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### OPTIMIZING REGULATION FOR AN OPTIMIZING ECONOMY

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*Much economic activity in the United States today emanates from technological advances that optimize through contextualization. Innovations as varied as Airbnb and Uber, fintech firms, and precision medicine are transforming major sectors in the economy by customizing goods and services as well as refining matches between available resources and interested buyers. The technological advances that make up the optimizing economy create new challenges for government oversight of the economy. Traditionally, government has overseen economic activity through general regulations that aim to treat all individuals equally; however, in the optimizing economy, business is moving in the direction of greater individualization, not generalization. An ever more optimizing economy therefore demands an increasingly smart, optimizing system of regulatory oversight. To ensure that government can properly balance policy goals in the new economy, steps need to be taken now to enhance the technological and analytical sophistication of the regulatory workforce, improve government's information technology infrastructure, build stronger and more complete collections of data, and draw on policy lessons from other periods of technological innovations. In the optimizing economy, government regulators will continue to play a crucial role in protecting the public from market failures, but, to fulfill that role, government will need to follow the private sector's lead and build up its own capacity for optimization.*

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## INTRODUCTION

Across a range of sectors, economic activity in the United States today increasingly derives from technological advances that facilitate the use of resources in ever more marginally effective and efficient ways. Rather than exploiting new resources altogether, many of the most captivating innovations in today's economy instead deploy technology to optimize the production or allocation of existing resources, goods, and services.

Consider several seemingly disparate examples. So-called sharing-economy firms like Uber and Airbnb find transformational ways to allocate to willing buyers otherwise under-used resources, such as private cars and extra bedrooms. Marketing firms rely more than ever on data mining to make highly targeted pitches to consumers, while supply-chain and delivery system optimization has streamlined manufacturing and retail markets. Major advances in health care now travel under the banner of "precision medicine," with health care professionals using sophisticated genetic screening and other data analysis to target treatments even more effectively to individual patients. Fintech firms promise to deliver financial products more accurately designed and priced to reflect underlying borrower risks and thus expand access to capital. These and other changes across the economy signal an important trend toward using technology to contextualize in ways that make possible more efficient uses of available resources.<sup>1</sup>

The emergence of such an optimizing economy holds important implications for public policy. Government must be able to keep up with fast-changing technological developments in order both to fulfill its important responsibilities to protect the public and to keep from impeding socially valuable changes in the economy. Just as the end of horse-and-buggy days meant that local governments needed to purchase cars for police officers to enforce speed limits on the roads, so too must regulatory agencies of all kinds adapt and respond to an increasingly technologically advanced society. An ever optimizing economy depends on an equally ever optimizing regulatory system. Government will not only fail to fulfill its important responsibilities if it cannot keep pace with private-sector innovation, but lagging governmental capacity also risks contributing to counterproductive barriers in private innovation, through blunt, ineffectual regulation. Policymakers from both ends of the political spectrum should be able to unite behind efforts to optimize regulation, taking steps to strengthen governmental capacity and improve its efficiency to match better the most significant trends toward optimization in the private sector and to ensure sustainable economic growth.

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<sup>1</sup> For further discussion of these trends, see *infra* Part I.

## I. THE OPTIMIZING ECONOMY

Economic growth depends on finding optimal outcomes for society. In this general sense, the idea of optimization is hardly new. The American economy has long benefited from entrepreneurial efforts to optimize business activity, such as when assembly-line methods dramatically improved manufacturing efficiency around the turn of the last century.<sup>2</sup> What is different today is how technology increasingly achieves optimization by enhanced precision in matching goods and services to individual preferences and needs. Today's optimization is often marked by a leap forward in individualization, as well as on a reliance on big data and advanced analytics to support greater contextualization and distributed activity. Major innovations with these characteristics are already starting to disrupt major sectors of the economy, including transportation, energy, health care, and manufacturing. More looms on the horizon.<sup>3</sup>

The transportation service behemoth, Uber, may provide the most salient example of the kind of disruption that the new optimizing model can create. Uber and, to a lesser extent, Lyft are transforming transportation services throughout the nation's metropolitan areas by giving everyone with a smartphone the ability to find a driver willing to take them where they want to go. These companies are built on digital and networking technology that improves the allocation of existing resources by matching people who need transportation with people who have vehicles and time available.

In this same way, other so-called sharing-economy firms also make better use of resources that would otherwise go under-utilized. Airbnb, for example, matches homes and apartments that property owners have available with people who want a place to stay. In New York City alone, 416,000 guests took advantage of Airbnb from August 2012 to July 2013, which, by one estimate, translated into a drop in rental of one million hotel rooms during that period.<sup>4</sup>

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<sup>2</sup> ROBERT J. GORDON, *THE RISE AND FALL OF AMERICAN GROWTH: THE U.S. STANDARD OF LIVING SINCE THE CIVIL WAR* 557 (2016) (noting how “[t]he assembly line, together with electric-powered tools, utterly transformed manufacturing” in the early 1900s).

<sup>3</sup> Many of these economic changes bear affinities with what Jeremy Rifkin describes as the “zero marginal cost society.” JEREMY RIFKIN, *THE ZERO MARGINAL COST SOCIETY: THE INTERNET OF THINGS, THE COLLABORATIVE COMMONS, AND THE ECLIPSE OF CAPITALISM* (2015).

<sup>4</sup> Laura Kusisto, *Airbnb Cites its Role in City*, WALL ST. J. (Oct. 21, 2013), <https://www.wsj.com/articles/airbnb-cites-its-role-in-city-1382405272> (citing a recent survey that found that Airbnb cost the New York hotel industry one million dollars in lost room nights over a period of eleven months); Jeremy Rifkin, *The Rise of the Sharing Economy*, L.A. TIMES (Apr. 6, 2014), <http://articles.latimes.com/2014/apr/06/opinion/la-oe-rifkin-airbnb-20140406> [<https://perma.cc/68MM-G5DP>] (citing the same survey). A study of Airbnb's impact on the hotel sector in Texas found that the entrance of Airbnb into this market reduced hotel prices, as well as contributed to up to a 10 percent decline in revenue for incumbent hotels. Georgios Zervas et al., *The Rise of the Sharing Economy: Estimating the Impact of Airbnb on the Hotel Industry* 1, 16 (Boston Univ.

The optimizing economy is broader than just sharing-economy firms. Conventional retail business also has been shaped dramatically by optimization. eBay optimizes retail sales by matching people who have items to sell with customers who want them. Amazon and Netflix use machine-learning to match customers better with products they likely desire. When customers go online to shop today, they now see displayed a variety of products identified as likely to interest them in particular. Facebook and other social media firms provide data to support still more sophisticated micro-targeted retail marketing.<sup>5</sup>

Similar strategies that optimize through individualization are starting to transform medicine.<sup>6</sup> Lung cancer treatments, for example, can now be customized based upon the identification of specific individual genes.<sup>7</sup> This movement toward so-called precision medicine is also facilitated by sophisticated data analysis of health records—somewhat akin to what Amazon and Netflix do with consumer purchasing data. The national shift to electronic medical records will only enhance future health care delivery based on machine learning and more precisely targeted treatments.<sup>8</sup>

Retailers like Amazon not only optimize through more individualized marketing, but they also have significantly optimized their supply chain management, inventory control, and product delivery systems. Overall, e-commerce businesses optimize retail space, as webpages take the place of physical stores and showrooms. But even with its warehouse storage, Amazon has

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Sch. Of Mgmt. Research Paper No. 2013-16, Nov. 18, 2016), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2366898](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2366898).

<sup>5</sup> See, e.g., TOM AGAN, SILENT MARKETING: MICRO-TARGETING 3 (Penn, Schoen & Berland Assoc.'s eds., 2007), <http://gaia.adage.com/images/random/microtarget031207.pdf> (“[Micro-targeting] combines attitudes, available consumer data and demographics to find like-minded people . . . and predict what they will do”); Bernard Marr, *Big Data: A Game Changer in the Retail Sector*, FORBES (Nov. 10, 2015), <https://www.forbes.com/sites/bernardmarr/2015/11/10/big-data-a-game-changer-in-the-retail-sector/#6bb069a59f37> [<https://perma.cc/T2VB-YFME>] (stating that big data analytic tools are being used to predict retail trends, optimize pricing, determine where demand will be, and identify interested buyers). Retail political campaigning has also been transformed by predictive analytics, big data, and microtargeting. See BRUCE I. NEWMAN, THE MARKETING REVOLUTION IN POLITICS: WHAT RECENT U.S. PRESIDENTIAL CAMPAIGNS CAN TEACH US ABOUT EFFECTIVE MARKETING 38 (2016) (explaining how campaign strategists have used micro-targeting to “break down the marketplace of voters into segments that were likely to be influenced by particular advertising strategies”).

<sup>6</sup> See generally J. Larry Jameson & Dan L. Longo, *Precision Medicine—Personalized, Problematic, and Promising*, 372 NEW ENG. J. MED. 2229 (2015); see also Francis S. Collins & Harold Varmus, *A New Initiative on Precision Medicine*, 372 NEW ENG. J. MED. 793 (2015) (discussing the benefits of precision medicine’s individualized, molecular approach to cancer).

<sup>7</sup> See generally Reinhard Buettner et al., *Lessons Learned from Lung Cancer Genomics: The Emerging Concept of Individualized Diagnostics and Treatment*, 31 J. CLINICAL ONCOLOGY 1858 (2013).

<sup>8</sup> See Sam Hawgood et al., *Precision Medicine: Beyond the Inflection Point*, 7 SCI. TRANSLATIONAL MED. 1, 1 (2015) (explaining how precision medicine relies on “massive data networks that access, aggregate, integrate, and analyze information from huge patient cohorts”).

proven itself a physical manifestation of the optimizing economy. Its inventory is stored not by product type, but instead by the precise size and shape of every item the company sells. Each item is given an identifying number and measured, and then complex computer algorithms direct where and how those items should be stacked based on physical dimensions—with the result that Amazon has at least doubled product storage rates over earlier inventory management systems.<sup>9</sup>

The nation's congested highways represent a similar space-optimization challenge. Google's self-driving cars, while still in the earliest stages, portend a transportation future that eventually could optimize time and energy.<sup>10</sup> Once everyone has a self-driving car, slowdowns caused by accidents or by drivers trying to cut ahead in exit lines could be dramatically reduced. Optimizing the transportation system to reduce congestion could deliver important productivity gains as well as make people's lives markedly happier.<sup>11</sup> In addition, when cars start to do all the driving, human occupants may be able to focus their attention away from the road to other more productive uses of travel time.

The future also may bring a highly distributed system of energy production built on solar panels and, to a smaller extent, micro-generators. Already these kinds of distributed energy technologies are being put into ever increasing use. With the prices for solar cells dropping dramatically, individuals are now not only powering their own homes, but also seeking to sell excess energy back to the grid. Full implementation of distributed energy production will depend ultimately on advances in energy storage technology; however, the prospect of using currently untapped roof space in cities around the country to produce energy holds significant optimizing potential.<sup>12</sup>

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<sup>9</sup> CBS News, *Amazon's Jeff Bezos Looks to the Future* (Dec. 1, 2013), <https://www.cbsnews.com/news/amazons-jeff-bezos-looks-to-the-future/> [<https://perma.cc/DYC4-2C2M>] (quoting Amazon vice president Dave Clark that “we have computers and algorithmic work that tells people the areas of the building that have the most space to put product in that's coming in at that time” and noting that “Amazon has become so efficient with its stacking, it can now store twice as many goods in its centers as it did five years ago”); Will Knight, *Inside Amazon's Warehouse Human-Robot Symbiosis*, MIT TECH. REV. (July 7, 2015), <https://www.technologyreview.com/s/538601/inside-amazons-warehouse-human-robot-symbiosis/> [<https://perma.cc/25GS-6NMY>] (noting that “Amazon's robotic shelves allow more products to be packed into a tighter space”).

<sup>10</sup> See Bernard Marr, *Key Milestones Of Waymo - Google's Self-Driving Cars*, FORBES (Sept. 21, 2018), <https://www.forbes.com/sites/bernardmarr/2018/09/21/key-milestones-of-waymo-googles-self-driving-cars/#1977ba265369> [<https://perma.cc/JB6J-XQQH>] (discussing Google's self-driving car project, Waymo).

<sup>11</sup> See Ike Brannon & Mike Gorman, *How Investment in Transportation Infrastructure Boosts Productivity*, THE HILL (Sept. 23, 2015), <http://thehill.com/blogs/pundits-blog/transportation/254601-how-investment-in-transportation-infrastructure-boosts> [<https://perma.cc/PF8C-N83C>] (explaining how congestion can have a significant effect on manufacturing productivity).

<sup>12</sup> For an overview, see generally Tom Baker et al., *Distributed Energy: A Disruptive Force*, BOSTON CONSULTING GROUP 1 (2014).

These are but some of the more prominent examples of the emerging optimizing economy. They reveal how significant parts of the economy's trajectory will be influenced by optimization, and they illustrate optimization's three main features: customization or individualization; the use of machine learning and other sophisticated forms of data analysis; and the reliance on distributed resources, such as data or distributed energy. These three characteristics underlie the great promise the optimizing economy holds for improving society—but they also create major challenges for government regulation.

## II. CHALLENGES FOR REGULATION

At its core, the optimizing economy is based on contextualizing: doing a better job in matching or otherwise finding ways to tap into and exploit smaller, more distributed, but previously underused, resources. And yet, therein lies the fundamental conundrum for government. Governments do not do so well with contextualizing. Indeed, they are generally not even in that business. Lawmaking, for example, is the business of establishing rules, which are, by definition, generalizations, not context-specific judgments.<sup>13</sup> And in the enforcement and implementation of laws, government bureaucracies aim to treat people equally—by treating everyone the same.<sup>14</sup> Even if government does not always achieve this equal-treatment aspiration in practice, the orientation toward standardization still persists throughout government and resists movement toward customization. The upshot is a growing mismatch between the private and public sectors, a gulf not just between private interests and the public interest, but a chasm in methods and capacities. Entrepreneurs increasingly aim at greater precision, while government regulators continue to operate through broad generalizations and standard operating procedures.

The growing gulf in optimization propensity and skill between the private and public sectors should concern anyone, no matter one's political philosophy. It may seem that calling attention to the optimization mismatch fits most naturally with a critique of regulation as a burdensome barrier to innovation. After all, when state and local government officials invoke existing regulations to resist disruptive innovations—such as when localities have enacted laws that protect incumbent taxicab businesses by placing restrictions on Uber and Lyft's networking dispatch services<sup>15</sup>—that resistance fits into a narrative of

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<sup>13</sup> See Frederick Schauer & Richard Zeckhauser, *Regulation by Generalization*, 1 REG. & GOV. 68, 69 (2007) (explaining how rules inherently depend on generalizations).

<sup>14</sup> Max Weber considered adherence to general rules a defining characteristic of bureaucracy. MAX WEBER, *ESSAYS IN SOCIOLOGY* 196, 214-216 (H. H. Gerth & C. Wright Mills, trans. 1946).

<sup>15</sup> See Harriet Taylor, *Uber and Lyft are Getting Pushback from Municipalities All Over the US*, CNBC (Sept. 2, 2016), <https://www.cnbc.com/2016/09/02/uber-and-lyft-are-getting-push-back-from-municipalities-all-over-the-us.html> [<https://perma.cc/D2K8-UGSU>] (discussing lawmakers' efforts to thwart Uber and Lyft's expansion plans).

regulatory stagnancy. But those who reject the critique of regulation as an unjustified drag on business and who, instead, worry that regulation is insufficiently protective of the public, ought also to be concerned about the optimization mismatch. New businesses and business practices, after all, bring with them new and different risks. If nothing else, the very newness of products and processes in the optimizing economy creates uncertainty about their impact on others and uncertainty over their quality. Think of how cybersecurity as a major policy problem simply did not exist twenty years ago.

But there is more than just the newness of optimizing innovations. Innovation by optimization actually may make hazards to the public harder to detect and prevent. Precision drugs, for example, have to be manufactured to more exacting standards if they are to be effective—which itself makes government’s job in overseeing product quality that much harder. Moreover, the conventional standards by which government tests new drugs for safety and efficacy may prove ill-equipped for an era of precision medicine, as more targeted formulas and treatment protocols necessarily reduce the sample sizes upon which drug testing’s statistical analysis depends.<sup>16</sup>

The optimizing economy’s penchant for distributing, as well as customizing, also may mean there could be many new sites of distinct harm that government will need to monitor. With the advent of 3D printing, for example, any individual with the necessary technology and know-how could begin to manufacture any number of products—even, potentially, new forms of biological substances or various kinds of dangerous materials.<sup>17</sup> The need for smarter, more sophisticated monitoring capacity by government seems only likely to increase.

And yet, government also needs to tread carefully when confronting optimizing innovations, because even if they hold risks, they also hold the potential for making significant improvements in society. In the face of prospects for significantly improved health outcomes from precision med-

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<sup>16</sup> For a recent survey of regulatory challenges presented by precision medicine, see Lin-Chau Chang & Thomas E. Colonnab, *Recent Updates and Challenges on the Regulation of Precision Medicine: The United States in Perspective*, 96 REG. TOXICOLOGY & PHARMACOLOGY 41 (2018).

<sup>17</sup> See, e.g., Robert J. Morrison et al., *Regulatory Considerations in the Design and Manufacturing of Implantable 3D-Printed Medical Devices*, 8 CLIN. & TRANSLATIONAL SCI. 594, 595 (2015) (describing a 3D-printed bioresorbable implantable device used to treat life-threatening disease); European Commission, *The Disruptive Nature of 3D Printing* 3 (Jan. 2017), [https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM\\_The%20disruptive%20nature%20of%203D%20printing%20v1.pdf](https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_The%20disruptive%20nature%20of%203D%20printing%20v1.pdf) (“[S]ome 3D biomedical systems are already capable of printing cells, proteins and organs.”); Richard Matthews, *Proposed New Regulations for 3D Printed Medical Devices Must Go Further*, THE CONVERSATION (Feb. 8, 2018), <http://theconversation.com/proposed-new-regulations-for-3d-printed-medical-devices-must-go-further-90314> [<https://perma.cc/V9VQ-U2CC>] (“As the costs of 3D printing have reduced, patients are now able to manufacture their own prosthetics at home . . .”).

icine, for instance, drug regulators charged with ensuring safety and efficacy of new products also must not impede the development of better medicines. What society needs is an ever more optimizing government to come closer to matching an ever more optimizing economy.

At some fundamental level, of course, regulatory officials always have had to confront a tradeoff between squelching technological innovation and overlooking new risks.<sup>18</sup> Indeed, balancing the benefits of government regulations with their costs is itself an optimization problem—although it has been one for which the federal government has only in the last few decades created robust institutional processes to try to solve.<sup>19</sup> Yet, no matter how well or poorly the federal government has reconciled regulatory benefits and costs in the past, in the years to come it will only become harder to regulate well. As the regulation of precision medicine illustrates, identifying and delivering regulatory benefits will become more complicated in the face of growing complexity and the contextualized nature of many business enterprises. Regulatory problems are likely to be subtler and much harder to detect overall. They likely will be more dynamic too, emerging from systems of economic transactions that are moving quickly—sometimes across borders.<sup>20</sup>

Regulators in the optimizing economy will also face challenges in controlling regulatory costs, potentially finding it more important than ever to minimize cumulative and overlapping regulatory burdens. According to the Office of the Federal Register, the size of the federal rulebook has grown nearly 2000 percent since 1950.<sup>21</sup> Although it is not clear whether this growth is itself a problem—compared to what should 2000 percent be

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<sup>18</sup> Tradeoffs are endemic to regulatory and other public policy decision-making. *See generally* RISK VS. RISK: TRADEOFFS IN PROTECTING HEALTH AND THE ENVIRONMENT (John D. Graham & Jonathan B. Wiener eds., 1997); GUIDO CALABRESI & PHILIP BOBBITT, TRAGIC CHOICES (1978).

<sup>19</sup> And, even then, the standards under which the institutional process of creating and reviewing benefit–cost analysis of major new regulations have shifted to some degree. In 1981, President Reagan formalized White House review of major regulations, directing in Exec. Order No. 12291, 3 C.F.R. § 127 (1981), that the benefits of regulation should generally “outweigh” their costs—a formal expression of optimization. In 1993, however, President Clinton replaced the Reagan executive order with one of his own (Exec. Order No. 12866, 58 Fed. Reg. 51735 (Oct. 4, 1993)) that has been retained by subsequent presidents and that requires, instead of full optimization, that regulations’ benefits “justify” their costs.

<sup>20</sup> *See, e.g.*, IMPORT SAFETY: REGULATORY GOVERNANCE IN THE GLOBAL ECONOMY 5 (Cary Coglianese et al. eds., 2010) (“The sheer volume of international trade creates a vast and complex network of the sources of safety problems”).

<sup>21</sup> OFFICE OF THE FED. REGISTER, CODE OF FEDERAL REGULATIONS (TOTAL VOLUMES AND PAGES 1950–2014), <https://www.federalregister.gov/uploads/2015/05/Code-of-Federal-Regulations-Total-Pages-and-Volumes-1938-2014.pdf>.

judged?—such growth does at least suggest the potential for increased cumulative regulatory costs. Michael Mandel and Diana Carew have argued that accumulating regulations bring more than just increased costs to businesses; they also may increase the possibility of undesirable interactions between regulations or potentially decrease the amount of upper-level management attention devoted to further business optimization and growth.<sup>22</sup>

In some existing areas of regulation, such as food safety and financial services, concern persists that regulations already overlap with each other or are administered by different government agencies in an uncoordinated fashion.<sup>23</sup> Such concerns seem only likely to grow in an optimizing economy. Uber, after all, faces disputes today over whether its drivers fall into the category of employees, who are subject to labor law protections, or the category of contractors, who are not.<sup>24</sup> Other firms offering optimizing innovations may find that they fit poorly into existing regulatory categories or even cut across several categories. Moreover, as firms increasingly build optimizing business strategies, the relative importance of overlapping regulatory authorities to their success may only increase. Overlapping jurisdictions and the accretion of regulation layered upon regulation may have been more easily accommodated in a “satisficing” era than in an optimizing one.<sup>25</sup>

### III. OPTIMIZING REGULATION

The growing mismatch between complex contextualization in the economy and an accumulated set of rule generalizations in the government may be one of most significant challenges for governance of the U.S. economy in the decades to come. What might be done to bring the U.S. federal government and its regulatory system into greater alignment with emerging innovations in the economy, so as to regulate more smartly an economy that is itself only growing smarter?

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<sup>22</sup> Michael Mandel & Diana G. Carew, *Regulatory Improvement Commission: A Politically-Viable Approach to U.S. Regulatory Reform*, PROGRESSIVE POL’Y INST. 1, 3 (2013).

<sup>23</sup> See Cary Coglianese, *There’s an Easy Way to Untangle Regulatory Knots*, L.A. TIMES (March 31, 2015, 6:46 PM), <http://www.latimes.com/opinion/op-ed/la-oe-0401-coglianese-regulations-20150401-story.html> [<https://perma.cc/UWP3-4CTC>] (recommending a strategy for government to reduce regulatory overlap).

<sup>24</sup> See Katy Steinmetz, *Why the California Ruling on Uber Should Frighten the Sharing Economy*, TIME (June 17, 2015), <http://time.com/3924941/uber-california-labor-commission-ruling/> [<https://perma.cc/78UQ-E2NM>] (discussing a 2015 ruling from the California Labor Commission in favor of an Uber driver seeking classification as an employee).

<sup>25</sup> Herbert Simon coined the term “satisfice.” Herbert A. Simon, *Rational Choice and the Structure of the Environment*, 63. PSYCH. REV. 129, 129 (1956).

First and foremost, an optimizing regulatory system will need an analytically sophisticated workforce.<sup>26</sup> Since at least the 1980s, though, it has been clear that the federal government confronts a shortfall in talented managers and leaders. As Paul Volcker’s National Commission on Public Service noted then, “too many of the best of the nation’s senior executives are ready to leave government, and not enough of its most talented young people are willing to join.”<sup>27</sup> Today, the federal government is facing the prospect of more than a third of the existing federal workforce reaching retirement age by 2020—a significant and sudden decline in needed human capital.<sup>28</sup> But as critical and monumental of a challenge as it is simply to maintain a federal workforce with mission-critical skills, the need today is no longer just to stem the tide of out-flow from the ranks of governmental service.<sup>29</sup> Government needs a new type of talent in-flow as well, one that brings even greater analytic capacities to the oversight of the optimizing economy.<sup>30</sup> The federal government needs human analytic capacity capable of understanding, tracking, and responding to new risks and new business practices in ways that do not impede productive innovations for society. If one of the answers to declining American competitiveness is, as Michael Porter and colleagues have recently suggested in the context of regulating unconventional oil and gas development,<sup>31</sup> the greater use of performance-

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<sup>26</sup> See Cary Coglianese, *Regulatory Excellence as ‘People Excellence,’* REG. REV. (Oct. 23, 2015), <https://www.theregreview.org/2015/10/23/coglianese-people-excellence/> [<https://perma.cc/2KR7-RS94>] (arguing that regulatory quality depends on the quality of regulatory workforces).

<sup>27</sup> Paul A. Volcker, *Preface to the NAT’L COMMISSION ON PUB. SERV., LEADERSHIP FOR AMERICA: REBUILDING THE PUBLIC SERVICE* (1989).

<sup>28</sup> *Federal Workforce: Sustained Attention to Human Capital Leading Practices Can Help Improve Agency Performance: Hearing Before the H. Comm. on Oversight and Gov’t Reform*, 115<sup>th</sup> Cong. 3-4 (2017) (testimony of Robert Goldenkoff, Director of Strategic Issues), <https://www.gao.gov/assets/690/684709.pdf>.

<sup>29</sup> For broader perspectives on the vital need for maintaining a competent federal workforce, see JOHN J. DI IULIO, JR., *BRING BACK THE BUREAUCRATS* (2014); DONALD F. KETTL, *ESCAPING JURASSIC GOVERNMENT: HOW TO RECOVER AMERICA’S LOST COMMITMENT TO COMPETENCE* (2016); MICHAEL LEWIS, *THE FIFTH RISK* (2018); PAUL C. LIGHT, *A GOVERNMENT ILL EXECUTED: THE DECLINE OF THE FEDERAL SERVICE AND HOW TO REVERSE IT* (2009).

<sup>30</sup> Among the needed analytic capacities must obviously be an understanding of and facility with machine learning and other big data analytic techniques that support optimizing trends in the private sector. But an analytically sophisticated workforce must also possess the habits of mind and analytic tools needed to keep learning over time. For accessible discussions of key modes of learning and inference, see RICHARD E. NISBETT, *MINDWARE: TOOLS FOR SMART THINKING* 149-170 (2015); Cary Coglianese, *Empirical Analysis of Administrative Law*, 2002 U. ILL. L. REV. 1111, 1115-1119 (2002); Cary Coglianese, *Learning What Works in Regulation*, REG. REVIEW (Mar. 7, 2018), <https://www.theregreview.org/2018/03/07/coglianese-rubin-learning-what-works-regulation/>.

<sup>31</sup> MICHAEL E. PORTER, DAVID S. GEE & GREGORY J. POPE, *AMERICA’S UNCONVENTIONAL ENERGY OPPORTUNITY* 1, 2, 7 (2015).

based and management-based approaches to regulation, government will need to have the distinctive human infrastructure in place to establish and implement these approaches in ways that actually work well.<sup>32</sup>

Second, the federal government's information technology infrastructure needs to rise to the task. "Amid all the uncertainty about government's future," notes Donald Kettl, "there is one sure thing."<sup>33</sup> That "sure thing" is that government "will operate in a world of increasing technology and data."<sup>34</sup> Yet unfortunately, too many federal computer systems are antiquated.<sup>35</sup> As recently as 2016, the U.S. Government Accountability Office (GAO) reported that three-quarters of federal IT spending each year goes to support old "legacy systems," many of which "are becoming increasingly obsolete" due to "outdated software languages and hardware parts that are unsupported."<sup>36</sup> Not only do such aging systems need to be upgraded, but still more challenging will be finding ways to combine databases across the federal government in order to use machine learning and "big data" analysis to make government smarter. New analytic tools can give regulatory agencies an ability to optimize their human resources better too. For example, an analysis conducted at the Penn Program on Regulation has shown that the federal Occupational Safety and Health Administration could improve its targeting of limited regulatory inspection resources dramatically by combining and applying machine learning to disparate governmental and private-sector datasets. In an economy increasingly propelled by machine learning and other optimizing analytics in the private sector, it makes sense that regulatory officials need to rely on these techniques too.<sup>37</sup> Some agencies, like the U.S. Environmental

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<sup>32</sup> See NATIONAL ACADEMIES OF SCI'S., ENGINEERING, & MED., DESIGNING SAFETY REGULATIONS FOR HIGH-HAZARD INDUSTRIES 100 (2018) ("A regulator that lacks or cannot develop a required capacity, such as a staff with sophisticated risk analysis and auditing competencies, may find that the attributes of a regulation type that make it attractive can create a considerable burden and practical obstacle to regulatory effectiveness."). See generally Cary Coglianese, *Management-Based Regulation: Implications for Public Policy*, in ORG. FOR ECON. COOPERATION & DEV., RISK AND REGULATORY POLICY: IMPROVING THE GOVERNANCE OF RISK (Gregory Bounds & Nikolai Malyshev eds., 2010); Cary Coglianese et al., *Performance-Based Regulation: Prospects and Limitations in Health, Safety, and Environmental Regulation*, 55 ADMIN. L. REV. 705 (2003).

<sup>33</sup> KETTL, *supra* note 29, at 146.

<sup>34</sup> *Id.*

<sup>35</sup> See Jack Moore, *The Crisis in Federal IT that's Scarier than Y2K Ever Was*, NEXTGOV (Nov. 20, 2015), <http://www.nextgov.com/cio-briefing/2015/11/crisis-federal-it-rivals-y2k/123908/> [<https://perma.cc/3DRH-R4YV>] (explaining that archaic IT systems are vulnerable to failure, difficult to protect from cybersecurity threats, and expensive to maintain).

<sup>36</sup> *Federal Agencies Need to Address Aging Legacy Systems: Hearing Before the H. Comm. on Oversight and Gov't Reform*, 114<sup>th</sup> Cong. (2016) (testimony of David A. Powner, Director, Information Technology Management Issues), <https://www.gao.gov/assets/680/677454.pdf>.

<sup>37</sup> Cary Coglianese & David Lehr, *Regulating by Robot: Administrative Decision-Making in the Machine-Learning Era*, 105 GEO. L. J. 1147, 1160 (2017) ("For much the same reason

Protection Agency, are starting to consider how new remote sensing and other technology can be deployed for improved regulatory monitoring.<sup>38</sup> But the government has many miles still to travel in order to use digital technology and artificial intelligence to catch up with the private sector.<sup>39</sup>

Finally, an optimizing government should learn from the past in order to chart a better path forward. Society has faced innovations and their associated risks before. Yet too often in the past, new technologies have been given a regulatory “free pass,” emerging with little government oversight but leaving public harms in their wake—as with much industrial development in the nineteenth and early twentieth centuries. Or, at the other extreme, new innovations have sometimes been blocked altogether. Both approaches are decidedly non-optimizing—even clunky—in the context of today’s economy.<sup>40</sup> And yet, remnants of these approaches still persist in public policy responses to recent innovations in the economy. Perhaps one of the more salient examples comes from the energy sector, where technological advances have enabled firms to find natural gas in literally fine-grained ways by using hydraulic fracturing—or fracking—to extract previously trapped energy resources. On the one hand, the federal government has exempted unconventional natural gas development entirely from certain environmental regulations under the so-called Halliburton amendment.<sup>41</sup> On the other hand, several states, including New York, have gone to the other extreme and have imposed complete bans on this method of energy extraction.<sup>42</sup> For many innovations in the optimizing economy, the government can afford neither to give a complete regulatory free pass in the face of new risks, nor to ban outright otherwise valuable new business models and practices. For example, in the face of a variety of concerns about the harmful effects of social media platforms, whether in violating personal privacy, propagating falsehoods,

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that machine learning has been exploited in the private sector, its use holds potentially great value to government agencies.”).

<sup>38</sup> Cynthia Giles, *Next Generation Compliance*, 30 ENVTL. F., 22, 24 (2013), <https://www.epa.gov/sites/production/files/2014-09/documents/giles-next-gen-article-forum-eli-sept-oct-2013.pdf>.

<sup>39</sup> The challenge, of course, is only partly technological. As Don Kettl notes, government needs to acquire both “powerful new data tools and better managers to use them.” KETTL, *supra* note 29, at xi; *see also* WILLIAM D. EGGERS, *DELIVERING ON DIGITAL: THE INNOVATORS AND TECHNOLOGIES THAT ARE TRANSFORMING GOVERNMENT* 239 (2016) (observing that “[d]igitally mature governments also build digitally savvy workforces”). That is why attracting and nurturing an analytically sophisticated workforce is the first and foremost priority.

<sup>40</sup> ALVIN W. ROTH, *WHO GETS WHAT—AND WHY: THE NEW ECONOMICS OF MATCHMAKING AND MARKET DESIGN* 227 (2015) (noting that decision-makers “can sometimes err by regulating too slowly and not vigorously enough, but also by regulating too hastily”).

<sup>41</sup> 42 U.S.C. § 300h(b)(2).

<sup>42</sup> *See, e.g.*, Jon Hurdle, *With Governor’s Signature, Maryland Becomes Third State to Ban Fracking*, STATE IMPACT PA. (Apr. 4, 2017), <https://stateimpact.npr.org/pennsylvania/2017/04/04/with-governors-signature-maryland-becomes-third-state-to-ban-fracking/> [<https://perma.cc/SYV5-9Z7U>].

or facilitating foreign interference in elections, the appropriate response is surely not doing nothing—nor is it to outlaw such platforms altogether.<sup>43</sup> Government's appropriate response to the risks presented by most innovations will presumably lie somewhere between inaction and overbroad regulation. But making the optimal choice between these two extremes will depend in the first instance on the collection and analysis of sound information by regulators. It will also require responsible, ongoing regulatory vigilance.<sup>44</sup> Smart regulation can only optimize by regulating just enough and in the right ways when regulators are themselves smart and attentive to the need to find the proper balance.<sup>45</sup>

### CONCLUSION

What stands in the way of more optimal regulation? Significant resource constraints, bureaucratic and political entrenchment, and a status quo bias—all of these are and likely will remain major impediments for some time to come. But the barriers need to be confronted and overcome. Regulatory challenges in an optimizing economy certainly will be no easier than ones in the past; however, they will prove decidedly insurmountable if nothing is done to counteract the growing mismatch between governmental capacity and private-sector innovation. Policy action must become smarter than ever before.

The path forward to expanded economic growth will involve new, creative forms of optimization. Indeed, an American economy based on natural resources and labor abundance may already be on the decline, and, if so, the economy of the future will, by necessity, be built on optimizing what is left. With significant portions of the economy already based on an imperative to optimize, and with businesses rapidly advancing in precision and analytic sophistication, government will only be able to fulfill its responsibilities by becoming more optimizing itself.

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<sup>43</sup> For discussion of concerns raised by social media, see, e.g., Ryan Broderick, *This Is How We Radicalized The World*, BUZZFEED (Oct. 29, 2018), <https://www.buzzfeednews.com/article/ryanhatesthis/brazil-jair-bolsonaro-facebook-elections> [https://perma.cc/7VR2-QF9P]; Peter Bruce, *The Facebook Controversy: Privacy Is Not the Issue*, SCI. AMER. (April 18, 2018), <https://blogs.scientificamerican.com/observations/the-facebook-controversy-privacy-is-not-the-issue/> [https://perma.cc/M34N-DTVQ]; Joanna Stern, *Facebook Really Is Spying on You, Just Not Through Your Phone's Mic*, WALL ST. J. (March 7, 2018), <https://www.wsj.com/articles/facebook-really-is-spying-on-you-just-not-through-your-phones-mic-1520448644>. For discussion of potential regulatory responses in an era of big data, see JAMIE SUSSKIND, *FUTURE POLITICS: LIVING TOGETHER IN A WORLD TRANSFORMED BY TECH* 354-359 (2018); Dirk Helbing et al., *Will Democracy Survive Big Data and Artificial Intelligence?*, SCI. AMER. (Feb. 25, 2017), <https://www.scientificamerican.com/article/will-democracy-survive-big-data-and-artificial-intelligence/> [https://perma.cc/C39V-XGCV].

<sup>44</sup> Cary Coglianese, *Innovation and Regulatory Vigilance*, JOTWELL (October 19, 2018), <https://adlaw.jotwell.com/innovation-and-regulatory-vigilance/> (reviewing CRISTIE FORD, *INNOVATION AND THE STATE: FINANCE, REGULATION, AND JUSTICE* (2017)).

<sup>45</sup> For a wide-ranging discussion of the attributes of smart regulation—and how to achieve it—see *ACHIEVING REGULATORY EXCELLENCE* (Cary Coglianese ed., 2017).