amendment when engaged in individualized adjudications and the reliance on the legislative process ("the proper state machinery") when engaged in legislative activity. *See also,* 5 U.S.C. 706(2)(A) ("The reviewing court shall . . . hold unlawful and set aside agency action, findings, and conclusions found to be . . . arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law . . . .").

[28] U.S. Constitution Art. I, § 10, cl. 1. ("No State shall . . . pass any . . . ex post facto Law . . . ."); Bowen v. Georgetown University Hospital, 488 U.S. 204, 223–24 (1988) ("Retroactive legislation has always been looked upon with disfavor . . . . [W]here quasi-legislative action is required, an agency cannot act with retroactive effect without some special congressional authorization").

[29] Id.

[30] *See* FCC v. Fox TV Stations, 132 S. Ct. 2307, 2317 (2012) ("A fundamental principle in our legal system is that laws which regulate persons or entities must give fair notice of conduct that is forbidden or required.").

due process, potentially imposing liability upon parties for conduct that was not clearly prohibited, it also imposes meaningful limitations on the state, channeling prospective regulation through legislative-style rulemaking processes. (Importantly, one of the checks on adjudicative regulation is the nature of remedies: generally, the greater the liability imposed for violation of regulations, the greater the process is due to establish the regulation.)

3. Public Interest vs. Public Choice

The account of regulation presented above – that it is generally justified by market failure, that it is undertaken in the "public interest," and that it is implemented through rulemaking and adjudication – was the dominant account through much of the 20th century. In the 1971 economist George Stigler offered a fundamentally different account of regulation: regulation was provided in response to market forces, subject to supply and demand, just as any other good in a market economy.[31] Under Stigler's theory of regulation, legislatures adopt rules in response to the private incentives of individual legislators. Under this theory the "public interest" model was replaced with a market model in which legislators sell policy in exchange for various forms of support from political constituencies. Legislators were, in effect, producers, selling regulations into the market. On the other side of the market were parties buying regulations – these parties may be firms, lobbying for firms through campaign contributions, fellow legislators, offering support for one legislator's regulations in exchange for support for their own proposals, or voters, offering their votes in exchange for preferred legislation.

Stigler's theory defined the contours of subsequent decades' debates over the nature of regulation. His theory articulated a private interest understanding of regulation that stood in apposition, and opposition, to the widely accepted public interest understanding.

There are various species of theory that fall under each branch of this dichotomous family. The Stiglerian private interest model, for instance, may include the "capture" theory of regulation, as well as being characteristic of schools of public choice economics and political economy.[32] On the other hand, every government is premised on the idea that government is possible – that regulation doesn't necessarily devolve to governance by market forces

---

[31] George Stigler, *The Theory of Economic Regulation*, BELL J. OF ECON. & MGMT. SCIENCE, v.2, no.1, 3, 3 (1971) ("[A]s a rule, regulation is acquired by the industry and is designed and operated primarily for its benefit.").

[32] *See, e.g.*, William F. Shughart II, *Public Choice*, LIBR. OF ECON. AND LIBERTY (last accessed Feb. 17, 2020), https://www.econlib.org/library/Enc/PublicChoice.html ("Because the vote motive provides reelection-seeking politicians with strong incentives to respond to the demands of small, well-organized groups, representative democracy frequently leads to a tyranny of the minority.").

but instead serves, through some mechanism, the polity. This mechanism may, for instance, be the public-mindedness of the actors that create and enforce regulation, truly acting in the spirit of the public interest; or it could be the result of governing institutions that insulate the "public interest" from private interest, creating a space in which forces of the public interest dominate over private interests; or it could be a mechanism of political accountability in which the polity exercises more direct power over government actors than private interests have the opportunity to.

Legal, economic, and political theorists have debated these and other theories of the control that public and private interests have over regulation for decades. This paper need not resolve these debates, however. What is important is to recognize that there are, broadly, two ways of conceptualizing the interests served by regulation: public and private interests. Regulation is widely assumed to serve the public's interest; but in many cases its mechanisms can be coopted to serve private interests. These interests are often at tension – especially where regulation is used to constrain private interests.

Partnership between public and private interests present a different way to manage these tensions. In some cases, P3s may prove more resilient to the concerns of public choice economics about the role of private interests in regulation. On the other hand, P3s may by subject to more trenchant or different forms of influence by private interests. These concerns are taken up further in Part III.

4. Governing the Commons

Nobel prize–winning economist Elinor Ostrom posited another resolution to market failures, which is worth noting briefly here. Based on her observations of how communities actually resolved common market failures – in her case, free-riding or over-consumption of public goods (in her vernacular, common pool resources) – she took exception to the standard formulation of market-based and regulation-based solutions. Rather, she argued, under suitable conditions local communities (that is, the users of the common pool resource) would develop governance institutions suitable to the characteristics of the resource. Such governance systems are more prescriptively regulatory than pure market-based mechanisms, but are informal compared to, and do not necessarily rely on, governmental regulatory mechanisms. As explained by one Ostrom scholar:

> The major insight that Lin [Ostrom]'s work on common-pool resource management emphasized was the evolved rule systems that emerged in order to provide accountability and effective mechanisms of punishment for those

> who violate the rules. Community based rules and community engagement found ways around the conflict-ridden situation of the commons, just as beekeepers and apple growers found ways around the situation of the externality, to realize the possibility of mutually advantageous social cooperation. These local systems of self-governance to preserve and protect the common-pool resource, Lin found in a diversity of human societies, persisted through time—in some instances for a century, in other instances dating back as far a millennium. . . . This leads to the second major lesson from Lin's work—it is the 'rules in use' that matter for social cooperation, not so much the 'rules in form'. In examining systems of governance, we need to distinguish between 'rules in form' (on the books) and 'rules in use' (the lived practice of everyday life) . . . .[33]

Ostrom's approach to regulation challenges and blends the characteristics of the theories described above – and, by virtue of defying traditional categorizations tends to be both richer and more easily overlooked. For instance, it challenges the notion of market failure, arguing that communities facing market failures can often develop self-regulatory norms that address the effects of the failure, without need to address its underlying causes.[34] On the other hand, it also challenges the need for, and nature of, the regulator-designed "public interest" response, arguing that the informal self-regulatory mechanisms of the community (or, in her vernacular, the "rules in use") can be more important than the formal regulation and enforcement mechanisms employed by the government (the "rules in form").[35] In a very real sense, her key argument is that communities self-govern, and this self-government is both more powerful and more effective than either market-based or capital-

---

[33] Peter J. Boettke, *Is the Only Form of 'Reasonable Regulation' Self Regulation?: Lessons from Lin Ostrom on Regulating the Commons and Cultivating Citizens*, 143 PUB. CHOICE 283, 288-9 (2010).

[34] This, for instance, is a central theme of Ostrom's GOVERNING THE COMMONS, which challenges the traditional binary of government regulation (the "Leviathan") and free-market privatization as the only solutions to collective action problems (a defining example of market failure), and argues for self-governance solutions to collective action problems such as seen with common pool resources. *See* ELINOR OSTROM, GOVERNING THE COMMONS 14 (Cambridge 1990) ("I argue that both [the central authority and parcelization approaches] are too sweeping in their claims. . . . Institutions are rarely either private or public – 'the market' or 'the state.' Many successful [common pool resource] institutions are rich mixture. of 'private-like' and 'public-like' institutions defying classification in a sterile dichotomy.").

[35] See Elinor Ostrom, Prize Lecture at The Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, IN 47408, and Center for the Study of Institutional Diversity, Arizona State University, Tempe, AZ, U.S.A.: Beyond Markets and States: Polycentric Governance of Complex Economic Systems (Dec. 8, 2009), https://www.nobelprize.org/uploads/2018/06/ostrom_lecture.pdf (discussing various examples where in which government regulation is assumed to be necessary to address market failures but in which self-regulatory, community governance solutions outperform government regulation).

G Government regulation. This represents a true "public private partnership" – more poignantly, "public" interests under this model are a manifestation of private interests. Among other things, this suggests a fundamentally different understanding of, and approach to, the concerns of the most common theories of "public choice." Under Ostrom's approach, the story of public choice is one of a mis-match between the design of public institutions as tools to address private concerns – as opposed to more commonly used accounts of private interests capturing public officials or public officials being individuals whose public decisions are governed by their own private interests.[36]

II. THE PARTNERSHIP MODEL

Public-private partnerships are of more recent vintage than more traditional regulatory structures.[37] Modern P3s find their origins in complex government development projects – projects where the completion of government undertakings depended significantly upon private industry. In the 1960s and 1970s, many of these projects had an air of industrial policy, with the government directing (or channeling) private resources to mass-scale government infrastructure or development initiatives. Starting in the 1980s, these partnerships began to take a more routinized, and smaller scale, structure. Urban housing, and related urban development, projects, for instance were increasingly undertaken as P3s. In these projects, the government would fund, and help to facilitate, the development of new housing projects; then those projects would be turned over to the private partners to administer day-to-day operations (including earning market-rate profits – as opposed, for instance, to regulated rates of return).

One important theme in the literature on P3s is that the term "public-private partnership" is used to describe a wide range of relationships between public and private entities, from arrangements that are little more than well-specified procurement contracts to far more ambitious initiatives. That said, P3s do have several common features, even if they have no universally

---

[36] Elinor Ostrom & Vincent Ostrom, *The Quest for Meaning in Public Choice*, 63 AM. J. ECON. & SOC. 105 (2004). Note discussion that Elinor Ostrom, in fact, served a term as the president of the Public Choice society. While her understanding of the field differs from its more common manifestations, her views were far from heterodox.

[37] The modern study of, and scale in the use of, P3s is of relatively recent vintage. It is undoubtedly the case that examples of P3s can be found throughout history. This article, however, need to delve into the history of P3s beyond recognizing the relatively recent vintage of attention to P3s as a form of governance.

accepted defining characteristics. Part II.A will describe examples of P3s to help orient the discussion.

Economists started studying P3s in earnest in the late 1990s, with key analytical works published around the turn of the century. Perhaps the defining work is Oliver Hart's analysis of them as a solution to the challenges of specifying contingency-complete procurement contracts for either the development or operation of infrastructure or similar projects.[38] One of the most common forms of P3 bundles the development and operation of a project, such that the entity contracted for its development has strong incentives to perform that part of its contract well in anticipation of having an ongoing obligation to operate and maintain the project.

This difference between P3s and traditional procurement contracts is the most defining feature of P3s: they attempt to align the incentives of the public and private parties, such that the contract takes on a more relational character than a transactional one. So long as both parties are committed to maintaining the value of that relationship, such contracts can be relied on as self-enforcing. If implemented correctly, this allows the parties to avoid the most complex parts of negotiating such contracts: specifying detailed contingencies, and monitoring and enforcing breaches of those requirements.

P3s have other notable characteristics or justifications. They are often discussed as a form of risk- and capital-pooling, where government and private actors come together, pooling resources, in a common enterprise. They are viewed as an efficient way to leverage comparative advantages of governmental and private actors in a single enterprise – relying, for instance, on private enterprise to structure capital, develop and implement innovative design, and manage the development process, but on government to implement compliance and regulatory obligations, scope the project to ensure it services necessary constituencies, and the like. And they are viewed as form of regulation, channeling private enterprise to serve public needs and to ensure ongoing democratic oversight of and satisfaction with ongoing provision of privately-managed services. Part II.B will dive more into the economic literature on P3s and consider the different economic explanations of them.

Part II.C will then describe the environments in which P3s succeed and contrast that to situations where they fail.

A. *Examples of P3s*

Public-private partnerships come in many forms and defy simply categorization of survey. It is useful, nonetheless, to consider some examples.

---

[38] *See* Part II.B, *infra*.

Two categories of examples are considered below: infrastructure projects and cybersecurity. Infrastructure projects are perhaps the most common form of P3. As discussed in Part II.B, they are also perhaps the most fraught, often sought out by public partners based on a misplaced belief that the P3 model offers a means to capitalize on greater efficiency or capabilities of private partners. Cybersecurity partnerships are of a different sort, often entered into out of necessity. Unlike infrastructure P3s, where public partners are capable of undertaking projects on their own but believe private partners have some greater ability to complete them efficiently, with cybersecurity public partners and private partners each approach the P3 because each lacks complementary capabilities that can only be provisioned by the other.

1. Infrastructure Projects as Public-Private Partnerships

The most talked-about examples in the literature of P3s are infrastructure projects. Transportation projects like toll roads have been popular around the United States.

For instance, the Texas Department of Transportation entered into a P3 with the LBJ Infrastructure Group in 2010 to construct the "IH 635 Managed Lanes Project," which was designed to "provide traffic congestion relief" on 13 miles of public highway.[39] The total investment in that project was $2.8B.[40] LBJ was given the contract to both design and build the roadway, as well as to operate and maintain it for 52 years.[41] In 2009, the Regional Transportation District of Denver, Colorado entered into a P3 agreement with Denver Transit Partners to design, build and operate the "Eagle Commuter Rail" project which would consolidate and extend a number of commuter rail lines.[42] Denver Transit Partners was given a 30 year commitment for operation of the completed project.[43]

Other infrastructure projects are undertaken as P3s, including in the areas of waste management, water provision, energy, broadband, government

---

[39] IH 635 MERGED LANES PROJECT MANAGEMENT PLAN, TEX. DEP'T OF TRANSP., 7 (2010), https://www.fhwa.dot.gov/majorprojects/pmp/pmp_ih365_lbj_txdot_1010.pdf.

[40] EDUARDO ENGLE ET AL., PUBLIC-PRIVATE PARTNERSHIPS TO REVAMP U.S. INFRASTRUCTURE, 11 (2011), http://www.informedcynic.com/P3/P3-reports/2011-partnerships-revamp-US-Infastructure.pdf#page=13.

[41] TEX. DEP'T OF TRANSP., *supra* note 39, at 5.

[42] *Background on the Eagle P3 Project,* FASTRACK REGIONAL TRANSPORTATION OF DENVER, http://www.rtd-fastracks.com/ep3_77 (last visited Apr. 29, 2020).

[43] *Id.*

buildings, and schools and universities.[44] Kentucky launched an ambitious statewide broadband construction P3 with Macquerie Capital in 2015.[45] The goal of that project is to construct a large middle-mile network that private companies and public bodies could use to connect to for last-mile Internet access.[46] Macquerie Capital was given the right to build and maintain the network for a period of 30 years.[47]

In 2015, Miami-Dade County announced its intention to enter into a P3 for the construction and operation of a biosolids waste processing plant.[48] The anticipated operation period will be 20 years.[49] Although it hasn't selected a partner for the project, as yet, Miami-Dade County intends to proceed with the project.[50] Formed in 2014,[51] Washington, D.C. has a dedicated Office of Public-Private Partnerships that looks for opportunities to expand public infrastructure with P3s.[52] Among other projects, Washington, D.C. has plans to engage or has already engaged P3s on modernizing public buildings,[53] updating the public street lights,[54] constructing public corrections facilities,[55] and building schools.[56]

---

[44] See, e.g., Engle et. al, *supra* note 40, at 11 (listing examples of private-public partnerships infrastructure projects across a variety of areas); PUBLIC-PRIVATE PARTNERSHIPS IN THE US: THE STATE OF THE MARKET AND THE ROAD AHEAD, PWC, 2 (2016), https://www.pwc.com/us/en/capital-projects-infrastructure/publications/assets/pwc-us-public-private-partnerships.pdf (providing examples of public-private partnership infrastructure projects beyond traditional toll roads).

[45] *Project Profile: KentuckyWired*, U.S. DEP'T. OF TRANSP. FED. HIGHWAY ADMIN., https://www.fhwa.dot.gov/ipd/project_profiles/ky_kentuckywired.aspx (last visted Apr. 29, 2020).

[46] *Id.*

[47] *Id.*

[48] MIAMI-DADE CTY. WATER & SEWER DEPT., MIAMI-DADE COUNTY WASD FACTS 1-2, 4 https://www.miamidade.gov/water/library/biosolids-processing-facility-project-fact-sheet.pdf (last visited April 29,2020).

[49] *Id.*

[50] Eric Singer, *National P3 Update: Water and Sewer Infrastructure*, BILZIN SUMBERG'S NEW MIAMI BLOG (June 18, 2019), https://www.newmiamiblog.com/2019/06/18/national-p3-update-water-and-sewer-infrastructure/.

[51] Public-Private Partnership Act of 2014, 62 D.C. Reg. 261 (Mar. 11, 2015)

[52] OFF. PUB.-PRIV. PARTNERSHIPS, https://op3.dc.gov (last visited April 29,2020).

[53] KATHRYN ROOS ET AL., D.C. OFFICE OF PUB.-PRIVATE P'SHIPS, DALY BUILDING MODERNIZATION PROJECT OVERVIEW, https://op3.dc.gov/sites/default/files/dc/sites/op3/publication/attachments/Daly%20Building%20Project%20Overview.pdf (last visited April 29,2020).

[54] *Project Profile: DC Smart Street Lighting*, OFF. PUB.-PRIV. PARTNERSHIPS, https://op3.dc.gov/node/1195519 (last visited April 29,2020).

[55] *Project Profile: Corrections Center*, OFF. PUB.-PRIV. PARTNERSHIPS https://op3.dc.gov/node/1195540 (last visited April 29, 2020).

[56] *Project Profile: Educational Facilities*, OFF. PUB.-PRIV. PARTNERSHIPS, https://op3.dc.gov/node/1197010 (last visited April 29,2020).

Long Beach, California launched the largest municipal P3 project in 2016: the construction of a six-block municipal center.[57] Montclair State University in New Jersey launched a P3 in 2011 to construct new housing for its students.[58] The University System of Georgia similarly launched a P3 process to build new student housing in 2018.[59] Alabama is underway in its plan to enter into a P3 for the construction of three new men's prisons in the state, using the private partner to finance and build the facilities, with the state subsequently leasing use of those facilities.[60]

Hospitals are frequently built using P3s as well. In the UK, the use of P3s to construct and operate hospitals for the National Health Service began in the 1990s (and was called "Private Finance Initiatives").[61] Canada also uses the P3 model for its hospital system. For example, the Brampton Civic Hospital in Ontario was begun under a P3 in 2003, with the contractual right to operate non-clinical services by the winning vendor for 28 years.[62]

2. Cybersecurity as a Public Private Partnership

Cybersecurity presents a different, but no less important, area where P3s can have good effect. As explained by Kristen Eichensehr, the United States has largely "backed into a de facto system of public-private cybersecurity."[63] Unlike with the case of discrete infrastructure projects, where public partners have sought out partnerships with private institutions in order to develop projects, the cybersecurity partnership "has accreted over time." This

---

[57] April Economides, *The New Long Beach Civic Center*, LONG BEACH BUS. J. (July 31, 2019), https://www.lbbusinessjournal.com/the-new-long-beach-civic-center/

[58] N.J. ASS'N OF STATE COLLEGES & UNIVS., PUBLIC-PRIVATE PARTNERSHIPS AT THE STATE COLLEGES AND UNIVERSITIES 1 (2015), http://www.njascu.org/SCU_Public_Private_Partnerships_61815.pdf.

[59] *University System of Georgia Seeks Proposals to Expand P3 Student Housing Program*, U. SYS. GA. (Apr. 20, 2018), https://www.usg.edu/news/release/university_system_of_georgia_seeks_proposals_to_expand_p3_student_housing_p/.

[60] Mike Cason, *5 Companies Tell Alabama They Can Finance, Build, Lease Prisons*, ADVANCE LOCAL (Aug. 26, 2019), https://www.al.com/news/2019/08/5-companies-tell-alabama-they-can-finance-build-lease-prisons.html.

[61] The track record of the Private Finance Initiatives has been criticized. *See*, Youssef El-Gingihy, *The Great PFI heist: The Real Story of How Britain's Economy has Been Left High and Dry By a Doomed Economic Philosophy*, THE INDEPENDENT (Feb. 17, 2018), https://www.independent.co.uk/news/long_reads/pfi-banks-barclays-hsbc-rbs-tony-blair-gordon-brown-carillion-capita-financial-crash-a8202661.html.

[62] David Barrows et al., *Public-private Partnerships in Canadian Health Care: A Case Study of the Brampton Civic Hospital*, 12 O.E.C.D. J. BUDGETING 1, 5 (2012), https://www.oecd.org/gov/budgeting/PPP%20Canadian%20healthcare.pdf.

[63] Kristen Eichensehr, *Public-Private Cybersecurity*, 95 TEX. L. REV. 467, 470 (2017) (internal quotations omitted).

accretion has resulted largely from the facts that the majority of our "cyber" infrastructure, including that used by public entities, is privately owned and operated – but that defending it against cybersecurity threats often requires the scale and tools only available to public entities. Over the past decades loose systems of information sharing and for coordinated action have developed to facilitate joint public-private cybersecurity activities that benefit both the public and private sectors.

Most of the important information systems exposed to cyberthreats are owned by private firms. Exposure to legal liability and an interest in service customer demand (including the demand not to put customers at risk) provides strong incentives for private firms to mitigate risk as best they can. Nonetheless, obtaining the necessary intelligence to effectively combat cyberthreats is difficult for any one firm acting alone. Consortia exist that track bugs and exploits, but their reach into particular incidents are limited by an affected firm's own disclosures. Law enforcement and government agencies are better positioned to understand when and where incidents occur, and to obtain useful information from affected systems. The roles of public officials and private firms is, therefore, likely to be mutually beneficial.

The federal government has long involved private firms in cybersecurity P3s in the form of "Information Sharing and Analysis Centers" ("ISAC").[64] The first such ISAC, the Financial Services ISAC, began in 1999, and "leverages its intelligence platform, resiliency resources and a trusted peer-to-peer network of experts to anticipate, mitigate and respond to cyberthreats."[65] In 2015, President Obama signed Executive Order 13691, which declared that

> Organizations engaged in the sharing of information related to cybersecurity risks and incidents play an invaluable role in the collective cybersecurity of the United States. The purpose of this order is to encourage the voluntary formation of such organizations, to establish mechanisms to continually improve the capabilities and functions of these organizations, and to better allow these organizations to partner with the Federal Government on a voluntary basis.[66]

---

[64] Megan Brown, *Cyber Imperative: Preserve and Strengthen Public-Private Partnerships*, NATIONAL SECURITY INSTITUTE (2018), http://nationalsecurity.gmu.edu/wp-content/uploads/2018/10/Cyber-Imperative-Final-Web.pdf.

[65] REDUCING CYBER-RISK IN THE GLOBAL FINANCIAL SYSTEM, FINANCIAL SERVICES INFORMATION SHARING AND ANALYSIS CENTER (FS-ISAC) (last visited Apr. 18, 2020), https://www.fsisac.com/what-we-do.

[66] Promoting Private Sector Cybersecurity Information Sharing, Exec. Order No. 13691, 3 C.F.R. 13691 (2015), https://obamawhitehouse.archives.gov/the-press-office/2015/02/13/executive-order-promoting-private-sector-cybersecurity-information-shari.

Under the ISAC model, state and federal government play coordinating roles to support and offer guidance to the private entities that operate networks or are otherwise on the "front lines" of cybersecurity activity. Network operators or those affected by cybersecurity incidents share information about, or request help from, public authorities. In some cases, such as in the context of criminal or nation-state activity, public authorities may take the lead in responding to incidents. In other cases, public authorities may collect information and analyze from affected parties and use that to help coordinate a private response to the incident. This approach is beneficial to both public and private partners. Most of the network infrastructure is owned and operated by hundreds or thousands of private companies. Because it does not control the networks, and, indeed, lacks the resources and capabilities to operate them even if they were publicly owned;, the government necessarily relies on private industry to secure these systems and take immediate responses to any incidents. On the other hand, responding to these incidents, and sometimes even just recognizing that they are occurring, requires visibility across the network infrastructure. No one private operator has such visibility, so coordination that can only be accomplished at a governmental scale is necessary, and is beneficial to the private partners.

Currently, all 50 states have a Chief Information Security Officer responsible for ensuring that government information is kept secure.[67] Some states leverage this office to interface with private industry of security and other IT-related topics. Michigan's CISP, for example, uses a "kitchen cabinet" of IT advisors to receive input on, among other topics, "ways to defend critical information, coordinate access and identity management, and embrace new and emerging technologies."[68]

This approach to partnership is different from that seen with infrastructure projects. In the cybersecurity context, the partners offer complementary capabilities, each bringing capabilities to the partnership that the other lacks – and, critically, having shared goals for the partnership. In the case of infrastructure projects, at least one of the parties (typically the government) is attempting to substitute its partner's capabilities for its own – the government *could* (and in fact often does) build and operate toll roads, schools, prisons, or hospitals on its own, but in some cases believes (for

---

[67] NATIONAL CONFERENCE OF STATE LEGISLATURES, STATEWIDE CHIEF INFORMATION SECURITY OFFICERS (Jan. 15, 2020) (last visited Apr. 18, 2020), https://www.ncsl.org/research/telecommunications-and-information-technology/state-statutes-creating-chief-information-security-officer-ciso-positions-in-state-government.aspx.

[68] Society for Information Management, *Why the Michigan CIO Teamed up with Local Tech Leaders on Infrastructure Policy*, MEDIUM (Mar. 8, 2017), https://medium.com/@SIMInt/why-the-michigan-cio-teamed-up-with-local-tech-leaders-on-infrastructure-policy-f8d46357eea4.

reasons discussed immediately below) that it will be advantageous to engage a partner in the development of operations of such projects.

B. *Theories of P3s*

As introduced above, the literature on P3s has focused a great deal on cost savings, efficiency, finance, and risk assignment. However, the literature has grown to include more robust economic explanations. Below in this section, each theory is surveyed.

1. Efficiency and Comparative Advantage

The most common benefits touted in the trade literature and by policymakers of P3 projects have to do with cost savings, efficiency, superior financing, and risk assignment.[69] However, it isn't clear why fundraising or risk assignment explain why government chooses to use P3s rather than traditional procurement or building its own capability. For instance, economist Oliver Hart calls this thinking "strange," explaining that that "it is hard to imagine an agent that is more able to borrow or to provide insurance than the government (with its enormous powers of taxation)."[70]

The explanation offered in the trade literature for this "strange" circumstance, that P3s would provide cost savings compared to the government undertaking projects directly, is comparative advantage. The argument is that the private sector is often better than the public sector at delivering on infrastructure projects at lower cost because it is incentivized by the need for profit, unlike the public sector. There are also incentives to deliver higher quality in order to win future contracts with government as well. On top of that, the private sector may have superior technical know-how and ability to take advantage of dispersed, tacit knowledge than a centralized authority.[71]

But, as Hart notes, a private company subject to the need for profit could also cut corners and deliver lower quality to keep costs down. Consider his example of prisons, which are sometimes operated directly by the

---

[69] Juan Rodriguez, *Public-Private Partnership Pros and Cons*, THE BALANCE SMALL BUSINESS (Aug. 27, 2019), https://www.thebalancesmb.com/public-private-partnership-pros-and-cons-844713; Peter Smet, *The Key Advantages of Using Public-Private Partnerships for Major US Infrastructure Projects*, REASON FOUNDATION (Aug. 12, 2019), https://reason.org/commentary/the-key-advantages-of-using-public-private-partnerships-for-major-us-infrastructure-projects/.

[70] Oliver Hart, *Incomplete Contracts and Public Ownership: Remarks, and an Application to Public-Private Partnerships*, ECON. J., Mar. 2003, at C69, C75.

[71] *See* F. A. Hayek, *The Use of Knowledge in Society*, ECON. J., Sept. 1945, at 519, 521 ("[S]o far as scientific knowledge is concerned, a body of suitably chosen experts may be in the best position to command all the best knowledge available . . . . ").

government and sometimes by private industry in partnership with the government:

> (1) The government can own a facility, a prison, say, and employ a manager to run it; or (2) the government can contract with a company owned by the prison manager to run the prison for a period of time . . . . [S]uppose that the prison manager can make two kinds of investment. He can invest in efficiency-enhancing ideas that raise the quality of prison services, e.g., develop new rehabilitation programmes; he can also spend time figuring out how to cut costs and quality, while staying within the letter of the contract. A government employee has little incentive to engage in either activity since it is easy for the government (as owner) to 'hold up' the employee without rewarding him appropriately. In contrast, a private prison owner-manager is less subject to hold up. The good news about this is that private ownership encourages the first, innovative type of investment. The bad news is that private ownership also encourages the second, quality-shading kind of investment. The choice between public and private ownership depends on which of these effects is more important.[72]

The example of cybersecurity described above may fit the comparative advantage explanation best. The dispersed knowledge of cyber-threats is much more likely to be known by private companies. Incentivizing the sharing of this information amongst affected industry and with proper authorities in order to protect consumers and citizens is to the benefit of society.

2. Incomplete Contracts and Agency Costs

Nobel prize-winning economist Oliver Hart identifies a better explanation for P3s: they serve to internalize costs of contractual performance between the parties, which can better align the incentives of the parties in cases where the terms of contractual performance cannot be well specified.[73] In his framing, they are a form of incomplete contracting.[74]

With complete contracts, the entire relationship between parties is specified, such that no discretion or autonomy between the parties remains. Thus, there would be no need for P3 projects as the government could just directly procure from the private sector and manage the projects themselves.

---

[72] Hart, *supra* note 70, at C71.

[73] *Id.*at C73 (explaining that the difference between the traditional and P3 contracting models is that, under the P3 model, the private counterparty internalizes certain costs of contract performance); C74 (explaining the circumstances where the P3 model is desirable).

[74] *See id.* at C72 ("In each case, the contract [between the government and the private entity] is assumed to be incomplete . . . . ").

In practice, however, no contract is complete. In incomplete contracts, the relationship isn't completely specified. Rather, each party retains autonomy over some portions of how it performs under the contract.

> The model suggests that the choice between PPPs and conventional provision turns on whether it is easier to write contracts on service provision than on building provision. . . . One of the (modest) benefits [of the model] is that it may shift attention from what seem to be secondary financing issues to what seems to be the central issue: (relative) contracting costs.[75]

As Hart explains, the choice of between a P3 (which he describes as bundling service with building) and "conventional provision" (described as unbundling) depends on relative contracting costs.[76] In his model, conventional contracting makes sense where the government can "well specif[y]" the terms on performance in a contract.[77] For instance, in his example of a contract for the construction and operation of a facility, a traditional procurement contracting model makes sense "if the quality of the building can be well specified, whereas the quality of the service [operating the services offered at the facility] cannot be."[78] But in the reverse case, where the quality of construction is difficult to specify, a partnership model may make sense.[79] The reason for this is that the private partner will need to operate the services post-construction, so will have an incentive to perform the construction in a matter that will facilitate the long-term operation of the facility.

Similarly, P3s can be used to reduce agency costs between the private participants and the government. This is effectively a variation on the incomplete contract perspective above. Agency costs arise when the interests of a principal, one who engages another to perform some service on their behalf, diverge from the interests of the agent, the person engaged to do a service.[80] Scholars have identified agency costs as including the monitoring expenditures by the principal (to make sure the agent is doing what he or she is supposed to), the bonding costs borne by the agent (limitations on agent

---

[75] *Id.* at C75.

[76] *Id.* at C74.

[77] *Id.*

[78] *Id.*

[79] *See id.* ("In contrast, PPP is good if . . . the quality of the building cannot be [well-specified.").

[80] *See* Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, 3 J. FIN. ECON. 305, 308 (1976) (defining agency costs as the sum of the residual loss "experienced by the principal due to this divergence" between his own interests and those of his agent's as well as the expenditures incurred by either party in order to minimize that loss).

agreed to as part of deal), and residual loss (the costs due to divergent interests even despite monitoring and bonding).

The agency problem arises as the private firms and the government may not always have aligned interests throughout the entirety of a project. As described above, private firms may wish to cut corners in order to hold down costs and maximize profits. Government agents may also have self-interest in being re-elected and can act opportunistically vis-à-vis private firms in refusing price flexibility, especially around elections. This has led some scholars to doubt whether P3s have actually solved agency problems in practice.[81]

The agency cost approach looks at the contracting process for P3s to efficiently allocate risks and responsibilities. As explained by Hart, a well-designed P3 aligns interests of the principal and agent by limiting the opportunities for moral hazard and adverse selection compared to regular procurement.[82]

3. Relational Contracting, Norms, and Self-Governance

Relational contracting has been explored by both legal and economic scholars. Legal scholar Ian Macniel pioneered an analysis of a subset of contracts not as discrete one-time events, but as relationships with built-in norms.[83] Scholars like Benjamin Klein have also studied relational contracts from an economic point of view, emphasizing the importance of reputation to participants in long-term incomplete contracts.[84] These two views diverge in important ways, but they share one important overlap in noticing that all exchanges are to some degree relational.[85]

---

[81] Florina Silaghi & Sudipto Sarkar, *Agency Problems in PPP Investment Problems* 2 (2018) (unpublished manuscript) (on file with Semantic Scholar), https://pdfs.semanticscholar.org/4d91/f97c30ac4b90c8cc00be1d8bdf634cdfaa6f.pdf (arguing that governments often mis-value P3 contracts and analyzing the optimal design of P3 contracts from within a real-options framework).

[82] See *supra*, note 73 (explaining that the P3 model allows principals to structure contracts so that their agents will internalize to costs of contractual performance).

[83] *See, e.g.*, Ian Macniel, *Relational Contract: What We Do and Do Not Know*, 78 WIS. L. REV. 483 (1985); Ian Macniel, *Values in Contract: Internal and External*, 78 NW. U. L. REV. 340 (1983).

[84] *See, e.g.*, Benjamin Klein & Kevin M. Murphy, *Vertical Integration as a Self-Enforcing Contractual Arrangement*, 87 AM. ECON. REV. 415 (1997); Benjamin Klein, *Transaction Cost Determinants of "Unfair" Contractual Arrangements*, 70 AM. ECON. REV. 356 (1980).

[85] Stefanos Mouzas & Keith Blois, *Relational Contract Theory: Confirmations and Contradictions*, 24 IMP CONF. 1, 2 (2008) https://www.impgroup.org/uploads/papers/6764.pdf (considering the ways in which understandings of relational contracts diverge in the P3 context and traditional economic contexts, and concluding that both "are, to some extent, relational.").

As Hart anticipated,[86] his model on incomplete contracts for P3s can be extended if the time limitation is removed. In a relational contract, norms that unite two parties over an extended period of time are very important for overcoming the agency problems identified above in an incomplete contract world.

> Relational norms refer to "behavioral expectations that are partially shared by a group of decision makers and directed toward collective or group goals." Relational norms include flexibility, information exchange, and solidarity. Flexibility is the notion that two parties are willing to make adaptations because of circumstances changing. Information exchange is the idea that two parties are willing to share useful information with each other. Solidarity refers to the idea that two parties are willing to maintain a bilateral relationship.[87]

These relational norms are especially important due to the long-term nature of P3 projects.[88]

One important characteristic of relational contracts is that they can be self-enforcing.[89] With such a contract, parties value the ongoing relationship created by the contract – or, less romantically, the expect stream of future benefits from ongoing performance of the contract – more than performance of any particular part of the contract itself. As such, parties are unlikely to breach the contract, even when it may be efficient for them to do so at any given point in time.[90]

This gives rise to another important characteristic of relational contracts. Because they are self-enforcing, they do not rely on any external enforcement

---

[86] *See*, Hart, *supra* note 70, at 75 ("Our model could be usefully extended in various ways. The model takes the length of contract as given - implicitly it is assumed that the world ends at date 2. As a result, it does not matter who owns the asset (prison) at the end of the contract. With more periods, both contract length and who owns the asset after the contract ends become interesting choice variables.")

[87] Xiaoan Zheng, Jingfeng Yuan, Jiyue Guo, Miroslaw J. Skibniewski & Sujun Zhao, *Influence of Relational Norms on User Interests in PPP Projects: Mediating Effect of Project Performance*, SUSTAINABILITY (June 2018), at 145, 148. https://www.mdpi.com/2071-1050/10/6/2027

[88] *Id.* at 149. (arguing that "[s]olidarity in the relational norms enables the public and private sectors to treasure the bilateral relationship and common interests rather than focusing on the maximization of self-interest.")

[89] *See*, Benjamin Klein, *The Role of Incomplete Contracts in Self-Enforcing Relationships*, 92 REVUE D'ECONOMIE INDUSTRIELLE 67, 68 (2000), *available at* https://www.persee.fr/doc/rei_0154-3229_2000_num_92_1_1037 (discussing the use of incomplete contracting terms to encourage self-enforcement by leveraging a transacting party's reputational capital).

[90] *Id.* at 76 (arguing parties to a contract have "reputational capital" that creates a "self-enforcing range" in which each party's "gain from non-performance remains less than the self-enforcing sanction that can be imposed.").

mechanism to ensure their ongoing performance. That is, they do not rely on the law – or even on the existence on a government to enforce that law – to ensure ongoing performance. Among other things, this is an example of the self-regulation or self-governance envisioned by Elinor Ostrom.[91]

III. REGULATION VS. PARTNERSHIP

Development of the partnership model for procurement over the past several decades raises the question of whether there is an analogous partnership model open to regulation – and, if so, whether such a model is desirable. This Part evaluates this model of regulation as partnership. It starts by arguing that regulation often is a form of partnership. It then asks the converse of the question, asking why regulation wouldn't be regulation. It then looks at the limitations of the regulation as partnership model and asks whether regulation should be viewed as partnership.

A. *Is Regulation Partnership?*

Part I presented a traditional understanding of regulation in which the government determines what conduct is in the public interest and uses its coercive powers to require private actors to comport their activity to the service of this interest. The story of regulation is, at times, more nuanced that this – in some cases it has a more partnership-like quality.

1. The Example of AT&T, Redux

Returning to the animating example of this paper, the regulatory history of AT&T during the 20th century was previously presented as an example of the dueling poles of market-based and more prescriptive approaches to regulation. That history, however, is more complicated. In many ways, the 20th century history of AT&T can also be understood as one of partnership with the federal government.

This partnership is best seen during the mid-century years surrounding the second world war and cold war. AT&T was instrumental to the both the hot and cold war efforts. AT&T's Bell Labs worked closely with academia and the defense industry to develop technologies essential for the war

[91] See *supra*, Part I.B.4.

effort.[92] AT&T was integral in the development of everything from radar, to the Internet, to satellite-based communications.[93] These, and many other, technologies were dual use, developed with as much mind to supporting government needs as to supporting AT&T's commercial mission. In return for this service to its government masters, AT&T was given great flexibility it how it conducted its business operations. This is perhaps most dramatically seen in the regulation of the prices it could charge consumers – the at-times lavish R&D costs associated with Bell Labs were generally treated as capital costs that were part of the base expenses that could be recovered with a guaranteed rate of return through its regulated prices.[94]

Another vantage through which we can see the partnership-like relationship is the seamless transition of senior AT&T leaders – again particularly through Bell Labs – between the company, government, and academia.

It is difficult to generalize the history of AT&T to other industries, companies, or contexts. The economic, technological, and political settings of the era gave rise to relatively unique institutional dynamics in which the lines between national defense establishment, industrial interest, and large parts of the academy were often blurred. The era gave rise to other large firms and industries – IBM and Xerox, the automobile and aerospace industries, for instance – that were allowed to serve private industry on arguably favorable policy terms in recognition of their strategic national importance. The history of government granted corporate charters in earlier eras sometimes carried similar expectations that corporations were allowed to carry out their corporate interests only with the expectation that they would serve the interests of the government (or crown), as well. Nonetheless, AT&T provides an arguably extreme example of this relationship.

AT&T also bore many of the negative hallmarks of these relationships – and of monopoly and regulations affected by public choice concerns. As technologically advanced as AT&T's research was, it was often slow to deploy new technologies, and invested heavily to keep competitors from entering its markets – which would have pushed to structure its business operations to serve a wider range of interest, sooner. For its part, AT&T relied on its relationship with the government, in which it tended to the government's interests, as a means to ensure that it could otherwise by run in accord with

---

[92] *See generally*, JON GERTNER, THE IDEA FACTORY: BELL LABS AND THE GREAT AGE OF AMERICAN INNOVATION (2012).

[93] *See id.* at 60-62 (describing AT&T's role in the development of radar technology); *see also id.* at ch. 6 (describing AT&T's role in the development of transistor technology); *see also id.* at ch. 12-13 (describing AT&T's role in the development of satellite technology).

[94] *See id.* at ch. 3 (describing growth of AT&T's revenues and the start of Bell Labs by funding from those revenues).

its own interests and vision of how the telephone and technology industries should operate. Neither the government's interest nor AT&T's interest, however, necessarily aligned with the public interest.

2. Indirect Regulation as Partnership?

The story of AT&T can be generalized, at least in a sense, into a discussion of other less direct forms of regulation than discussed in Part I – forms of regulation that may be more collaborative, or at least less intrusive, than more traditional regulation.

For instance, regulators may use tools such as "jawboning," regulation by "raised eyebrow" or the use of actual or threatened hearings or other public scrutiny, or even the threat of potential regulation to encourage industry to act in certain ways.[95] These are all forms of indirect regulation and operate under the same premise: increasing the costs for firms to engage in undesired conduct, without the need for actual, direct, regulation. The theory is simple: because no CEO likes to testify before Congress, spending time forced to answer questions intended to embarrass them and their company (to use one example), CEOs will conduct the company's business to avoid such experiences. Or, to use another example, because the threat of regulation and negative press coverage can adversely affect a company's stock performance, company leadership can be encouraged to take actions to avoid such adverse effects by tending to the interests of their would-be regulators.

The flipside of this is that industry may make accommodations to regulators in order to appease their concerns or to develop a reputation as "good corporate citizens" – in order to avoid the embarrassment or costs of being subject to "indirect regulation." This corporate "noblesse oblige" may serve the public interest – a firm may attempt to marshal positive public sentiment as a shield against abusive practices of regulators intent upon advancing their own interests. At least as likely, however, the incentive is for firms to keep regulators happy by tending to those regulators' interests. Thus, as with the history of AT&T, corporate and government interests may align with each other, but not with the public interest.

---

[95] H. Thomas Austern, *Expertise in Vivo*, 15 ADMIN. L. REV. 46, 50 (1963) (discussing "jaw-bone enforcement" and "the lifted eyebrow"). See *generally* Lars Noah, *Administrative Arm-Twisting in the Shadow of Congressional Delegations of Authority*, 1997 WIS. L. REV. 873 (1997); Tim Wu, *Agency Threats*, 60 DUKE L.J. 1841 (2011).

3. Contemporary Industry and Regulators as Partners

As is discussed in Part III.B, below, the contemporary understanding of regulation is not one of partnership. This is also seen in the discussion of indirect regulation, above. While there may be occasional moments of aligned incentives, most "partnership" is more instrumental towards private goals than an effort to establish or create common goals.

This is on remarkable display, again, in the telecommunications setting. In the 1980s and 1990s, for instance state and local regulators regularly used licensing obligations to extract concessions from cable companies – everything from channel capacity on cable networks to capital investment in various municipal projects. This form of rent extraction does bear some hallmark of partnership – the cable companies were generally allowed to maintain monopoly franchises, which they could use to fund the regulators' pet projects – but, again, the partnership is support in the partners' private interests, not the public interest.[96] Backroom bargains like these have remained common in the antitrust setting, with both federal regulators extracting concessions from in consideration for allowing mergers to go through (e.g., in the Comcast-NBCU Merger)[97] and state regulators doing the same (e.g., Colorado's decision not to challenge T-Mobile's acquisition of Sprint after the companies agreed to make significant state-specific investments).[98]

In the 1980s, the government experimented with a new form of rulemaking, "negotiated rulemaking" or "negotiated regulation," that aspired to a more cooperative approach to regulation.[99] This effort was prompted by concerns that the relationship between regulators and industry was too adversarial, and a belief that greater involvement in the regulated industry in the crafting of the regulations to which it would be subject would lead to the development of rules that were higher quality and that had greater support of those subject to them.

The negotiated regulation process has some of the hallmarks of partnerships: parties coming together to address some commonly defined goal on terms acceptable to each, capturing expertise of the parties across the development and implementation stages of rule development, greater

---

[96] *See generally* Thomas W. Hazlett, *Cable TV Franchises as Barriers to Video Competition*, 12 VA. J.L. & TECH. 1 (2007).

[97] *See, e.g.*, Comcast Corp., Gen. Elec. Co. and NBC Universal, Inc., 26 FCC Rcd. 4238 (2011) (memorandum opinion and order).

[98] *See* Colo. A.G., Assurance of Voluntary Compliance, (2019), https://coag.gov/app/uploads/2019/10/TMO-Colorado-AG-AVC-Fully-Executed.pdf.

[99] *See generally* Cary Coglianese, *Assessing Consensus: The Promise and Performance of Negotiated Rulemaking*, 46 DUKE L.J. 1255 (1997).

engagement of parties that will be subject to the rules in the development of them. The promised benefits of negotiated rulemaking, however, have not borne out. Rather that producing rules with greater industry buy-in, research has shown that rules developed using negotiated rulemaking are challenged in court for often than rules developed through more traditional, "adversarial," approaches to rulemaking. Some of the reasons for this, along with other consideration of why regulation isn't partnership, are taken up in the next section.

B. *Why Isn't Regulation Partnership?*

The discussion above considered and criticized some of the ways in which regulation may have characteristics of partnership. The discussion below focuses on the conflicts between thinking of regulation as partnership.

1. The Adversarial Mindset

The American approach to regulation – and to law in general – is overwhelmingly adversarial.[100] This is seen in our common law traditions. It is seen in our earliest regulatory understandings of private interests as something standing apart from "the public interest." It is seen in the basic dichotomy between rulemaking and adjudication as the two dominant modalities of regulatory action.

The history leading up to the experiments with negotiated rulemaking in the 1980s capture some of these concerns: federal agency rulemaking in the 1960s and 1970s had become more and more time consuming, costly, and adversarial.[101] Implementation of the then-newly established EPA's rules were increasing compliance costs and viewed as hostile to industry. The FTC's efforts to regulate advertising directed at children led it to being dubbed the "National Nanny", and the Commission was even shut down by Congress for a period in response to its regulatory zeal.[102] In 1979 President

---

[100] *See, e.g.*, ROBERT KAGAN, ADVERSARIAL LEGALISM: THE AMERICAN WAY OF LAW (2003).

[101] *Id.* at 46 ("In the 1960s and 1970s … Congress embraced adversarial legalism.").

[102] *see also* J. Howard Beales, *The FTC's Use of its Unfairness Authority: Its Rise, Fall, and Resurrection*, FEDERAL TRADE COMMISSION (May 20, 2003), https://www.ftc.gov/public-statements/2003/05/ftcs-use-unfairness-authority-its-rise-fall-and-resurrection ("The breadth, overreaching, and lack of focus in the FTC's ambitious rulemaking agenda outraged many in business, Congress, and the media . Even the Washington Post editorialized that the FTC had become the "National Nanny. Most significantly, these concerns reverberated in Congress. At one point, Congress refused to provide the necessary funding, and simply shut down the FTC for several days. Entire industries sought exemption from FTC jurisdiction, fortunately without success. Eventually, Congress acted to restrict the

Carted quipped that "It should not have taken 12 years and a hearing record of over 100,000 pages for the FDA to decide what percentage of peanuts there ought to be in peanut butter."[103]

Unsurprisingly, regulators' adjudicatory function is no less adversarial or burdensome – it is, after all, modelled on adversarial judicial proceedings.[104] But judicial proceedings require an active case or controversy in order for a matter to be heard by a court and are governed by various procedural safeguards that protect parties from unwarranted litigation and ensure parity of process.[105] Administrative proceedings, conversely, are subject to greatly reduced procedural safeguards.[106] Indeed, some agencies consciously use them as a mechanism for developing new regulation. In such cases, agencies may bring administrative actions against firms not so much based upon on the specific conduct of the firm but upon the agency's interest in developing new law outside of the rulemaking setting.[107]

This basic approach of developing law – and other forms of legally-binging rules – in an adversarial setting is deeply rooted in common law traditions. Lawmakers and regulators are overwhelmingly lawyers, trained in the common law tradition. This gives them a predisposition both towards adversarial settings and a belief that such proceedings will (over time and many cases – though many elide this element) lead to the development of good law. But that does not mean that the adversarial approach is the only one to regulation – let alone the best, or even particularly good, one.

FTC's authority, including legislation preventing the FTC from using unfairness in new rulemakings to restrict advertising. So great were the concerns that Congress did not reauthorize the FTC for fourteen years. Thus chastened, the Commission abandoned most of its rulemaking initiatives, and began to re-examine unfairness to develop a focused, injury-based test to evaluate practices that were allegedly unfair."). *See also The FTC as National Nanny,* WASH. POST (Mar. 1, 1978), https://www.washingtonpost.com/archive/politics/1978/03/01/the-ftc-as-national-nanny/69f778f5-8407-4df0-b0e9-7f1f8e826b3b/.

[103] PUBLIC PAPERS OF THE PRESIDENTS OF THE UNITED STATES: JIMMY CARTER 1979 BOOK 1 484 (1980)

[104] *See generally* Section 554 of the Administrative Procedure Act, 5 U.S.C. § 554 (2012).

[105] *See* U.S. CONST. art. III, § 2; U.S. CONST. amends. V, XIV (outlining the judicial process).

[106] Most agency adjudications are informal adjudication (governed primarily by APA Section 555), which, compared to formal adjudications (governed by Section 554), offers relatively modest process. *Cf.* 5 U.S.C. § 555(b), (c), and (e) *with* 5 U.S.C. § 554. The due process protections surrounding fact finding are significantly less in the administrative context than the judicial context. *See generally,* Evan D. Bernick, *Is Judicial Deference to Agency Fact-Finding Unlawful?*, 16 GEO J.L. & PUB. POL'Y 27 (2018).

[107] *See* Justin (Gus) Hurwitz, *Data Security and the FTC's UnCommon Law*, 101 IOWA L. REV. 955, 984 (2016) (noting that the "[Federal Trade] Commission [uses] its case-selection prerogative to guide the development of the law.").

2. The Transactional Mindset

Where regulators bring a counterproductively adversarial mentality to regulation, industry can bring a dangerously transactional mentality. Regulation can be viewed as a cost of doing business or an obstacle to be overcome. This is particularly true in static industries, industries subject to disruption, or firms newly subject to regulation. In such settings, "regulation" may seem backward looking or irrelevant to the firms' forward looking businesses. Why should Facebook worry about the privacy rules developed to regulate the telephone network? Why should Uber or Airbnb worry about regulations developed during an era of road weary hobbits travelling by ferry and staying the local inn? Regulators who would subject these businesses to rules designed for technologies of yesteryear are to be humored – and to the extent that they cannot be, technologies are designed around the regulators' authority. The purpose of the rules is to frustrate the purposes of the firm.

It can be easy to be sympathetic to this approach to law, especially when regulations seem as hopelessly outdated and regulators as hopelessly out of touch as they often do in the tech industry. But this assumes a static model of regulation, in which regulators do not learn, regulations do not change, and – perhaps most of all – where those regulations serve no broader purpose. All regulators believe their regulations serve important, broader, social purposes – and many do. The transactional approach to regulation only defers an ultimate reckoning with these regulators. More importantly, it only defers the day where the firm's business will need to be reconciled with the underlying purposes that the regulations serve.

IV. REGULATION AS PARTNERSHIP

The line between regulation and partnership is curiously blurry. The need for regulation is premised on a divergence between public and private interests, creating a need for regulators to impose rules to constrain or facilitate the conduct of private actors. The purpose of P3s is to harness private interests to accomplish public ends. Fundamentally, both are about aligning public and private interests.

On the other hand, the need for each arises in very different contexts. The need for regulation generally arises after some industry or technology has reached a critical mass of adoption to address concerns that arise with its operation. In such cases, the government is responding to the development or conduct of industry. A P3 is generally initiated by the government, and is undertaken to address a more discrete purpose, on terms defined at the

outset. Both, however, face the similar challenging of aligning potentially mismatched incentives between the public and private parties.

While often deployed based on ill-conceived notions of cost-savings and administrative efficiency, the value of the P3 model is greatest in the relational context. As articulated by Hart, a P3 model is really a form of incomplete contracting, where terms of the contract need not be fully specified because each party is endogenously incentivized to perform to the other party's satisfaction. The most common form of P3 falling into the mold is the two-stage development-management contract – but the greater the value of maintaining the relationship, the more likely the P3 arrangement will prove beneficial to all parties involved. The more interesting lesson from P3s, however, follows in the other direction: while the P3 model works better the more relational it is, it is more likely to fail the more transactional it becomes. Indeed, absent the minimum two-stage relationship, a "P3" is often little more than a procurement contract.

The same dynamic plays out in the regulatory context. The story of AT&T is one of an ongoing relationship between the firm and its regulators and stands in contrast to the more recent transactional approach to regulation seen in much of the technology industry.

Of course, there is nothing wrong with ordinary, transactional, procurement contracts. Indeed, they represent most government contracts. The P3 model is only used in a subset of arrangements. The same can be said for most laws and regulations. Signage requirements for trucks carrying dangerous materials and roadways should not be contingent upon a relationship between regulators and industry; nor should the fat content of skim milk or the peanut content of peanut butter or the requirements for obtaining a passport or buying a house.

The value of the relational model, for both P3s and regulation, is at its zenith where the relationship itself is the thing of value – where each party brings to the relationship skills, knowledge, or some other comparative advantage. AT&T brought R&D capabilities that it could leverage to satisfy specific government needs and the promise to connect everyone to the telephone network to its midcentury relationship with the federal government. The federal government brings an ability to coordinate and share information between state, local, federal, and international entities as a trusted intermediary to the cybersecurity community. In both cases, the counterparties care more about continuing the relationship than about the value of any specific interaction.

The entrances to the Federal Trade Commission building in Washington, D.C., are flanked by a pair of statues, jointly named *Man Controlling Trade*. Each statue depicts a muscular man struggling to control, with his bare hands,

an equally muscular horse. These statues are an evocative crystallization of the traditional adversarial relationship between private interests and the government. But the partnership model suggests that this understanding of the relationship is wrong – or at least incomplete. There are circumstances where the carrot is mightier than the stick, and where the power of the stick may be entirely illusory.

This critique goes both ways: just as it is wrong to think of the role of the regulator as adversarial to private interests, it is problematic for private interests to approach the regulator, and the public interest it purports to represent, in purely transactional terms. The horses outside the FTC building represent the real dangers that unconstrained commerce can represent – wild, rampaging, and destructive.

But there is a greater underlying truth to the FTC statues: men (to use the gender of adopted by the statue's artist) are governed by reason, whereas horses are governed by nature and instinct. There are twin assumptions that the private interests of commerce, on one hand, are wild, potentially dangerous to the public interest, and that their regulation, on the other, is necessarily in the public interest. To the extent that the status quo approach to regulation gives rise to a counterproductive adversarial/transactional dynamic, we should look to the regulators, governed as they are by reason as opposed to the uncontrollable wills of private enterprise, to correct for this dynamic. To the extent that the adversarial model of governance has proven to be counterproductive, fault for that lies with the laws and regulations that embraced adversarial governance, not those subject to them; and to the extent that partnerships, founded in relational governance, are preferable, responsible for adopting such a modality also lies with the regulators.

The standard, and most trenchant, critique of "partnership" models of governance is found in public choice. Regulators and regulation are subject to capture under the best of circumstances – and a partnership model of governance would seemingly embrace such capture. It would be akin to "regulating" the henhouse by partnering with the foxes to guard it. It is common, for instance, to point to examples such as AT&T's cozy relationship with the FCC, which led the FCC to give undue reliance to assertions by AT&T, such as the one that the "Hush-a-Phone" device – nothing more than a piece of plastic cupped over the mouthpiece of a telephone – had to be banned because it could potentially damage the telephone network.[108]

This concern misunderstands the public choice critique generally, and the concern of regulatory capture. A partnership-based approach to governance is just as susceptible to public choice concerns as an adversarial one. The concern raised by the public choice critique is that any public institution is

[108] See, e.g., Hush-A-Phone v. United States, 238 F.2d 266 (D.C. Cir. 1956)

subject to capture by private interests – and the challenge of the critique is to design institutions that are resilient to those interests.

Indeed, this is perhaps the greatest lesson and challenge raised by this paper's framing example of AT&T. AT&T was one of the great American companies. It was well-loved by most consumers, it was a committed and beneficial partner to the government, and it was one of the greatest sources of innovative activity in the country's history. But it was also a ruthless monopoly that used its relationship with the FCC to stifle competition and maintain its position within the economy.

CONCLUSION & CODA

The concluding portion of this paper is being written during a remarkable and tragic time: the nation and the world are in the throes of the novel coronavirus pandemic. While only a small and comparatively unimportant part of the history currently being written, this period carries important lessons about the power of regulatory partnerships.

Private industry is showing the good that it is capable of when the public interest is clear. From companies collaborating on urgently needed innovation[109] to firms making accommodations to benefit consumers in need,[110] industry – particularly the tech sector – has risen to the occasion of our current circumstances to demonstrate its fundamental humanity.[111] And

---

[109] *See, e.g.,* Darrell Etherington, *FDA Authorizes Production of a New Ventilator That Costs up to 25x Less Than Existing Devices*, TECHCRUNCH (Apr. 15, 2020), https://techcrunch.com/2020/04/15/fda-authorizes-production-of-a-new-ventilator-that-costs-up-to-25x-less-than-existing-devices/ ("Both medical device maker . . . and Boston Scientific . . . contributed to the development of the design.").

[110] *See, e.g.,* Allen St. John, *ISPs Raise Speeds and Suspend Data Caps in Response to the Coronavirus Pandemic*, CONSUMER REPORTS (Mar. 23, 2020), https://www.consumerreports.org/internet-providers/isps-respond-to-coronavirus-raise-speeds-suspend-data-caps-keep-america-connected-pledge/("[S]ome internet service providers (ISPs) are pledging to raise broadband speeds, suspend data caps, and generally make life easier for all.").

[111] *See, e.g.,* Steven Levy, *Has the Coronavirus Killed the Techlash?*, WIRED (Mar. 20, 2020), https://www.wired.com/story/plaintext-has-the-coronavirus-killed-the-techlash/ ("Facebook has gotten rare kudos for its responses to the pandemic . . . ."); Ryan Bourne, *The Techlash is Over – or at Least It Should Be*, THE TELEGRAPH (Apr. 9, 2020), https://www.telegraph.co.uk/business/2020/04/09/techlash-least-should/ ("The firms' business activities adjusted quickly, while the companies donated masks, testing assistance and relief for businesses to help the broader effort."); Casey Newton, *How COVID-19 is Changing Public Perception of Big Tech Companies*, THE VERGE (Mar. 26, 2020, 6:00 AM), https://www.theverge.com/interface/2020/3/26/21193902/tech-backlash-covid-19-coronavirus-google-facebook-amazon ("Where they once had been loath to intervene in matters of fact, suddenly Facebook and Twitter were prominently featuring links to high-quality information . . . ."); Jon Neiditz and Kilpatrick Townsend, *COVID-19: Terminate the Techlash!*, JD SUPRA (Mar. 30, 2020), https://www.jdsupra.com/legalnews/covid-19-terminate-the-techlash-11260/ (mentioning the creation of

many of these stories are facilitated by regulators that are working to waive rules or otherwise facilitate important work on an emergency basis, such as the Food and Drug Administration (FDA) issuing Emergency Use Authorizations[112] and the FCC waiving various rules, allowing flexible use of spectrum, and extending universal service funding to help keep people online.[113]

There are also less positive stories to be told and lessons to be learned. In the United States, our regulatory response was slow to facilitate widespread testing.[114] The Centers for Disease Control and Prevention (CDC) and FDA maintained their traditional, centralized, command-and-control approach to public health administration, denying private efforts to facilitate testing until well after the coronavirus had established its foothold in the United States. This stands in stark contrast to the experiences elsewhere. For instance, "Germany's equivalent to the U.S. Centers for Disease Control and Prevention ... makes recommendations but does not call the shots on testing for the entire country."[115] That approach is similar to that partnership-based approach used in the United States for cybersecurity, where federal authorities play an information gathering and analysis role, working to facilitate and support private responses to cybersecurity incidents.[116]

The introduction of this article explained that it is "really about how we regulate the technology industry, and how that industry approaches its regulators."[117] The dynamic in recent years has been acrimonious: regulators have too often approached the tech sector from an adversarial perspective and industry has responded in kind, either with its own adversarial position or by viewing regulatory compliance as a "cost of business" transaction. This dynamic is unfortunate and ultimately harmful to the public interest. Fortunately, there are alternative approaches to be explored, such as the

---

"tech innovations like an app that identifies everyone who has tested positive for COVID-19 within a certain physical distance").

[112] *See, e.g.*, Dave Sebastian, *FDA Approves Devices to Be Modified into Ventilators Amid Shortage*, WALL. ST. J. (Mar. 27, 2020 3:22 PM), https://www.wsj.com/articles/fda-approves-devices-to-be-modified-into-ventilators-amid-shortage-11585336944 (announcing the special authorization for medical devices to be modified as ventilators).

[113] *See* FEDERAL COMMUNICATIONS COMMISSION, KEEP AMERICANS CONNECTED PLEDGE, (2020), https://www.fcc.gov/keep-americans-connected.

[114] *See, e.g.*, Alec Stapp, *Timeline: The Regulations—and Regulators—That Delayed Coronavirus Testing*, THE DISPATCH (Mar. 20, 2020), https://thedispatch.com/p/timeline-the-regulationsand-regulatorsthat ("What's unfortunate is that there was no similar push at the beginning of the crisis to expedite coronavirus testing.").

[115] *See* Rob Schmitz, *Why Germany's Coronavirus Death Rate Is Far Lower Than In Other Countries*, NPR (Mar. 25, 2020, 12:03 PM), https://www.npr.org/2020/03/25/820595489/why-germanys-coronavirus-death-rate-is-far-lower-than-in-other-countries.

[116] *See supra* part II.A.2

[117] *See supra* Introduction.

partnership-based, relational models of governance considered in this article. Ultimately, no one model of governance is best for all contexts and no model is perfect for any single context. But adding consideration of partnerships to the standard binary choice between prescriptive ex-ante regulation and laissez-faire, market-based, ex-post enforcement expands the regulatory toolbox.