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NOTE

Using Value-Agnostic Incentives to Promote Pharmaceutical Innovation

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Abstract. Who lives, who dies, and who decides? For more than one hundred years, innovative pharmaceuticals have cured disease, prolonged life, and reduced human suffering. However, the social welfare benefits associated with pharmaceuticals come at increasingly steep costs. Millions of Americans are unable to afford lifesaving medications, leading to calls for reform at all levels of government—including proposals for nationalized drug companies, value-based pricing, and compulsory licensing of drugs approved by the Food and Drug Administration. Although some of these proposals might be socially beneficial, this Note argues that they are doomed to short-term political failure in the United States. By directing outrage primarily at the business decisions of innovative, for-profit companies with legal monopolies over pharmaceuticals, legal scholars and policy analysts advocating for increased government intervention overlook difficult policy considerations likely to stymie novel innovation and commercialization efforts directed by politically accountable actors. For example: In a resource-strapped world, which diseases should limited research and development funds be directed toward? Should the most effective drugs be pursued, regardless of cost and delays? And given high failure rates for pharmaceuticals reaching even Phase III clinical trials, how many experimental drugs should be investigated for a specific disease? Relying on the private sector for pharmaceutical innovation allows government officials to sidestep these politically toxic questions—the drug-development equivalent of "death panels," a political term describing purported health care rationing administered by bureaucrats.

To clarify the tradeoffs policymakers face in formulating innovation incentives, this Note provides a conceptual framework for understanding pharmaceutical innovation, describes the U.S. government's current approach to incentivizing drug development, and explains why recent proposals for government intervention in drug development markets are too politically fraught to gain the broad legislative support necessary to increase access to medicines in practice. Instead, this Note proposes "value-agnostic" programs, which indirectly influence innovation while leaving original disease- and drug-level value

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judgments in private hands, as a more realistic path for pharmaceutical reform. This Note suggests, as one example of this framework, a patent buyout system that enables the U.S. government to nudge pricing while substantially maintaining current innovation incentives. Specifically, before selling or exclusively licensing an approved drug or drug candidate, recipients of certain federal drug discovery subsidies would first be required to auction off related patents, with the U.S. government maintaining the right to purchase or license at the second-highest bid price.

Table of Contents

Introduction

Approximately 125,000 Americans die each year because they do not take their medications as prescribed.[1] High prescription drug prices contribute to medication nonadherence, with millions of Americans forgoing their medications because they cannot afford them.[2] For example, only a small fraction of the estimated 3.2 million Americans infected with hepatitis C, a virus that can cause liver cancer and cirrhosis in untreated patients,[3] are treated with potent antiviral medications like Gilead's first-in-class hepatitis C drug Sovaldi (sofosbuvir).[4] Despite cure rates above 95% when using Sovaldi in combination with other medications,[5] many state Medicaid programs only cover Sovaldi's $84,000 price tag for their sickest patients.[6] Because pharmaceutical companies like Gilead own patents covering their lifesaving drugs,[7] competitors cannot make, use, sell, offer to sell, or import lower-cost generics until the patents expire or are invalidated.[8] Many patients

1. Meera Viswanathan et al., *Interventions to Improve Adherence to Self-Administered Medications for Chronic Diseases in the United States: A Systematic Review*, 157 ANNALS INTERNAL MED. 785, 785 (2012).

2. *See* Howard LeWine, *Millions of Adults Skip Medications Due to Their High Cost*, HARV. HEALTH PUB.: HARV. HEALTH BLOG (Jan. 30, 2015, 3:59 PM), https://perma.cc/L7TM-P6RW.

3. *See* Deena Beasley, *FDA Approves Gilead's Breakthrough Hepatitis C Pill*, REUTERS (Dec. 6, 2013, 1:48 PM), https://perma.cc/PP82-QVAM; Jake Harper, *States Deny Pricey Hepatitis C Drugs to Most Medicaid Patients*, NPR: SHOTS (Dec. 27, 2015, 5:32 AM ET), https://perma.cc/EK69-38GG.

4. *See* Amy Maxmen, *Hepatitis C Drugs Stoke Patent Fight*, 543 NATURE 17, 17 (2017). For a discussion of the controversy surrounding Gilead's pricing scheme, see, for example, Hannah Brennan et al., *A Prescription for Excessive Drug Pricing: Leveraging Government Patent Use for Health*, 18 YALE J.L. & TECH. 275, 286-93 (2016).

5. *See* Maxmen, *supra* note 4, at 17.

6. *See* Olga Khazan, *The True Cost of an Expensive Medication*, ATLANTIC (Sept. 25, 2015), https://perma.cc/WV6A-LGHG.

7. As of March 2019, Gilead had listed nine U.S. patents covering sofosbuvir in the Orange Book, a publication maintained by the Food and Drug Administration (FDA) listing approved drug products and related patent information submitted by the product owner. *See Patent and Exclusivity for: N204671*, U.S. FOOD & DRUG ADMIN., https://perma.cc/4D79-6VER (archived Nov. 4, 2018); *see also Approved Drug Products with Therapeutic Equivalence Evaluations (Orange Book)*, U.S. FOOD & DRUG ADMIN., https://perma.cc/9L5C-9GHK (last updated Apr. 29, 2019).

8. *See* 35 U.S.C. § 271(a) (2017). Gilead's patents related to sofosbuvir have been challenged around the world. *See* World Health Org., Patent Situation of Key Products for Treatment of Hepatitis C: Sofosbuvir 15 (2016), https://perma.cc/F3AU-73VQ. Due to data exclusivity granted under the Drug Price Competition and Patent Term Restoration Act of 1984, often known as the Hatch-Waxman Amendments, a generic drug company cannot submit an Abbreviated New Drug Application (ANDA) to the FDA until at least four years after a new chemical entity, such as sofosbuvir, is approved. *See* 21 U.S.C. § 355(c)(3)(E)(ii) (2017); *Small Business Assistance: Frequently Asked Questions*
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will therefore die prematurely before Gilead's hepatitis C patents begin to expire in 2029,[9] twenty years after Gilead filed its oldest patents covering sofosbuvir.[10]

U.S. drug prices are largely driven by what the patent-constrained market will bear; "there is little evidence of an association between research and development costs and drug prices."[11] Monopoly pricing is not unique to the pharmaceutical industry.[12] In many industries, the price of a good, such as the iPhone X, is typically (and unsurprisingly) what consumers are willing to pay.[13] But few goods produce as many positive externalities as pharmaceuticals do.[14] As drug discovery chemist and industry analyst Derek Lowe has observed, "[t]he more important, the more involved with matters of life and

for New Drug Product Exclusivity, U.S. FOOD & DRUG ADMIN., https://perma.cc/X29F-LFTB (last updated Feb. 11, 2016); *see also* Drug Price Competition and Patent Term Restoration Act of 1984, Pub. L. No. 98-417, § 101, 98 Stat. 1585, 1585-92 (codified as amended at 21 U.S.C. § 355). New chemical entity data exclusivity for sofosbuvir ended on December 6, 2018, allowing generics to file ANDAs and challenge Gilead's Orange Book patents as invalid. *See Patent and Exclusivity for: N204671*, *supra* note 7.

9. *See* Gilead Scis., Inc., Annual Report (Form 10-K), item 1, at 15 (Feb. 27, 2017). While piracy is common in many technological areas, "[t]he close link between the intangible patented information and the tangible good of the drug, along with the broader institutional, technological, and normative context, facilitates the use of exclusion rights to commodify by proxy the critical health information generated in the pharmaceutical field." Amy Kapczynski & Talha Syed, Essay, *The Continuum of Excludability and the Limits of Patents*, 122 YALE L.J. 1900, 1922 (2013).

10. *See* 35 U.S.C. § 154(c).

11. Aaron S. Kesselheim et al., *The High Cost of Prescription Drugs in the United States: Origins and Prospects for Reform*, 316 JAMA 858, 863 (2016). The market for pharmaceuticals, like health care generally, is characterized by secrecy, imperfect information, and middlemen. *See* Robin Feldman, *Perverse Incentives: Why Everyone Prefers High Drug Prices—Except for Those Who Pay the Bills*, 57 HARV. J. ON LEGIS. (forthcoming 2020) (manuscript at 5-7), https://perma.cc/QS6G-XVBQ. Accordingly, "[n]o one would ever suggest that spending within the health care system follows an ordinary, rational model." *Id.* (manuscript at 4).

12. *See, e.g.*, Abbott B. Lipsky, Jr. & J. Gregory Sidak, *Essential Facilities*, 51 STAN. L. REV. 1187, 1223-25 (1999) (discussing Microsoft's operating system monopoly); Elizabeth I. Winston, *What If Seeds Were Not Patentable?*, 2008 MICH. ST. L. REV. 321, 329-31 (discussing Monsanto's monopoly over genetically modified seeds).

13. *See* Jefferson Graham, *iPhone X's Sluggish Sales May Mean Price Cuts Are Coming*, USA TODAY (updated Mar. 28, 2018, 3:29 PM ET), https://perma.cc/UW4K-AF3U ("Low prices are not in Apple's DNA.").

14. *See* Kevin Outterson, *The Vanishing Public Domain: Antibiotic Resistance, Pharmaceutical Innovation and Intellectual Property Law*, 67 U. PITT. L. REV. 67, 89 (2005) ("Lifesaving drugs greatly benefit society. To the extent that pharmaceutical companies do not capture *all* consumer surplus created by antibiotic therapies, the public enjoys a positive externality of consumer surplus: better health at a bargain price."). *But see id.* at 86-88 (discussing the costs of inadequate access as a countervailing negative externality).

death something appears to be, the more uneasy people feel about paying market prices."[15] Paradoxically, people may feel more outrage over high prices for lifesaving therapies—drugs many believe the pharmaceutical industry is insufficiently incentivized to develop[16]—than over incremental improvements or lifestyle drugs.

Because the pharmaceutical industry relies on patents and monopoly prices for lifestyle and lifesaving drugs alike, it has been labeled the poster child for both patents[17] and corporate greed,[18] prompting calls for reform in the United States.[19] While some reform proposals only rely on indirect

15. Derek Lowe, *Drugs and Money and How It Feels*, SCI. TRANSLATIONAL MED.: IN THE PIPELINE (Jan. 10, 2008), https://perma.cc/TBU3-QTZW.

16. *See* James Love & Tim Hubbard, Comment, *The Big Idea: Prizes to Stimulate R&D for New Medicines*, 82 CHI.-KENT L. REV. 1519, 1520 (2007) (proposing a prize system tied to health care outcomes to encourage investment in "areas of greatest public interest and need"); *see also* Donald Light & Joel Lexchin, *Pharmaceutical R&D: What Do We Get for All That Money?*, BMJ, Aug. 11, 2012, at 22, 24 ("Companies are delighted when research breakthroughs occur, but they do not depend on them, declarations to the contrary notwithstanding."); Huseyin Naci et al., *Why the Drug Development Pipeline Is Not Delivering Better Medicines*, BMJ 1 (Oct. 23, 2015), https://perma.cc/9S5H-LBK2 ("Industry analysts fret that financial rewards are no longer sufficient for companies to maintain the investment needed to develop clinically useful drugs.").

17. *See* Lisa Larrimore Ouellette, Note, *How Many Patents Does It Take to Make a Drug?: Follow-On Pharmaceutical Patents and University Licensing*, 17 MICH. TELECOMM. & TECH. L. REV. 299, 300 & n.1 (2010) ("The pharmaceutical industry is the poster child for a strong patent system."); *see also infra* note 28 and accompanying text (noting that patent rights are technology neutral and do not discriminate based on a drug's significance).

18. *See, e.g.*, Eric Lamm, Comment, *Keeping Consumers Out of the Crossfire: Final-Offer Arbitration in the Pharmaceutical Market*, 65 UCLA L. REV. 926, 928 & n.5 (2018) ("The industry's profitability, together with the sensationally bad behavior of some of its corporate managers, has caused many to blame the drug pricing problem on big pharma greed." (footnote omitted)).

19. *See generally, e.g.*, Michael A. Carrier, *Five Actions to Stop Citizen Petition Abuse*, 118 COLUM. L. REV. ONLINE 82 (2018) (offering proposals to limit "the most egregious aspects" of the citizen petition process, which some pharmaceutical companies use to delay generic entry and maintain monopoly pricing); Rebecca S. Eisenberg & W. Nicholson Price, II, *Promoting Healthcare Innovation on the Demand Side*, 4 J.L. & BIOSCIENCES 3 (2017) (discussing the role of health care payers in innovation reform, including in assessments of cost effectiveness and off-label uses); Robin Feldman & Evan Frondorf, *Drug Wars: A New Generation of Generic Pharmaceutical Delay*, 53 HARV. J. ON LEGIS. 499 (2016) (proposing a systems-based reform of the Hatch-Waxman regime and advocating for greater emphasis on standards rather than rules to increase access to low-cost generic medications); Peter Lee, *Toward a Distributive Agenda for U.S. Patent Law*, 55 HOUS. L. REV. 321 (2017) (proposing a more "distributive agenda" for U.S. patent law, in part to improve access to and development of technologies such as pharmaceuticals for marginalized communities); Rachel E. Sachs, *Delinking Reimbursement*, 102 MINN. L. REV. 2307 (2018) (proposing delinking regulatory approval and payer reimbursement to promote more socially valuable drug development); Rachel E. Sachs, *Prizing Insurance: Prescription Drug Insurance as Innovation Incentive*, 30 HARV. J.L. & TECH. 153 (2016) (discussing the potential of prescription drug insurance,
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government pricing influence,[20] scholars and policy analysts have increasingly called for direct interventions, such as publicly financing pharmaceutical companies,[21] forcing them to reincorporate as benefit corporations,[22] tying federal grant funding to price controls,[23] or using the government's eminent domain power to overcome patent monopolies.[24]

Although some of these proposals requiring the government to grapple with drug prices head-on might be socially beneficial, this Note does not consider the normative merits of previous proposals. Instead, this Note argues that proponents of direct government intervention overlook a critical factor that distinguishes the public sector from the private sector and limits the feasibility of direct intervention: political accountability. While existing

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such as Medicaid, as an innovation incentive to encourage development of treatments for diseases that disproportionately affect low-income populations).

20. *See* sources cited *supra* note 19; *see also* G. Caleb Alexander et al., *Reducing Branded Prescription Drug Prices: A Review of Policy Options*, 37 PHARMACOTHERAPY 1469, 1472-75 (2017) (classifying the fifty-two solutions proposed in peer-reviewed literature into five broad categories: revising the patent system, encouraging research to increase development of new drugs, altering pharmaceutical regulation, decreasing market demand, and developing innovative pricing policies); Kesselheim et al., *supra* note 11, at 858 ("The most realistic short-term strategies to address high prices include enforcing more stringent requirements for the award and extension of exclusivity rights; enhancing competition by ensuring timely generic drug availability; providing greater opportunities for meaningful price negotiation by governmental payers; generating more evidence about comparative cost-effectiveness of therapeutic alternatives; and more effectively educating patients, prescribers, payers, and policy makers about these choices.").

21. *See* Dean Baker, Co-Dir., Ctr. for Econ. & Policy Research, Svedberg Seminar: Drugs Are Cheap; Why Do We Let Governments Make Them Expensive? 9-11 (Feb. 13, 2017), https://perma.cc/65KW-Q5QZ (discussing an alternative public financing model for pharmaceutical research and development (R&D)).

22. *See* Yaniv Heled et al., *Why Healthcare Companies Should Be(come) Benefit Corporations*, 60 B.C. L. REV. 73, 138-40 (2019) (proposing that health care companies, including pharmaceutical companies, should be forced to reincorporate as benefit corporations).

23. *See* Peter S. Arno & Michael H. Davis, *Why Don't We Enforce Existing Drug Price Controls?: The Unrecognized and Unenforced Reasonable Pricing Requirements Imposed upon Patents Deriving in Whole or in Part from Federally Funded Research*, 75 TUL. L. REV. 631, 632-36, 642 (2001) (proposing using the "march-in" provision of the Bayh-Dole Act to implement price controls); Alfred B Engelberg & Aaron S Kesselheim, Opinion, *Use the Bayh-Dole Act to Lower Drug Prices for Government Healthcare Programs*, 22 NATURE MED. 576, 576 (2016); William O'Brien, Comment, *March-In Rights Under the Bayh-Dole Act: The NIH's Paper Tiger?*, 43 SETON HALL L. REV. 1403, 1404-07 (2013) (arguing for a broader interpretation of the march-in rights provision and suggesting reforms to promote its use); *see also* Bayh-Dole Act, Pub. L. No. 96-517, § 6(a), 94 Stat. 3015, 3018-27 (1980) (codified as amended at 35 U.S.C. §§ 200-212 (2017)).

24. *See* Margo A. Bagley, *The Morality of Compulsory Licensing as an Access to Medicines Tool*, 102 MINN. L. REV. 2463, 2495 (2018) (justifying compulsory licenses because "[g]overnments have a moral obligation to provide access to life-saving treatments for their citizens"); Brennan et al., *supra* note 4, at 279-80, 353-54.

literature discusses government incentives to lower drug prices,[25] this Note highlights common features underlying existing government-backed innovation policies and explains how political headwinds, such as interest group pressure and election timing, may shape U.S. pharmaceutical innovation policy design.

Specifically, this Note argues that current U.S. pharmaceutical innovation incentives reflect the same "value agnosticism"—neutrality toward both the disease treated and the curative potential of the treatment—embedded in most of the American health care system. Value agnosticism avoids the appearance of government-administered "death panels" rationing essential health care at the cost of potential static efficiency gains (such as lower prices).[26] In policy choices ranging from tax incentives for research and development (R&D) to the regulatory approval process to intellectual property rights, the government makes no, or only coarse, distinctions between specific therapeutics,[27] leaving direct decisions about who will be treatable in private hands. For example, the U.S. government has adopted a facially technology-neutral approach to patent law,[28] a stance it has exported worldwide through free trade agreements such as the Agreement on Trade-Related Aspects of Intellectual Property Rights.[29] Therefore, patents for incremental innovations

25. *See* sources cited *supra* notes 23-24; *see also, e.g.*, Rena M. Conti & Meredith B. Rosenthal, *Pharmaceutical Policy Reform—Balancing Affordability with Incentives for Innovation*, 374 NEW ENG. J. MED. 703, 703-04 (2016) ("The high prices of prescription drugs have become an issue of paramount concern to Americans. This concern has now found its way into policy proposals from presidential candidates and is preoccupying state and federal lawmakers . . . .").

26. *Cf.* Elizabeth Weeks Leonard, *Death Panels and the Rhetoric of Rationing*, 13 NEV. L.J. 872, 878-80 (2013) (discussing the public's aversion to considering costs and limiting choices in health care).

27. *See infra* Part III.C.

28. *See* Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1156 (2002). Burk and Lemley note that many aspects of patent law, such as obviousness and enablement, are technology specific in practice. *See id.* However, if an invention is deemed patentable, the term and scope of the patent right are technology neutral. *See, e.g.*, 35 U.S.C. §§ 154(a)(2), 271. More fundamentally for pharmaceutical patents, the U.S. Patent and Trademark Office (PTO) often cannot distinguish incremental innovations from breakthroughs because firms are not required to perform clinical trials before seeking a pharmaceutical patent, so both types of contributions are granted a standardized monopoly term without a consideration of relative efficacy. *See* Benjamin N. Roin, *Unpatentable Drugs and the Standards of Patentability*, 87 TEX. L. REV. 503, 532-45 (2009).

29. *See, e.g.*, Agreement on Trade-Related Aspects of Intellectual Property Rights art. 27, ¶ 1, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, 311 [hereinafter TRIPS Agreement].

enjoy the same government-backed monopoly term—twenty years from the date of filing—as those for breakthrough therapies.[30] Similarly, data exclusivity, which constrains the ability of the Food and Drug Administration (FDA) to consider applications by additional manufacturers seeking approval to sell copycat therapeutics, makes only broad distinctions among therapeutics. For example, these rules provide different exclusivity periods for new therapeutics relative to new uses of old therapeutics (distinguishing only between small molecules and biological products), and for new therapeutics for uncommon diseases, antibiotics, and therapeutics that undergo certain pediatric trials.[31] By contrast, no major legislation to increase the government's role in valuing specific-disease treatments—at the development or marketing stage—has been passed in the United States, with most direct intervention proposals dying in committee.[32]

Thus, politically successful, value-agnostic programs could serve as a model for further short-term reform efforts in the United States. Because value-agnostic programs indirectly influence innovation while leaving original value judgments—about whom new therapeutics should be made for, when, and at what cost—in private hands, they allow the government to avoid accusations of drug-development "death panels." However, broadly conceived programs can significantly impact future R&D directions, as illustrated by the Orphan Drug Act of 1983, which dramatically increased the number of

30. *See* 35 U.S.C. § 154(a)(2). However, the term for any individual patent—again, regardless of technology—may be extended due to delay at the PTO. *See id.* § 154(b)(1)(A). Additionally, patent term extension (PTE) is available for some FDA-approved drugs. *See id.* § 156. Like most aspects of patent law, PTE does not differentiate based on the social value of a pharmaceutical or the disease it treats. *See id.*

31. *See* Ctr. for Drug Evaluation & Research & Ctr. for Biologics Evaluation & Research, FDA, Draft Guidance for Industry: Reference Product Exclusivity for Biological Products Filed Under Section 351(a) of the PHS Act 2-3 (2014), https://perma.cc/TCM4-YS94; *Frequently Asked Questions on Patents and Exclusivity*, U.S. FOOD & DRUG ADMIN., https://perma.cc/9SU2-A49S (last updated May 2, 2018); *see also* 42 U.S.C. § 262(k) (2017).

32. For example, proposals to dramatically ramp up government drug discovery funding typically fail in committee. *See, e.g.*, Medical Innovation Prize Fund Act, S. 495, 115th Cong. (2017) (proposing a $100 billion fund to reward pharmaceutical innovation in lieu of patents); Free Market Drug Act, H.R. 5155, 108th Cong. (2004) (proposing a National Institute for Biomedical Research and Development with over $20 billion in average annual funding, as well as a $50 million fund to reward significant medical advances).

approved therapies for rare diseases without specifically incentivizing development efforts for a particular disease or drug type.[33] Value-agnostic programs may even lower costs. Nevertheless, value-agnostic programs allow politicians to pass hard choices to the private sector, where they do not seem to be choices at all. But even if value-agnostic programs represent a second- (or third-) best option for cost-efficient reform, short-term advances do not preclude more radical future reforms.

This Note proceeds in four Parts. Part I offers key conceptual considerations when analyzing pharmaceutical innovation policies and highlights two overlooked players in early-stage drug development policy: early-stage financiers and developers. Part II discusses the pharmaceutical innovation landscape, focusing on tradeoffs inherent in for-profit drug development as well as potential targets for future policies. Part III, the heart of this Note, explains how political accountability may influence policymakers' incentives to directly control pharmaceutical access. Additionally, Part III demonstrates that many influential U.S. pharmaceutical innovation programs avoid making disease- and medication-level value judgments, even when such judgments appear to be consistent with program goals. Part III then argues that value-agnostic programs modeled after current government-backed incentives provide a more realistic path for further reform, at least in the short term, than the proposals dominating the existing literature. As one example of this framework, Part IV suggests a patent buyout system that could promote public health without significantly altering private decisionmakers' current role in early-stage drug discovery.

33. *See Developing Products for Rare Diseases & Conditions*, U.S. FOOD & DRUG ADMIN., https://perma.cc/E3E7-X6V6 (last updated Feb. 13, 2019) ("The program has successfully enabled the development and marketing of over 600 drugs and biologic products for rare diseases since 1983. In contrast, fewer than 10 such products supported by industry came to market between 1973 and 1983."); *see also* Orphan Drug Act, Pub. L. No. 97-414, 96 Stat. 2049 (1983) (codified as amended in scattered sections of the U.S. Code).

I. Conceptualizing Pharmaceutical Innovation

When scholars discuss "pharmaceutical innovation," they are typically referring to the discovery and development of new therapeutics. However, this umbrella definition obscures important innovation elements implicated by incentives, such as:

- *Developer*: Who discovers new therapeutics?
- *Early-stage financier*: Who finances early-stage development (such as drug discovery, preclinical trials, and Phase I/II clinical trials)?
- *Late-stage financier*: Who pays for late-stage development (such as Phase II/III clinical trials and the approval process)?
- *Marketer*: Who markets new therapeutics?
- *Payer model*: Who pays for new therapeutics, and how are those costs passed on to patients?
- *Disease*: Which diseases do developers target?
- *Therapy*: What types of therapeutics (small molecule drugs, protein-based therapeutics, cell therapies, or gene therapies) are developed?
- *Efficacy*: How effective are new therapeutics (i.e., cures versus incremental innovations)?
- *Quantity*: How many distinct new therapeutics are developed?
- *Timing*: When do new therapeutics make it to market?

Considering each innovation element highlights the potential implications of proposed reforms, including accountability traps—that is, elements of particular importance to specific patient interest groups, such as disease- and drug-level development incentives. For example, the *disease* element directly impacts public perception of fairness because, in a resource-constrained society, encouraging drug development for specific diseases necessarily favors some interest groups over others.[34] The *payer model* likewise affects public opinion. While taxpayers and the privately insured directly or indirectly pay pharmaceutical shadow taxes on patented therapeutics,[35] patients are often sensitive to copayment rates that impose an obvious burden on their

34. *See infra* Part III.A.

35. A shadow tax represents the difference between the monopolistic price for a good and its marginal cost of production. *See* Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303, 314, 371-73 (2013). Shadow taxes on patented goods are associated with deadweight loss. *See id.* at 314 & n.29. In health care, patients pay shadow taxes directly through copays and deductibles and indirectly through insurance premiums and general taxation.

pocketbooks.[36] Additionally, *efficacy* and *timing* influence health care outcomes by balancing the suffering of present and future patients: Will the public pay for modest treatments attainable now, enabling symptomatic relief for present patients who have no other options? Or will it not, potentially providing an incentive for firms to engage in riskier, long-term research efforts to produce better treatments for future patients?

Incentivizing specific *therapies* often implicates the same questions indirectly, but the answers are provided by nonaccountable private actors. And notably, not all nonaccountable private actors involved in pharmaceutical development are motivated by the same things. For example, *early-stage financier*s are often overlooked in reform discussions. However, many novel therapies are now developed by university researchers and biotech firms, not by large pharmaceutical companies.[37] These biotech firms often sell the therapies they develop to established firms for late-stage clinical trials and marketing,[38] attenuating the connection between *developer* and *early-stage financier* profits and patent-sanctioned monopoly pricing, the most controversial innovation incentive offered to pharmaceutical companies.

Part II below explains how the current for-profit drug development model works in more detail, while Parts III and IV explore how value-agnostic government programs leverage intertwined innovation elements to promote public health objectives without making direct disease- and drug-level value judgments.

II. The For-Profit Drug Development Model

Many large pharmaceutical companies are listed on major stock market exchanges.[39] As publicly traded corporations, pharmaceutical companies are structured to value shareholder interests over patient needs.[40] And drug

36. *See* Sendhil Mullainathan, *When a Co-Pay Gets in the Way of Health*, N.Y. TIMES (Aug. 10, 2013), https://perma.cc/MY7Q-C2RD.

37. Among U.S.-developed drugs approved between 1998 and 2007, over half of those considered to be scientifically innovative or responsive to unmet medical needs were developed by biotech firms and universities that spin out biotech companies. *See* Robert Kneller, *The Importance of New Companies for Drug Discovery: Origins of a Decade of New Drugs*, 9 NATURE REVIEWS DRUG DISCOVERY 867, 872 fig.2 (2010); Derek Lowe, *Where Drugs Come From: By Country*, SCI. TRANSLATIONAL MED.: IN THE PIPELINE (Nov. 9, 2010), https://perma.cc/2AU4-6V2C.

38. *See infra* notes 51-54 and accompanying text.

39. *See Big Pharma's Bets: Where They're Investing and Acquiring Across Biotech, Drug Delivery, and More*, CBINSIGHTS: RES. BRIEFS (Oct. 4, 2018), https://perma.cc/27D6-UJYT (listing the top ten publicly traded pharmaceutical companies by market capitalization).

40. *See* Michael Hiltzik, *Gilead Says Drug Profits Must Stay High to Pay for "Innovation," but 100% of Its Profits Went to Shareholders*, L.A. TIMES (Oct. 23, 2017, 1:25 PM), https://perma.cc/G4MB-DA9K; *see also* Heled et al., *supra* note 22, at 79 ("Currently, the

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companies have served their shareholders well over time, increasing revenue from $534 billion to $775 billion between 2006 and 2015.[41] In fact, in 2013, the multibillion-dollar pharmaceutical industry generated higher profit margins than any other industry.[42]

But high pharmaceutical profit margins only exist by grace of the government. The chemical formulae for pharmaceuticals are knowledge goods;[43] once a formula is published, other producers with access to appropriate manufacturing equipment can produce and sell that pharmaceutical for a price close to its marginal cost of production.[44] While estimates of development costs vary widely—from $43.4 million per new drug (estimated by Donald Light and Rebecca Warburton)[45] to $2.6 billion per approved compound (estimated by the industry-supported Tufts Center for the Study of Drug Development)[46]—the investments made in moving a drug from test tube to pharmacy shelves are indisputably large.[47] In 2015, for example, members of

development and provision of many healthcare products and services to meet public health needs remains, with the exception of hospital services, largely in the hands of traditional corporations. Traditional corporations are primarily incentivized to pursue the maximization of value for their shareholders, making stock value and profits from the sale of products and services the primary focus of corporate decisions." (footnotes omitted)).

41. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-18-40, DRUG INDUSTRY: PROFITS, RESEARCH AND DEVELOPMENT SPENDING, AND MERGER AND ACQUISITION DEALS 16 (2017).

42. *See* Richard Anderson, *Pharmaceutical Industry Gets High on Fat Profits*, BBC NEWS (Nov. 6, 2014), https://perma.cc/6762-64ED; *see also* Heled et al., *supra* note 22, at 77 (noting that the pharmaceutical industry's median return exceeds the median return for all Fortune 500 companies by a factor of two or three).

43. Knowledge goods are goods capable of being digitized. *See* Daniel J. Hemel & Lisa Larrimore Ouellette, *Knowledge Goods and Nation-States*, 101 MINN. L. REV. 167, 168 n.1 (2016). Knowledge goods are often considered to be public goods, meaning they are nonrivalrous and nonexcludable. *See* Joseph E. Stiglitz, *Knowledge as a Global Public Good*, *in* GLOBAL PUBLIC GOODS: INTERNATIONAL COOPERATION IN THE 21ST CENTURY 308, 308-10 (Inge Kaul et al. eds., 1999).

44. The drug reproducibility assumption, while largely true for small molecule drugs, does not fully apply to biological products (biologics) because the manufacturing process, which often involves a living cell, introduces inherent product variations that may affect safety and efficacy. *See Biosimilar and Interchangeable Products*, U.S. FOOD & DRUG ADMIN., https://perma.cc/4CV3-T2U7 (last updated Oct. 23, 2017).

45. Donald W. Light & Rebecca Warburton, *Demythologizing the High Costs of Pharmaceutical Research*, 6 BIOSOCIETIES 34, 47 (2011).

46. Joseph A. DiMasi et al., *Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs*, 47 J. HEALTH ECON. 20, 31 (2016); *see also Sponsored Research*, TUFTS CTR. FOR STUDY DRUG DEV., https://perma.cc/85LF-8FTS (archived May 3, 2019).

47. To obtain FDA approval to market pharmaceuticals in the United States, firms must test their new drugs for human safety and efficacy through a series of clinical research trials. *See Step 3: Clinical Research*, U.S. FOOD & DRUG ADMIN., https://perma.cc/V87W-NHUK (last updated Jan. 4, 2018). The clinical trial process begins with a small, short

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the Pharmaceutical Research and Manufacturers of America invested about $59.6 billion in R&D,[48] almost double the 2015 R&D budget of the National Institutes of Health (NIH), which was $29 billion.[49] Without government-backed monopoly power, a pharmaceutical company might face rapid competition from low-cost manufacturers, preventing the company from earning a profit on its considerable investment. Thus, to encourage new drug development, state-backed monopolies for innovation (patents) and commercialization (data exclusivity) protect pharmaceutical companies from competition for fixed time periods.[50]

While traditional innovation incentives (patents and data exclusivity) remain the norm, the innovation route that these incentives were designed for (candidate identification, preclinical testing, and clinical testing all conducted by one company) does not reflect the path most traveled today. Because of the considerable costs and risk associated with drug development,[51] today's large

study establishing safety and appropriate dosing (Phase I, 70% pass rate); progresses to larger studies of several months to two years testing efficacy (Phase II, 33% pass rate); and culminates in a large, long-term study of one to four years examining efficacy and monitoring adverse drug reactions (Phase III, 25%-30% pass rate). *See id.*

48. *Research and Development Expenditure of Total U.S. Pharmaceutical Industry from 1995 to 2017 (in Billion U.S. Dollars)*, STATISTA, https://perma.cc/ZNW3-NNA7 (archived Mar. 28, 2019).

49. *See* NAT'L SCI. BD., SCIENCE & ENGINEERING INDICATORS 2018, ch. 4, at 90 (2018), https://perma.cc/7JZU-7XWC.

50. *Cf.* Robin Feldman, *Regulatory Property: The New IP*, 40 COLUM. J.L. & ARTS 53, 54-55 (2016) (discussing how quasi-patent regulatory property extends IP rights beyond patent rights). Notably, the popular view of patents as an innovation incentive—with emphasis placed on idea conception, not reduction to practice, *see* Lisa Larrimore Ouellette, Pierson, *Peer Review, and Patent Law*, 69 VAND. L. REV. 1825, 1826 (2016)—fails to account for the rewards patents provide in the pharmaceutical industry. For most pharmaceuticals, preclinical costs are surpassed by clinical trial costs. *See* Joseph A. DiMasi et al., *The Price of Innovation: New Estimates of Drug Development Costs*, 22 J. HEALTH ECON. 151, 167 & fig.2 (2003); Stella Stergiopoulos et al., *Characterizing the Cost of Non-Clinical Development Activity*, CONTRACT PHARMA (June 5, 2013), https://perma.cc/B7CL-VABG ("According to the Pharmaceutical Research and Manufacturers of America (PhRMA), in 2011 major pharmaceutical and biotechnology companies spent $10.5 billion or 22% of total annual R&D costs on non-clinical research . . . ."). Effectively, pharmaceutical patents act as retrofitted rewards for commercialization effort (which patent law ordinarily ignores and was not designed to directly encourage), not invention. *See* Roin, *supra* note 28, at 509-11. For a discussion of how patents only indirectly and imperfectly incentivize commercialization, see Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 355-80 (2010).

51. Like those of drug development costs, estimates of clinical trial failure rates vary. *See* Derek Lowe, *A New Look at Clinical Success Rates*, SCI. TRANSLATIONAL MED.: IN THE PIPELINE (Feb. 2, 2018), https://perma.cc/RGY3-XUE4. One recent, detailed study found that 13.8% of all drug development programs eventually lead to approval, a higher probability of success than many older estimates. *See* Chi Heem Wong et al., *Estimation of Clinical Trial Success Rates and Related Parameters*, 20 BIOSTATISTICS 273, 273, 285 (2019).

pharmaceutical companies often do not conduct all steps of the process in-house.[52] Instead, many "innovative" pharmaceutical companies acquire most of their promising new drugs through mergers and acquisitions, becoming *marketers* and *late-stage financiers* for drugs developed elsewhere.[53] By decoupling innovation and commercialization, the pharmaceutical industry has created a new breed of drug developers with alternative financing and profit models.[54] Because these new innovators are often cash strapped and acquisition focused,[55] they are more reliant on ex ante innovation incentives than their predecessors and less likely to be the direct beneficiaries of ex post rewards for their efforts.

This new innovator-incentive asymmetry presents opportunities for lowering drug costs without affecting innovation rates, a common concern for drug pricing reforms.[56] Illustratively, the patent buyout proposal in Part IV

52. *See* Nicole Fisher & Scott Liebman, *Are M&A Replacing R&D in Pharma?*, FORBES (Apr. 22, 2015, 6:14 AM), https://perma.cc/QGC5-TND7. Scholars and analysts debate the net effect of mergers and acquisitions on pharmaceutical innovation. Some researchers claim that mergers dampen innovative capability, while others believe that mergers increase R&D productivity by increasing firms' scientific depth, as well as their objectivity. *Compare* Justus Haucap & Joel Stiebale, *Research: Innovation Suffers When Drug Companies Merge*, HARV. BUS. REV. (Aug. 3, 2016), https://perma.cc/CXQ9-C4R7 (describing how pharmaceutical mergers reduce innovation), *with* Michael S. Ringel & Michael K. Choy, Feature, *Do Large Mergers Increase or Decrease the Productivity of Pharmaceutical R&D?*, 22 DRUG DISCOVERY TODAY 1749, 1752-53 (2017) (finding that large pharmaceutical mergers appear to be associated with higher R&D productivity).

53. *See* Andrew Moore, *The Big and Small of Drug Discovery: Biotech Versus Pharma; Advantages and Drawbacks in Drug Development*, 4 EMBO REP. 114, 115, 116 tbl.2 (2003). Biotech companies and university spinouts transfer a small but significant fraction of their new therapeutics to established entities before FDA approval. *See* Kneller, *supra* note 37, at 872-75, 879-80.

54. *See* Jennifer Alsever, *Big Pharma Innovation in Small Places*, FORTUNE (May 13, 2016), https://perma.cc/XY49-4X5K (estimating that 64% of drugs approved in 2015 originated at startups). Some scholars have noted that smaller biotech companies may be more efficient at developing new drugs, suggesting that the R&D transition may be socially beneficial. *See, e.g.*, Donald L Drakeman, Commentary, *Benchmarking Biotech and Pharmaceutical Product Development*, 32 NATURE BIOTECHNOLOGY 621, 623-25 (2014).

55. *See, e.g.*, Richard Fisher, *Biotech and Pharma Develop a Symbiotic Relationship*, NEW SCIENTIST (Apr. 5, 2006), https://perma.cc/4DEX-8J3M ("In the past few years, biotech firms have increasingly become part of big pharma's R&D wing . . . . At the simplest level, large pharmaceutical companies need products for their depleted drugs pipelines, while cash-strapped biotech firms need an injection of money to keep their heads above water."); Joanna Glasner, *Home Run Exits Happen Stealthily for Biotech*, TECHCRUNCH (July 28, 2018), https://perma.cc/F4FP-VCZR (discussing biotech exits and milestone payments).

56. *Cf.* Colleen Chien, *Cheap Drugs at What Price to Innovation: Does the Compulsory Licensing of Pharmaceuticals Hurt Innovation?*, 18 BERKELEY TECH. L.J. 853, 855-57 (2003) (questioning the "fundamental assumption" that "[t]he twin goals of increasing access to existing medicines and promoting research and development of new medicines" are in tension); Rachel E. Sachs & Austin B. Frakt, *Innovation-Innovation Tradeoffs in Drug*

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below leverages the new innovator-incentive asymmetry while maintaining the current disease- and therapy-neutral approach to U.S. government-backed incentives discussed in Part III below.

III. Value Agnostic by Default: Existing Government-Backed Incentives

Incentives do more than encourage drug discovery. Incentive design influences strategic decisions at the heart of drug discovery—like who new therapeutics are made for, when, and at what cost.[57] The same is arguably true for U.S. medical services policy, where the government-run Medicare program has made some inroads promoting value-based care.[58] However, Medicare's value-based programs target physician and hospital services,[59] which exist in a distinct innovation ecosystem.[60] Unlike pharmaceuticals, physician services—such as care delivery systems and surgical procedures—are rarely regulated directly,[61] with limitations instead imposed largely by tort law and professional licensing boards. Moreover, medical practitioners are immune from care-related patent infringement liability,[62] so innovative procedures not protected through trade secrets can rapidly disseminate throughout the

Pricing, 165 ANNALS INTERNAL MED. 871, 871 (2016) (summarizing the pharmaceutical industry's argument that "[i]f the government limits manufacturers' ability to recoup the costs of risky research and development, including investments that fail to lead to marketable drugs, they will simply reduce their investment in developing new drugs").

57. Incentives may also affect where drugs are made. The United States arguably subsidizes access to medicines worldwide, *see* Sarah Kliff, *The True Story of America's Sky-High Prescription Drug Prices*, VOX (updated May 10, 2018, 9:19 AM EDT), https://perma.cc/QN3E-2AUS, and also develops many of the world's next-generation pharmaceuticals, *see* Kneller, *supra* note 37, at 871 fig.1. Between 1998 and 2007, almost half the drugs approved by the FDA originated in the United States, roughly tracking U.S. market size. *See id.*; Lowe, *supra* note 37.

58. *See What Are the Value-Based Programs?*, CENTERS FOR MEDICARE & MEDICAID SERVICES, https://perma.cc/7ZH4-RQMA (last updated July 25, 2018).

59. *See id.*

60. *See* Anna B. Laakmann, *When Should Physicians Be Liable for Innovation?*, 36 CARDOZO L. REV. 913, 915-16 (2015) ("Unlike medical product manufacturers, innovative physicians are not subject to mandatory regulation by the Food and Drug Administration (FDA) or other public agencies.").

61. *See* Jonathan J. Darrow, *Explaining the Absence of Surgical Procedure Regulation*, 27 CORNELL J.L. & PUB. POL'Y 189, 190-91, 194-95 (2017) ("[N]otwithstanding the frequency of surgical procedures and their often critical importance to patient health, no state or federal agency either approves the use of new surgical procedures or directly regulates existing procedures.").

62. *See* 35 U.S.C. § 287(c) (2017).

medical profession. Therefore, the potential for innovation distortion is more attenuated than in the pharmaceutical innovation context, which relies on monopoly pricing to compensate for long commercialization delays and high regulatory hurdles.

Beyond health services, pharmaceuticals inhabit an innovation ecosystem divorced from that of most consumer goods. Pharmaceuticals "carry a moral weight that most privately traded goods do not, for there is a widespread belief that people have a right to health care that they do not have to smartphones or trainers."[63] As Howard Leichter explained in his prescient 1992 article on the difficulties faced by lawmakers in designing politically accountable rationing systems in health care:

> Health care . . . has a uniquely personal aspect. The aphorism that "if you have your health, you have everything," and the empirical evidence on the importance that Americans attach to good health, suggest that health care occupies a special, if not unique, place in our value system and produces extraordinary political circumstances.[64]

For adequate existing treatments, debates on health care rights center on price[65] and cost effectiveness.[66] But when no treatment (or only inadequate treatment) exists, different questions, such as for whom to develop treatments first, are raised. Incentives provide the answers, directly or indirectly, by making certain treatments more financially attractive to early-stage financiers and developers.

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63. *The New Drugs War*, ECONOMIST (Jan. 4, 2014), https://perma.cc/5EUJ-M59A. For a discussion of the role of cognitive bias in pharmaceutical innovation policy, see Cynthia M. Ho, *Drugged Out: How Cognitive Bias Hurts Drug Innovation*, 51 SAN DIEGO L. REV. 419, 420-30 (2014). For a discussion of its role in intellectual property, see Maggie Wittlin et al., *What Causes Polarization on IP Policy?*, 52 U.C. DAVIS L. REV. 1193, 1195-99 (2018).

64. Howard M. Leichter, *Political Accountability in Health Care Rationing: In Search of a New Jerusalem*, 140 U. PA. L. REV. 1939, 1942 (1992).

65. This question can be reframed as a debate about surplus allocation between producers and consumers where the value of the surplus is both (1) high in tangible dollar terms (e.g., costs saved on alternative care, increased work capacity); and (2) high in intangible but fundamental value (e.g., quality of life). Who captures intangible surplus is an ethically loaded question at the heart of debates about cost effectiveness versus cost savings.

66. *Cf.* Frank Davidoff, Editorial, *The Heartbreak of Drug Pricing*, 134 ANNALS INTERNAL MED. 1068, 1069 (2001) (differentiating cost savings from cost effectiveness). Sofosbuvir, at $84,000 per treatment, is cost effective. *See* Michael Hiltzik, *Is That $100,000 Hepatitis Treatment Worth the Price?: Yes, but Can Society Afford It?*, L.A. TIMES (Jan. 15, 2016, 2:35 PM), https://perma.cc/C9UU-79S4. This does not mean anyone wants to pay for it, especially public and private payers with many hepatitis C patients whose costs are normally incurred over time and across insurers. *See id.*

A. Therapeutic Gaps and Rationing Rhetoric

Given the fundamental interests at stake in drug development and marketing, it is perhaps unsurprising that the federal government does not directly control many aspects of pharmaceutical policy, even though intervention might improve health outcomes for current patients.[67] Making drugs is expensive and inefficient.[68] However, if the government wanted to run a drug company and subsidize all stages of preclinical and clinical drug development, it could, just as the government could nationalize all health care if it wanted to. But the federal government probably does not want to run a pharmaceutical company, for reasons unrelated to competency.[69]

In an era of tax cuts and falling scientific funding,[70] dramatically ramping up direct drug development funding would be a political challenge.[71] More importantly though, the government would have to answer politically problematic questions if the National Center for Advancing Translational Science (NCATS)[72] were repurposed as a public-sector Pfizer. For instance, which of the thousands of currently untreatable rare diseases[73] deserve attention first? Should funding be directed to additional drugs for common

67. *But see infra* notes 131-41 and accompanying text (discussing NIH funding priorities).

68. *See* Paul Workman et al., Commentary, *How Much Longer Will We Put Up with $100,000 Cancer Drugs?*, 168 CELL 579, 580 (2017).

69. For a prescient discussion of the difficulties faced by lawmakers in designing politically accountable rationing systems in health care, see Leichter, *supra* note 64, at 1942-51.

70. General tax cuts may act as an implicit R&D subsidy, although lower overall rates do not directly encourage R&D-related activities and may dilute the incentive power of tax credits.

71. For a discussion of how industry, public interest groups, and legislators arrived at the Hatch-Waxman Amendments, which fundamentally altered the pharmaceutical marketplace over thirty years ago, see, for example, Erika Leitzan, *The History and Political Economy of the Hatch-Waxman Amendments*, 49 SETON HALL L. REV. 53 (2018). *See also* Drug Price Competition and Patent Term Restoration Act of 1984, Pub. L. No. 98-417, 98 Stat. 1585 (codified as amended in scattered sections of the U.S. Code). If anything, views on government intervention in health care have become more polarized over time. *See* Frank Newport & Andrew Dugan, *Partisan Differences Growing on a Number of Issues*, GALLUP (Aug. 3, 2017), https://perma.cc/9J6P-FHA2 ("Even in 2001, Republicans were much less likely than Democrats to say the federal government should be responsible for ensuring all citizens have healthcare coverage (45% vs. 75%, respectively), but from 2006 to 2009, GOP support for this position fell 20 points to 21% in 2009—and it has not recovered considerably since.").

72. NCATS focuses on accelerating translational science, including clinical trials and drug discovery for rare and neglected diseases. *See* Nat'l Ctr. for Advancing Translational Scis., Nat'l Insts. of Health, Transforming Translational Science 1 (2018), https://perma.cc/F9MK-5DGK.

73. *See FAQs About Rare Diseases*, GENETIC & RARE DISEASES INFO. CTR., https://perma.cc/PS5L-E62T (last updated Nov. 30, 2017).

conditions if current treatments are inadequate for many patients?[74] If so, should that funding come at the expense of financing R&D for less common diseases with no treatment at all? With limited finances, should any money be spent developing treatments for neglected tropical diseases that afflict few to no Americans each year?

These are all questions about life and death—who lives and who dies. The boy with a rare, untreatable neurodegenerative disease?[75] Or the girl whose skeleton keeps growing due to a disorder affecting one in two million people?[76] Because pharmaceutical companies do not owe a duty to the public to spend private funds to maximize public health, we celebrate their breakthroughs with only minor grousing about what other outcomes those funds could have purchased. By contrast, when the federal government spends taxpayer money on R&D, the public holds politically accountable actors responsible for their choices.[77]

And the government would have to make choices. Despite spending nearly $60 billion annually on drug development,[78] pharmaceutical companies only received FDA approval for thirty-one new drugs per year on average between 2008 and 2016.[79] Even assuming sufficient knowledge of disease biology[80] and

74. Disregarding their net impact on social welfare, many "me-too" drugs are happy accidents resulting from convergent research. *See* Derek Lowe, *Those Me-Too Drugs*, SCI. TRANSLATIONAL MED.: IN THE PIPELINE (Jan. 26, 2011), https://perma.cc/6SWQ-MU3Z. Because so many drugs fail clinical trials, "allowing multiple firms to tackle these problems may sometimes be required [to produce] a single successful drug within a class." Roin, *supra* note 28, at 540 n.192. Illustratively, about 400 clinical trials for Alzheimer's disease have failed to produce an effective treatment. *See* Melissa Healy, *One of the Most Promising Drugs for Alzheimer's Disease Fails in Clinical Trials*, L.A. TIMES (Jan. 9, 2018, 3:55 PM), https://perma.cc/PC5F-2Q9U. Given the high failure rate and the prevalence and severity of Alzheimer's, it is not clear that the public experiences a relative harm if competition ultimately produces many me-too Alzheimer's drugs earlier rather than one drug years later.

75. *See* Meghana Keshavan, *Their Children Are Dying. So These Families Are Racing to Raise Money for Research No One Else Will Fund*, STAT (June 30, 2017), https://perma.cc/JRH7-CKRH.

76. *See* Carl Zimmer, *The Girl Who Turned to Bone*, ATLANTIC (June 2013), https://perma.cc/5J8U-W2YF.

77. *See, e.g.*, T.R. Reid, *Where's the War on Alzheimer's?*, AARP BULL. (Jan.-Feb. 2015), https://perma.cc/S42X-KMUW.

78. *See supra* text accompanying note 48.

79. CTR. FOR DRUG EVALUATION & RESEARCH, U.S. FDA, ADVANCING HEALTH THROUGH INNOVATION: 2017 NEW DRUG THERAPY APPROVALS 9 (2018), https://perma.cc/PU9B-Z5B8. In 2017, only 33% of new FDA-approved drugs were first in class (i.e., had novel mechanisms for treating diseases) and only 39% were approved to treat rare diseases. *See id.* at 10.

80. *See* Jeff Settleman & Robert L. Cohen, Commentary, *Communication in Drug Development: "Translating" Scientific Discovery*, 164 CELL 1101, 1101 (2016) ("[D]isease biology is immensely complex, and despite an ever-increasing understanding of both

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that the lowest estimate of cost per approved drug ($43.4 million) would apply to public drug discovery,[81] developing new therapeutics for patients suffering from every one of the thousands of rare diseases without treatment options would cost over $282 billion, an almost ten-fold increase over the NIH's total 2015 R&D budget.[82] Using the more widely quoted estimate of $2.6 billion per new drug,[83] the cost would skyrocket to $16.6 trillion, over four times the federal government's $4 trillion total budget in 2017.[84] And those drugs probably would not be cures, just like the drugs the R&D cost estimates are based on. Drug development may buy more health than it costs, but the government would need to weigh future health against present education, security, and social welfare to finance treatments for even a tenth of the currently untreatable diseases.[85]

Moreover, there are no "right" answers to many life and death questions implicated by pharmaceutical development. With high, individualized stakes but no objective metric to hold regulators accountable, regulators may be overly influenced by interest group pressure.[86] And any "objective" metric will reflect largely subjective values, which may expose the decisionmaking process to gaming (for longstanding calculations) or capture (for the oft revised).[87]

Despite the potential for regulatory capture, executive agencies following legislative directives might be the best actors to make unpopular life or death decisions. But to date the government has shown no interest in displacing

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basic and disease biology, our ability to identify the most relevant therapeutic targets and to discover drugs that selectively, effectively, and safely modulate those targets to produce clinical benefit remains frustratingly limited.").

81. *See supra* text accompanying note 45.

82. *See supra* text accompanying note 49.

83. *See supra* text accompanying note 46.

84. *See* Leigh Angres & Jorge Salazar, Cong. Budget Office, The Federal Budget in 2017 (2018), https://perma.cc/H68J-UX5M. In 2017, total national health care spending by both public and private payers was similar in magnitude to the federal budget, at around $3.4 trillion. *See* Ctrs. for Medicare & Medicaid Servs., National Health Expenditure Projections 2018-2027, at 1 (n.d.), https://perma.cc/AKG6-76T5.

85. For a discussion regarding the high costs of cures, see, for example, Maria Kefalas, *How Much Would You Pay for the Miracle of Gene Therapy?*, STAT (May 3, 2018), https://perma.cc/VU2G-V43S.

86. *See* Leichter, *supra* note 64, at 1954-56.

87. *See generally* Sidney A. Shapiro & Rena Steinzor, *Capture, Accountability, and Regulatory Metrics*, 86 TEX. L. REV. 1741, 1742-46 (2008) (discussing difficulties in holding regulatory agencies accountable using conventional regulatory metrics). Illustratively, in the physician services context, ineffective regulation and gaming have limited the impact of Medicare reform efforts. *See* Nicholas Bagley, *Bedside Bureaucrats: Why Medicare Reform Hasn't Worked*, 101 GEO. L.J. 519, 521-25 (2013) (connecting failed Medicare reforms to poor institutional design and overreliance on physician-bureaucrats).

private sector decisionmakers. Given high levels of political polarization around health care policy, it is not clear that the government currently has the public mandate to make tough policy decisions, even if legislators were interested in doing so.[88] Accordingly, this Note's proposal in Part IV below only enables executive agencies to indirectly influence pharmaceutical development priorities.

Furthermore, the American public's distaste for so-called "death panels," impersonal tribunals which ostensibly make health care decisions based on predetermined economic criteria,[89] limits the practicability of government-controlled drug development. After all, countries that have intervened at the marketing level have experienced significant interest group pressures to pay for existing treatments, especially for diseases with only one treatment option.[90] With a twelve-to-fifteen-year timeline for moving a drug from lab bench to bedside,[91] the potential reward of lower drug prices many years down the line comes with considerable short-term political risk. Blaming Gilead for avoidable deaths is easy. Committing to save lives—and paying for it—is not.

B. Incentive Distortions in Current Proposals

Given political realities, sweeping U.S. health care reform, including government price control for all pharmaceuticals, is probably not coming soon.[92] Politicians and the public are uncomfortable putting a price tag on health,[93] and value-based reforms, which tie prices or regulatory approval for all medications to the number of Quality-Adjusted Life Years (QALYs) or

88. *See* Sarah Frostenson, *Health Shouldn't Be Contentious. But It's Incredibly Polarizing.*, VOX (updated Mar. 23, 2017, 1:10 PM EDT), https://perma.cc/CS4W-WEC2.

89. *See, e.g.*, Carrie Lukas, Opinion, *The Truth Behind Obamacare's "Death Panels,"* U.S. NEWS & WORLD REP. (Dec. 10, 2012, 8:00 AM), https://perma.cc/D7W4-36YZ.

90. *See, e.g.*, Robert Steinbrook, *Saying No Isn't NICE—The Travails of Britain's National Institute for Health and Clinical Excellence*, 359 NEW ENG. J. MED. 1977 (2008); Theresa Boyle, *Ontario's Special Drug Program Mired in Backlog*, TORONTO STAR (Oct. 12, 2010), https://perma.cc/UW6G-MVUQ.

91. *See Drug Development: The R&D Journey*, BAYER AG, https://perma.cc/YD7C-W2DB (archived Mar. 28, 2019).

92. Despite President Trump's populist campaign promises, the Trump Administration's May 2018 blueprint for lowering drug prices did not include government price negotiation, focusing instead on "giv[ing] private entities more tools to negotiate better deals on behalf of consumers, insurers and employers." *See* Robert Pear, *Trump Promises Lower Drug Prices, but Drops Populist Solutions*, N.Y. TIMES (May 11, 2018), https://perma.cc/DYY2-U79N.

93. *Cf.* Robert Rubin, *Value Pricing for Drugs: Whose Value, What Price?*, HEALTH AFF.: BLOG (Mar. 28, 2016), https://perma.cc/6YAX-U5ND ("We need a public conversation about the economic value placed on a year of life, which is underlying all of these analyses. This simply has not been done in the US.").

Disability-Adjusted Life Years (DALYs) resulting from treatment,[94] implicate the same "death panel" accountability traps that plague health care generally. Moreover, many breakthrough therapies paradoxically may not fare well under value-based pricing proposals, reducing incentives to develop even the drugs that should be most favored when value dictates price. Some very expensive drugs are cost effective, but the tremendous efficacy that makes them cost effective also implicates health care rights.[95] While cost-effective drugs short of cures, or those that only work in a small patient population, often escape public pricing censure, the most effective drugs for common diseases inspire debate.[96]

Assuming the government lacks an appetite for comprehensive value-based drug pricing, any policy reform will affect drugs on a piecemeal basis. To evaluate how piecemeal price controls may distort incentives, consider one innovative government patent use scheme proposed by Hannah Brennan and colleagues.[97] They propose using the government's patent eminent domain power under 28 U.S.C. § 1498[98] to purchase generic versions of some patented medicines, providing "full" compensation to the innovator based on risk-adjusted R&D expenditures (reduced to reflect the proportion of the worldwide market captured by the government's expected use) plus a reasonable profit.[99] Because reasonable profit calculations are tied to generic drug prices, innovators operating under this scheme would receive roughly the same reward for developing a cure for AIDS as they would for a diabetes drug similar to those already on the market, assuming risk-adjusted R&D costs were similar.[100] Thus, unlike the value-agnostic programs discussed in Subpart C

94. *See* Brennan et al., *supra* note 4, at 323.

95. *See supra* note 66 and accompanying text.

96. Corporate decisions may reflect this tension. Bristol-Myers Squibb, for example, sold its global diabetes business in 2014 to restructure as a specialty-drug company. *See* GERRY HANSELL ET AL., THE BOS. CONSULTING GRP., THE 2016 VALUE CREATORS REPORT: CREATING VALUE THROUGH ACTIVE PORTFOLIO MANAGEMENT 21 (2016), https://perma.cc/6GD6-DNU6.

97. *See* Brennan et al., *supra* note 4.

98. Under 28 U.S.C. § 1498, if the United States uses a patented invention without a license, "the owner's remedy shall be by action against the United States in the United States Court of Federal Claims for the recovery of his reasonable and entire compensation for such use and manufacture." 28 U.S.C. § 1498(a) (2017).

99. *See* Brennan et al., *supra* note 4, at 315-17. The profit would be a share of the generic drug profit. *See id.* at 315 & n.193. As discussed above, generic drug profit margins are very low. *See* Cynthia Koons, *Why We May Lose Generic Drugs*, BLOOMBERG BUSINESSWEEK (Apr. 11, 2018, 2:00 AM PDT), https://perma.cc/FX9A-QVMG; *supra* notes 43-44 and accompanying text.

100. Notably, generic drug profits do not reflect innovator risk at either the development or product liability level. Because generic drug manufacturers cannot alter drug labeling, they are generally insulated from state law product liability claims.
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below, the proposed § 1498 compensation program goes beyond ignoring specific therapeutic value in policymaking. Instead, the scheme, as applied, effectively eliminates therapeutic value as a consideration for setting ex post rewards.

If applied broadly, § 1498 compensation would not provide any signal to innovators about what treatments (*therapy*, *efficacy*, *disease*) to develop. Nor would it incentivize companies to pursue risky therapeutics—pure risk adjustment merely compensates for the likelihood of failure. Because investors and managers are risk averse,[101] firms may gravitate toward lower risk projects even if they develop enough drugs to feel risk neutral under the scheme. Without risk premiums, small venture-backed biotech firms may be especially likely to change their R&D focus because their fates are tied to only one or two therapeutics.

Beyond risk, the proposed compensation scheme may also make firms neutral to patient population size. Superficially, the additional per-unit royalty should nudge innovators to pursue treatments for common diseases. However, uncompensated product liability risk may be higher with more patients,[102] and the interplay between volume and profit in the generic industry is complex because more generics tend to enter large markets, driving down profits per unit.[103] As a result, § 1498 compensation may (or may not) provide a small push away from orphan disease research, despite enormous existing needs.

But there is reason to believe that § 1498-style pricing would remain the exception under the proposal, rather than the rule. Brennan and colleagues favor limited use and argue that "the government's mere invocation of its government use power in a single pharmaceutical patent case will immediately impact prices in other cases."[104] However, uniform price drops did not occur when the government threatened to invoke § 1498 to procure ciprofloxacin

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See Mut. Pharm. Co. v. Bartlett, 133 S. Ct. 2466, 2470, 2480 (2013). Accordingly, risky drugs may be less valuable overall under this scheme because reasonable profits are not risk adjusted.

101. *See* Todd A. Gormley & David A. Matsa, *Playing It Safe?: Managerial Preferences, Risk, and Agency Conflicts*, 122 J. FIN. ECON. 431, 445-47 (2016) (explaining managerial preferences for "playing it safe"); Jessica Stillman, *5 Harsh Truths About Venture Capital from an Industry Insider*, INC. (Feb. 10, 2016), https://perma.cc/3WB3-XX5N (discussing venture capitalists' risk aversion).

102. For a discussion of innovator liability for injuries inflicted by generic drugs under state law, see, for example, Eric G. Lasker et al., *Taking the "Product" Out of Product Liability: Litigation Risks and Business Implications for Innovator and Co-Promoter Liability*, 82 DEF. COUNS. J. 295 (2015).

103. *See* Chintan V. Dave et al., Correspondence, *Prices of Generic Drugs Associated with Numbers of Manufacturers*, 377 NEW ENG. J. MED. 2597, 2598 fig.1 (2017).

104. Brennan et al., *supra* note 4, at 321.

during the anthrax scare in the early 2000s.[105] Unless the government demonstrates more political courage than it has to date in health care, it is not clear that result would differ today.

Accordingly, unless politically accountable actors were willing to satisfy all interest groups by asserting, or showing willingness to assert, eminent domain over all therapies, § 1498 price controls would likely be limited to uncontroversial cases. In several instances when the government has directly intervened to upset pharmaceutical monopolies, it has done so to procure antibiotics,[106] which most large pharmaceutical companies no longer develop because they are not profitable enough.[107] But antibiotics are unique among therapeutics; anyone can catch an infectious disease, inducing widespread fear[108] and a broadly felt need for readily available antibiotics to halt the spread of the disease. Additionally, unlike many marketed therapeutics that target specific diseases (such as particular cancers), most antibiotics are "broad spectrum," showing efficacy against many infections.[109] Most Americans support increasing access to effective antibiotics and antiviral therapies, which is reflected in U.S. government initiatives to improve antibiotic accessibility.[110] It is unlikely that the same broad political support would exist if the U.S. government chose to subsidize treatment—whether through eminent domain procurement or targeted drug development—for a handful of the up to 7,000 rare diseases believed to exist, without providing similar benefits to the 25 to 30 million other Americans suffering from other rare, untreatable diseases.[111]

Furthermore, even if the government were willing to grant compulsory licenses under § 1498, patents are not the only barrier to entry for generics. For

105. The federal government threatened to invoke § 1498 in late 2001. *See* Jacquie Lee, *Can an Obscure, 100-Year-Old Patent Law Take On Big Pharma?*, BLOOMBERG L. (May 21, 2018), https://perma.cc/U73K-BB5D ("In 2001, Tommy Thompson, then the secretary for the Department of Health and Human Services, threatened to use Section 1498 to create versions of the antibiotic ciprofloxacin after an anthrax scare following 9/11."). Yet drug company profits in 2002 only dropped 3.5% relative to 2001 despite a generally "anemic national economy," suggesting minimal if any impact on general drug pricing. *See* PUB. CITIZEN, 2002 DRUG INDUSTRY PROFITS: HEFTY PHARMACEUTICAL COMPANY MARGINS DWARF OTHER INDUSTRIES 1 (2003), https://perma.cc/MV9E-7WX8.

106. *See* Brennan et al., *supra* note 4, at 303-06.

107. *See* Maryn McKenna, *We Need Antibiotics. They're Not Profitable to Make. Who Pays?*, NAT'L GEOGRAPHIC (May 23, 2015), https://perma.cc/VXU9-RRJU.

108. *See* G. Pappas et al., *Psychosocial Consequences of Infectious Diseases*, 15 CLINICAL MICROBIOLOGY & INFECTION 743, 743-45 (2009).

109. *See generally, e.g.*, Edwin M. Ory & Ellard M. Yow, *The Use and Abuse of Broad Spectrum Antibiotics*, 185 JAMA 273 (1963).

110. *Cf.* Nicholas Bagley & Kevin Outterson, Opinion, *We Will Miss Antibiotics When They're Gone*, N.Y. TIMES (Jan. 18, 2017), https://perma.cc/P89Z-Z4D4 (summarizing efforts by Congress and administrative agencies to "fix the broken antibiotic business model").

111. *See FAQs About Rare Diseases*, *supra* note 73.

example, even with a compulsory license, most generics could not enter the U.S. market without obtaining FDA approval.[112] Under the current rules, innovators are entitled to data exclusivity, a five- to twelve-and-a-half-year time period in which no generic can rely on the innovator's clinical trial data to obtain FDA approval.[113] Even after data exclusivity expires, obtaining approval for a new copycat can take several months or years, particularly for biological drugs with heightened regulatory requirements, because the generic manufacturer must demonstrate bioequivalence[114] and good manufacturing practices.[115]

Under the § 1498 scheme, innovators could still charge supracompetitive prices before generics obtained marketing approval from the FDA. Their ability to price supracompetitively during FDA review would likely depend on whether a therapeutic could be ethically denied to patients for several months to years—that is, whether the next-best treatment option provides enough clinical benefit to the patient that a doctor can wait out the FDA review process rather than prescribe the treatment while the innovator faces no generic competition. Accordingly, the scheme might motivate innovators to target acute or terminal conditions in lieu of chronic diseases.

Subpart C below explains the government's current approach to incentivizing drug development and access to medicines. By relying on the private sector for value determinations, the government sidesteps the politically toxic questions inherent in value-based programs, as well as the incentive distortions that may result from eliminating value judgments altogether. The value-agnostic proposal in Part IV of this Note is modeled after the programs discussed below.

C. Value Agnosticism in Pharmaceutical Innovation

To date, the U.S. government has adopted a hands-off approach to pharmaceutical innovation, consistent with the political accountability impediments discussed in Subpart A above. From patent term and patent term extension (PTE),[116] to the FDA approval process and regulatory exclusivity,[117] to R&D-

112. *See* Brennan et al., *supra* note 4, at 340-45.

113. *See* Henry Grabowski et al., *Data Exclusivity for Biologics*, 10 NATURE REVIEWS DRUG DISCOVERY 15 (2011).

114. *See* Henry G. Grabowski et al., *Regulatory and Cost Barriers Are Likely to Limit Biosimilar Development and Expected Savings in the Near Future*, 33 HEALTH AFF. 1048, 1049-50 (2014) (estimating that obtaining approval for a complex biosimilar may take more than five years, compared with two to three years for small molecule generics).

115. *See Current Good Manufacturing Practice (CGMP) Regulations*, U.S. FOOD & DRUG ADMIN., https://perma.cc/5S8B-EGQF (last updated Nov. 1, 2018).

116. *See supra* text accompanying note 30.

117. *See supra* text accompanying note 31.

related tax incentives[118] and rights retained in federally developed inventions under Bayh-Dole,[119] to Medicaid rebates,[120] the U.S. government makes no, or only coarse, distinctions based on disease targeted or therapeutic value.

1. Value-agnostic federal drug development subsidies

The costs of drug development are not borne entirely by for-profit companies, and federal drug development subsidies provide several examples of value agnosticism in action. Presently, the government, an *early-stage financier*, funds pharmaceutical R&D through direct and indirect mechanisms, leading some to complain that taxpayers pay twice for new medicines.[121] Table 1 below summarizes some of the major federal drug development subsidies, which total about $36 billion annually. For comparison, worldwide R&D spending by U.S.-owned pharmaceutical companies, along with U.S.-based R&D by foreign companies, totaled approximately $89 billion in 2014.[122]

Table 1

Major Federal Drug Development Subsidies

Funding Source	Incentive Type	Magnitude of Incentive
Department of Health and Human Services (HHS) R&D funding	Ex ante	$30.4 billion (in 2015)[123]
Patent licensing revenue supported by Bayh-Dole	Ex post	$3.0 billion (in 2016)[124]
Pharmaceutical R&D-related tax credits	Ex ante	$1.2 billion (in 2014)[125]
Orphan drug tax credit	Ex ante	$1.5 billion (in 2014)[126]

118. *See infra* text accompanying notes 165-73.

119. *See infra* notes 142-51 and accompanying text.

120. *See infra* Part III.C.1.c.

121. *See, e.g.*, Peter Arno & Michael Davis, Opinion, *Paying Twice for the Same Drugs*, WASH. POST (Mar. 27, 2002), https://perma.cc/4BSQ-FS63.

122. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 41, at 29.

123. *See* NAT'L SCI. BD., *supra* note 49, ch. 4, at 86 tbl.4-16.

124. This figure covers revenue across all technologies. *See* ASS'N OF UNIV. TECH. MANAGERS, FY 2016 AUTM U.S. LICENSING ACTIVITY SURVEY: A SURVEY OF TECHNOLOGY LICENSING AND RELATED ACTIVITY FOR U.S. ACADEMIC AND NONPROFIT INSTITUTIONS AND TECHNOLOGY INVESTMENT FIRMS 4, 12 (2016).

125. U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 41, at 38.

126. *Id.* at 37.

This Subpart briefly explains these federal drug development subsidies, emphasizing the value agnosticism baked into current financing schemes.

a. Direct funding: Bayh-Dole and academic medicines

Across technological fields, the federal government annually funds more than $100 billion of direct R&D conducted by federal entities, businesses, and academic institutions.[127] During the 2015 fiscal year, the government provided about $30.4 billion in R&D funding to the Department of Health and Human Services (HHS),[128] the agency housing the NIH. HHS is the main federal funding source for health-related R&D,[129] and most of its R&D budget finances research by extramural scientists and engineers.[130]

NIH grants: While NIH grants are frequently associated with academic labs, pharmaceutical companies and other for-profit businesses are also eligible for federal funding.[131] Government grants to extramural researchers act as ex ante innovation incentives, with government—rather than market—actors determining which projects to fund (*developer*, *therapy*, *disease*, and *quantity*) and how much.[132]

In setting funding priorities, the NIH considers public health, "scientific merit, portfolio balance, and budgetary considerations."[133] Additionally, the NIH funds solicited and unsolicited proposals that "support the advancement of the NIH mission to enhance health, extend healthy lives, and reduce the burdens of illness and disability,"[134] using peer review to help make funding decisions.[135] Thus, NIH funding priorities are one important exception to the general rule that the government does not directly influence pharmaceutical innovation at the specific-disease level.

But the exception proves the rule. While the NIH makes decisions affecting human health, it sidesteps many accountability concerns by broadly

127. *See* NAT'L SCI. BD., *supra* note 49, ch. 4, at 74, 75 tbl.4-15.

128. *Id.* ch. 4, at 86 tbl.4-16, 90.

129. *Id.* ch. 4, at 90.

130. *See id.* ch. 4, at 86 tbl.4-16.

131. *See* Lee Katterman, *A Few Companies Are Reaping the Benefits of NIH Investigator-Initiated Basic Grants*, SCIENTIST (Nov. 27, 1995), https://perma.cc/MW65-QLAV.

132. *See* Hemel & Ouellette, *supra* note 35, at 320-21.

133. *See* Sally Rockey & Carrie Wolinetz, *Burden of Disease and NIH Funding Priorities*, NIH EXTRAMURAL NEXUS (June 19, 2015), https://perma.cc/3CG6-RN7P.

134. *See Grants Basics*, NAT'L INSTITUTES HEALTH, https://perma.cc/5E2U-DVCM (last updated Feb. 21, 2017).

135. *See Peer Review*, NAT'L INSTITUTES HEALTH, https://perma.cc/J4BK-CU7U (last updated Dec. 11, 2018).

funding R&D.[136] Instead of directing tens of millions of dollars into a single product, like pharmaceutical developers do, the NIH funds projects in 285 research or disease areas,[137] providing an average research project grant of $520,429 in 2017.[138] In most instances, NIH funding is only weakly connected to new therapeutics, with over half of the NIH R&D budget going toward early-stage research like target discovery.[139] Moreover, NIH basic science funding produces cross-disease spillovers (i.e., insights regarding conditions beyond the disease directly under investigation), mitigating some concerns about over- or underfunding of treatments for specific diseases.[140]

Furthermore, the NIH is one ex ante funding source among many for researchers with promising projects.[141] Accordingly, NIH funding priorities are less likely to steer drug development directions than are pricing or regulatory reforms, which unavoidably impact the ex post compensation available to innovators.

Bayh-Dole patents: Under the Bayh-Dole Act of 1980, extramural researchers maintain patent rights to inventions they create using federal grants from the NIH and other government agencies, subject to certain statutory conditions.[142] Specifically, a federal grant recipient must notify the funding agency about its

136. *See NIH Research Grants—Digital Media Kit*, NAT'L INSTITUTES HEALTH, https://perma.cc/F4G5-NY76 (last updated Mar. 20, 2019).

137. *Estimates of Funding for Various Research, Condition, and Disease Categories (RCDC)*, NIH RES. PORTFOLIO ONLINE REPORTING TOOLS, https://perma.cc/9CRH-A2J7 (last updated June 30, 2018).

138. *See* Mike Lauer, *FY 2017 by the Numbers*, NIH EXTRAMURAL NEXUS (Mar. 7, 2018), https://perma.cc/AV6J-BJ92.

139. *See* Mike Lauer, *NIH's Commitment to Basic Science*, NIH EXTRAMURAL NEXUS (Mar. 25, 2016), https://perma.cc/CR9Z-UR9F (noting funding for research "without specific applications towards processes or products in mind").

140. *See* Pierre Azoulay et al., *Public R&D Investments and Private-Sector Patenting: Evidence from NIH Funding Rules* 31-33 (Nat'l Bureau of Econ. Research Working Paper Series, Working Paper No. 20,889, 2017), https://perma.cc/8DRK-5V2J.

141. *See* Michael Anft, *When Scientific Research Can't Get Federal Funds, Private Money Steps In*, CHRON. PHILANTHROPY (Feb. 8, 2015), https://perma.cc/EY4Z-CRNY (discussing private foundation research funding); David Gorn, *Will State Voters Continue to Pour Money into Stem Cell Research?*, NPR: SHOTS (Jan. 25, 2018, 5:00 AM ET), https://perma.cc/9S8K-DTAT (discussing state funding for regenerative medicine research). In addition, venture capitalists have invested several billion dollars into life sciences ventures. *See Life Sciences Venture Capital Funding in the United States in 2016, by Cluster (in Billion U.S. Dollars)*, STATISTA, https://perma.cc/4NDM-25K6 (archived Mar. 28, 2019) (indicating that venture capital funding in the life sciences in the San Francisco Bay Area and the Greater Boston Area exceeded $6 billion combined in 2016).

142. *See* Bayh-Dole Act, Pub. L. No. 96-517, § 6(a), 94 Stat. 3015, 3018-27 (1980) (codified as amended at 35 U.S.C. §§ 200-212 (2017)).

invention within a reasonable amount of time.[143] Assuming no public disclosures have been made that would create a patentability time bar,[144] the grantee then has two years to decide whether to retain patent rights, plus an additional year to file a patent application if rights are retained.[145] The funding agency may pursue patent rights in any jurisdiction (domestic or foreign) where the grantee chooses not to file a patent application.[146]

All Bayh-Dole patents must specify that the government maintains certain rights in the federally funded invention,[147] although this disclosure requirement is frequently ignored.[148] Among other rights, the funding agency retains a "nonexclusive, nontransferrable, irrevocable, paid-up license" to the patent,[149] and the agency may (but never does[150]) exercise march-in rights to issue additional licenses if necessary "to alleviate health or safety needs," or to address a patentee's failure to take "effective steps to achieve practical application."[151] Part IV.A below revisits the strings theoretically attached to Bayh-Dole patents.

Academic medicines: While Bayh-Dole may not be the "most inspired piece of legislation to be enacted in America over the past half-century,"[152] it has spurred a formidable amount of pharmaceutical R&D.[153] Illustratively, more than $100 billion in NIH funding contributed to over two million publications related to new drugs approved by the FDA between 2010 and 2016, with at least

143. *See* 35 U.S.C. § 202(c)(1). Regulations implementing the Bayh-Dole Act have required disclosure within two months. *See* 37 C.F.R. § 401.14(c)(1) (2018).

144. *See* 35 U.S.C. § 102.

145. *See id.* § 202(c)(2)-(3).

146. *See id.* § 202(c)(3), (d).

147. *See id.* § 202(c)(4), (6).

148. *See* Arti K. Rai & Bhaven N. Sampat, *Accountability in Patenting of Federally Funded Research*, 30 NATURE BIOTECHNOLOGY 953, 954-55 (2012). If the patentee is confronted regarding its failure to disclose, the patentee can file a certificate of correction to add a federal funding report to the granted patent. *See* James Love, *Errors in Patent Grants: More Common in Medical Patents*, HARV. L. PETRIE-FLOM CTR.: BILL OF HEALTH (Oct. 21, 2017), https://perma.cc/4628-RJ5R.

149. *See* 35 U.S.C. § 202(c)(4).

150. *See* Ryan Whalen, Note, *The Bayh-Dole Act & Public Rights in Federally Funded Inventions: Will the Agencies Ever Go Marching In?*, 109 NW. U. L. REV. 1083, 1084-85 (2015).

151. 35 U.S.C. § 203(a).

152. *But see* Opinion, *Innovation's Golden Goose*, ECONOMIST (Dec. 12, 2002), https://perma.cc/39NM-SHTN (praising the Bayh-Dole Act).

153. *See* Bhaven N. Sampat & Frank R. Lichtenberg, *What Are the Respective Roles of the Public and Private Sectors in Pharmaceutical Innovation?*, 30 HEALTH AFF. 332, 336 (2011). For one perspective on the present and future of university drug discovery, see Liza Vertinsky, *Making Knowledge and Making Drugs?: Experimenting with University Innovation Capacity*, 62 EMORY L.J. 741, 768-90 (2013).

one publication related to every new drug.[154] While NIH funding primarily contributed to drug target identification rather than discovery of new molecular entities, "NIH funding was directly or indirectly associated with every one of the 210 new molecular entities approved from 2010-2016."[155] Furthermore, Ashley Stevens and colleagues have estimated that public sector research institutions contributed to the discovery of between 9.3% and 21.2% of "all drugs involved in new-drug applications approved during the period from 1990 through 2007,"[156] consistent with previous studies suggesting that 7.6% of drugs approved between 1981 and 1990[157] and 6.7% of new drugs approved between 1990 and 1999 originated outside the pharmaceutical industry.[158]

b. Indirect funding: tax-based subsidies

In addition to direct subsidies, several provisions in the U.S. tax code provide R&D-related tax incentives.[159] Like patent incentives, most R&D-related tax credits do not discriminate between different technological fields,[160] or only coarsely differentiate.[161] Accordingly, "the projects incentivized under a tax credit regime may not be the ones with the highest social benefit."[162] Instead, tax credits act as a non-risk-adjusted reward for research expenditures.[163] While tax credits may increase the likelihood that a resource-constrained company will pursue a more expensive research project, they likely only nudge the direction of innovation on the margins (such as when a willing inventor would pursue a profitable project over alternatives but for her ability to raise capital). However, tax credits may also result in "inefficient" R&D where R&D costs would be higher than expected revenue but for the tax credit.[164]

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154. *See* Ekaterina Galkina Cleary et al., *Contribution of NIH Funding to New Drug Approvals 2010-2016*, 115 PROC. NAT'L ACAD. SCI. 2329, 2330 (2018).

155. *See id.*

156. Ashley J. Stevens et al., *The Role of Public-Sector Research in the Discovery of Drugs and Vaccines*, 364 NEW ENG. J. MED. 535, 540 (2011).

157. *See* Kenneth I. Kaitin et al., *The Role of the Research-Based Pharmaceutical Industry in Medical Progress in the United States*, 33 J. CLINICAL PHARMACOLOGY 412, 414 (1993).

158. *See* DiMasi et al., *supra* note 50, at 157.

159. *See* Hemel & Ouellette, *supra* note 35, at 321-26. Many state governments also provide R&D tax credits, which are beyond the scope of this Note. For a discussion of state R&D credits, see, for example, *id.* at 325.

160. *See id.* at 328.

161. *See, e.g.*, *infra* text accompanying notes 174-78.

162. Hemel & Ouellette, *supra* note 35, at 329.

163. *See id.* at 329, 337-38.

164. In some cases, this may still enhance social welfare where the market undervalues socially useful inventions.

Value-agnostic R&D-related tax incentives: Under § 174 of the Internal Revenue Code, taxpayers can deduct specified R&D costs.[165] Additionally, § 41 of the Code provides a corporate R&D tax credit applying to "qualified research expenses,"[166] defined as expenses undertaken for purposes that are "technological in nature";[167] intended to yield applications "useful in the development of a new or improved business component of the taxpayer";[168] and associated with activities comprising an experimentation process.[169] Generally, the § 41 tax credit rewards corporations for *increasing* R&D spending and thus is only available for qualified research expenses above a threshold dictated by previous expenditures.[170]

Based on IRS data, the pharmaceutical manufacturing industry averaged about $22.5 billion per year in qualified research spending between 2005 and 2014.[171] For fiscal year 2014, the IRS estimated that pharmaceutical-related corporations claimed $1.2 billion in general R&D-related tax credits.[172] Established pharmaceutical companies likely claimed most of these general R&D-related tax credits, which favor larger developers.[173]

Orphan drug tax credit: Unlike general R&D-related tax incentives, the orphan drug research credit specifically targets pharmaceuticals, allowing companies to claim a 25% tax credit for qualified clinical testing expenses incurred while testing drugs for rare or orphan diseases which affect fewer than 200,000 people living in the United States.[174] Therefore, without wading into an accountability trap by differentiating between thousands of rare

165. *See* I.R.C. § 174(a)(1) (2017); *see also Implications of Certain Tax Reform Provisions on Research Incentives*, ERNST & YOUNG: TAX NEWS UPDATE (Feb. 20, 2018), https://perma.cc/NSQ8-2YFV (discussing changes to R&D-related tax incentives, including § 174, implemented as part of the 2017 tax reform).

166. *See* I.R.C. § 41(a).

167. *See id.* § 41(d)(1)(B)(i).

168. *See id.* § 41(d)(1)(B)(ii).

169. *See id.* § 41(d)(1)(C).

170. *See id.* § 41(a)(1), (c)(1)-(3).

171. U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 41, at 39.

172. *See id.* at 38.

173. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO/GGD-94-139, TAX POLICY: PHARMACEUTICAL INDUSTRY'S USE OF THE RESEARCH TAX CREDIT 3 (1994) (noting that between 1981 and 1990, "[t]he biotechnology sector of the industry, which consists largely of smaller companies, benefited very little from the credit").

174. *See* I.R.C. § 45C; Zachary Brennan, *Senate, House Agree to Cut Orphan Drug Research Credit in Half in Tax Bill*, REG. AFF. PROFESSIONALS SOC'Y: REG. FOCUS (Dec. 18, 2017), https://perma.cc/9UHZ-8VT8.

diseases, the orphan drug tax credit encourages companies to pursue treatments for diseases "once seen as unworthy of corporate investment."[175]

The credit has incentivized corporate investment,[176] perhaps too much. Between 2005 and 2014, inflation-adjusted claims for the orphan drug credit increased sharply from about $280 million to $1.5 billion.[177] The success—and cost—of the credit was raised during the 2017 tax debates, with one estimate indicating that reducing the credit would save the government nearly $30 billion over the next decade.[178]

Patent boxes: present and possible: In the 2017 tax reform, Congress introduced a provision mimicking "patent box" incentives used by jurisdictions like the United Kingdom.[179] Patent box regimes allow companies to pay a reduced tax rate on revenues derived from corporate patent exploitation, including sales of patented products, license fees, and royalties.[180] Therefore, patent boxes, which provide ex post rewards to *marketers* of successful inventions, complement R&D-related tax incentives for *developers*, which subsidize R&D projects that may result in commercializable inventions.[181]

Patent boxes currently come without strings attached,[182] and do not differentiate between patented inventions. However, as discussed in Part IV below, a pharmaceutical patent box tied to a patent buyout scheme is one option for extending the reach of buyouts beyond small companies and academic institutions that rely on government grants.

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175. *See* Katie Thomas & Sheila Kaplan, *Congress Weighs Repeal of Tax Credit for Rare Disease Drugs*, N.Y. TIMES (Nov. 8, 2017), https://perma.cc/ARC9-96RD.

176. *Cf.* Dayton Misfeldt & James C. Robinson, *Orphan Diseases or Population Health?: Policy Choices Drive Venture Capital Investments*, HEALTH AFF.: BLOG (July 21, 2017), https://perma.cc/ZE4N-B6RH (noting venture capital's enthusiasm for orphan disease treatments and connecting it to policy choices).

177. U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 41, at 37.

178. *See* Sarah Jane Tribble, *Advocates for Patients with Rare Diseases Defend Tax Credits for Orphan Drugs*, NPR: SHOTS (Nov. 29, 2017, 4:16 PM ET), https://perma.cc/X7QD-9QHM.

179. *See* Lisa Pfatteicher et al., *GILTI and FDII: Encouraging U.S. Ownership of Intangibles and Protecting the U.S. Tax Base*, BLOOMBERG TAX (Feb. 27, 2018), https://perma.cc/ZCB4-JSHN; *see also* Tax Cuts and Jobs Act, Pub. L. No. 115-97, sec. 14202(a), § 250(a), 131 Stat. 2054, 2213-14 (codified at I.R.C. § 250(a)).

180. *See The Patent Box*, MEWBURN ELLIS, https://perma.cc/DEZ5-NSB4 (archived Mar. 28, 2019).

181. *See* Hemel & Ouellette, *supra* note 35, at 331-33.

182. *See* Lisa Ouellette & Daniel Hemel, *The Case for a Patent Box with Strings Attached*, WRITTEN DESCRIPTION (Oct. 11, 2017), https://perma.cc/XPM2-8QUC (noting the lack of strings attached to patent boxes implemented in foreign countries, and proposing to implement a U.S. patent box with a shortened monopoly term in exchange for reduced tax rates).

c. Indirect funding: federally mandated coverage requirements

The federal government also provides a valuable indirect subsidy via pharmaceutical coverage requirements.[183] Under federal law, Medicaid and Medicare are required to cover most FDA-approved prescription drugs; similarly, state and federal law limit private insurers' ability to exclude certain FDA-approved drugs from their prescription drug formularies.[184] Accordingly, payers often must reimburse enrollees for "me-too" drugs and drugs of modest efficacy—drug manufacturers generally do not need to *earn* coverage if they meet the FDA's approval standards. When drug coverage is mandatory and the only question is cost, payers often cannot bargain effectively with pharmaceutical companies.[185]

In fact, by law most public payers cannot negotiate with pharmaceutical companies.[186] State Medicaid programs are one (more value-agnostic) exception: "By statute, they receive rebates worth about one-quarter of a drug's average manufacturer price. But if a manufacturer chooses to sell the drug to someone else for less than the rebated amount, Medicaid will only pay that 'best price.'"[187] This arrangement theoretically guarantees that "Medicaid can buy the drug at the cheapest price that the manufacturer can afford to sell it."[188]

2. Value-agnostic objective-oriented programs

As further illustrated by the nonexhaustive examples in this Subpart, value agnosticism pervades federal pharmaceutical policy choices beyond drug development subsidies. Even programs designed to promote specific health care outcomes only obliquely establish disease-level objectives and outcome valuations, and generally do so by awarding property rights that allow the market to set an ex post reward, similar to the orphan drug tax credit discussed above.

a. Priority review vouchers

The FDA's priority review voucher (PRV) program was designed to incentivize pharmaceutical companies to develop treatments for neglected

183. For a detailed discussion of the linkage between FDA approval and reimbursement for prescription drugs, see Sachs, *Delinking Reimbursement*, *supra* note 19, at 2311-21.

184. *See id.*

185. *See id.* at 2336 ("A payer that can credibly follow through on the threat not to cover a particular product can likely extract greater discounts in agreeing to cover it.").

186. *See* Kesselheim et al., *supra* note 11, at 862.

187. Rachel Sachs et al., *Value-Based Pricing for Pharmaceuticals in the Trump Administration*, HEALTH AFF.: BLOG (Apr. 27, 2017), https://perma.cc/CU2S-KTBP.

188. *Id.*

diseases without imposing a direct burden on taxpayers.[189] Specifically, the PRV program grants developers of drugs for statutorily specified neglected diseases (such as malaria and tuberculosis) and rare pediatric diseases a "voucher" entitling them to priority review of any other new drug application.[190] For drugs evaluated under priority review, the FDA aims to provide a decision in six months, rather than the aspirational ten months for standard review.[191]

For large pharmaceutical companies, PRVs act as innovation incentives by allowing manufacturers to bring profitable drugs to market four or more months earlier than under normal FDA procedures. The architects of the program assumed that the program would not significantly increase health care costs because "cash flows will be realized one year sooner [while] effective patent life and market life will be constant."[192] But these assumptions are only true when: (1) a drug is covered by at least one patent issuing before the FDA approval date (and thus eligible for PTE due to regulatory review time); (2) follow-on patents do not extend the drug's market life past the expiration date of the patent with PTE; and (3) the patent with PTE is not subject to a five/fourteen limit (i.e., no more than five years of PTE will be granted, and the PTE cannot be used to extend the postregulatory approval exclusivity period beyond fourteen years[193]) on extension.[194] Accordingly, the pharmaceutical company using the voucher determines its value by choosing which drug to apply it to.[195] Smaller pharmaceutical companies, or companies focused on drugs already eligible for priority review, can also profit by selling a PRV to a company with a potential blockbuster in its pipeline, tying the value of the reward to an entirely different product developed by a distinct firm.[196] To date,

189. *See* David B. Ridley et al., *Developing Drugs for Developing Countries*, 25 HEALTH AFF. 313, 321 (2006); PRIORITY REV. VOUCHERS, https://perma.cc/H6CF-32KY (archived Mar. 28, 2019).

190. *See* PRIORITY REV. VOUCHERS, *supra* note 189.

191. *See Priority Review*, U.S. FOOD & DRUG ADMIN., https://perma.cc/KB5D-LN57 (last updated Jan. 4, 2018).

192. *See* Ridley et al., *supra* note 189, at 318.

193. 35 U.S.C. § 156(c)(3), (g)(6) (2017).

194. With less PTE, faster regulatory review will equate to more days on the market. Similarly, if the five/fourteen constraints apply and PTE does not make up for all the time lost to regulatory review (e.g., due to long clinical trials that delay approval by more than five years), the patentee will have a longer exclusive market life if the approval phase is shortened.

195. For one critique of this cross-subsidization function, see Ana Santos Rutschman, *The Priority Review Voucher Program at the FDA: From Neglected Tropical Diseases to the 21st Century Cures Act*, 26 ANNALS HEALTH L. 71, 71, 93-98 (2017).

196. *See* PRIORITY REV. VOUCHERS, *supra* note 189.

PRVs have sold for $68 million to $350 million, with six vouchers sold in 2017 for known sale prices between $110 million and $130 million.[197]

b. Patents for Humanity

Inspired by the PRV program,[198] the U.S. Patent and Trademark Office (PTO) implemented a competitive Patents for Humanity program in 2012 that awards winners a certificate to accelerate a patent application, ex parte reexamination, or an ex parte appeal to the Patent Trial and Appeal Board.[199] Patent owners or licensees can enter the contest by submitting applications "describing how they've used their patented technology or products to address humanitarian challenges for the less fortunate."[200] Benefitting the less fortunate is broadly defined to include actions such as targeting impoverished populations, making technologies more available for humanitarian use, and supporting research by others.[201]

While patentees can pay a fee to accelerate patent applications through the PTO's Track One program,[202] ex parte appeal acceleration is normally only available in one application in exchange for withdrawing another appeal.[203] Ex parte reexamination, on the other hand, normally cannot be accelerated. Like PRVs then, the Patents for Humanity certificate's value—when it purchases something that the patentee cannot buy already—depends on the market value of a longer effective patent term.

c. Generic entry incentives

Generic entry incentives encourage marketing, not innovation. Nevertheless, the government has adopted value-agnostic programs even for generic entry incentives unlikely to affect early-stage research directions. These programs attempt to fulfill one promise of the patent system, namely, that after a patent monopoly ends, other manufacturers can enter the market and lower prices. According to one estimate, generic drugs account for 89% of

197. *See id.*

198. *See* Request for Comments on Incentivizing Humanitarian Technologies and Licensing Through the Intellectual Property System, 75 Fed. Reg. 57,261, 57,261 (Sept. 20, 2010).

199. *See Patents for Humanity*, U.S. PATENT & TRADEMARK OFF., https://perma.cc/PE63-N7BM (archived Mar. 29, 2019).

200. *Id.*

201. *See id.*

202. *See USPTO's Prioritized Patent Examination Program*, U.S. PATENT & TRADEMARK OFF., https://perma.cc/8G8N-ACMV (archived Mar. 29, 2019).

203. *See Expedited Patent Appeal Pilot—Frequently Asked Questions*, U.S. PATENT & TRADEMARK OFF., https://perma.cc/DK29-PT5M (last updated June 16, 2015).

prescriptions but only 26% of drug costs.[204] While low generic drug prices may benefit patients in the short term, they squeeze manufacturers, pushing many out of business.[205] To encourage resource-constrained generic manufacturers to challenge brand-name patentholders or bring a low-cost generic to market when there are no approval barriers, the government still relies on market-driven incentives rather than direct government transfers, just as it does for patented medicines. Specifically, the government uses two blunt, value-agnostic instruments—limited exclusivity periods and priority review—to encourage generic entry.

180-day exclusivity: Under the Hatch-Waxman Amendments, the first filer of an Abbreviated New Drug Application (ANDA) with a Paragraph IV certification concerning a brand-name drug (referred to as a Reference Listed Drug) may be entitled to 180 days of generic exclusivity, during which the FDA will not approve another ANDA with a Paragraph IV certification.[206] Under Paragraph IV, a generic manufacturer certifies that its product does not infringe any patents listed in the Orange Book, a publication maintained by the FDA containing approved drug products and related patent information submitted by the product owners—or alternatively that any listed conflicting patents are unenforceable.[207] If successful in an infringement suit, the first filer can sell its generic product in a duopoly market with the brand-name company for 180 days[208] and charge supracompetitive prices.[209] However, because exclusivity is more valuable to the innovator than to the generic manufacturer, many innovators pay generic companies not to market products through "pay-for-delay" settlements.[210]

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204. Charles Ornstein & Katie Thomas, *Generic Drug Prices Are Falling, but Are Consumers Benefiting?*, N.Y. TIMES (Aug. 8, 2017), https://perma.cc/X6QJ-T8LH.

205. *See* Koons, *supra* note 99.

206. *See* 21 U.S.C. § 355(j)(2)(A)(vii)(IV), (j)(5)(A)-(B) (2017); *see also* Drug Price Competition and Patent Term Restoration Act of 1984, Pub. L. No. 98-417, 98 Stat. 1585 (codified as amended in scattered sections of the U.S. Code).

207. *See Patent Certifications and Suitability Petitions*, U.S. FOOD & DRUG ADMIN., https://perma.cc/V57B-FL3D (last updated Mar. 28, 2019).

208. Sometimes the market includes more sellers if the brand name authorizes sales of other generics. *See* C. Scott Hemphill & Mark A. Lemley, *Earning Exclusivity: Generic Drug Incentives and the Hatch-Waxman Act*, 77 ANTITRUST L.J. 947, 981-82 (2011).

209. *See id.* at 953-54.

210. *See* Kevin B. Soter, Note, *Causation in Reverse Payment Antitrust Claims*, 70 STAN. L. REV. 1295, 1298-300 (2018); *Pay-for-Delay: When Drug Companies Agree Not to Compete*, FED. TRADE COMMISSION, https://perma.cc/XF7W-C4HB (archived Mar. 29, 2019). While the Federal Trade Commission can challenge pay-for-delay settlements as an antitrust violation under the rule of reason, the U.S. Supreme Court declined to rule that such settlements are presumptively illegal in *FTC v. Actavis, Inc.* *See* 133 S. Ct. 2223, 2237 (2013).

Inspired by the 180-day monopoly granted to successful generic challengers, a new 180-day marketing exclusivity period was introduced in October 2017 to encourage generic manufacturers to market off-patent drugs.[211] Specifically, a generic manufacturer filing an ANDA to market a generic version of a drug on a list of more than 200 medicines with no generic competition is also eligible for marketing exclusivity if the ANDA is approved.[212]

Notably, neither exclusivity period is tied to difficulties in manufacturing the generic drug or costs incurred invalidating related patents. Moreover, neither requires the government to put a dollar value on the public benefits associated with generic competition. Instead, generic exclusivity motivates manufacturers by allowing them to charge a supracompetitive price that may not reflect relative value and does not reflect manufacturing costs—just like innovators do.[213]

Priority review: Perhaps unsurprisingly, generic prices only fall close to the marginal cost of production when multiple manufacturers enter the market. Based on one study comparing relative generic and brand-name drug prices between 2008 and 2014, the average ratio of generic price to brand-name price per dose only fell below 50% after at least five manufacturers released generic drugs.[214] Accordingly, to encourage competition, the FDA prioritizes ANDA review when fewer than four ANDAs have already been approved for the reference listed drug.[215] This criterion of four preexisting ANDAs is fixed without regard for patient need or specific drug prices.

The government programs discussed in this Part indirectly influence innovation while leaving original value judgments in private hands. The common framework underlying these programs—incentives divorced from specific diseases and therapeutic efficacy—suggests a path forward for further pharmaceutical reforms. In Part IV below, this Note provides an example of a reform consistent with this framework—sale-triggered option rights linked to public funding—that might enable the U.S. government to nudge pharmaceutical prices without significantly altering early-stage R&D incentives.

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211. *See* Shraddha Chakradhar & Roxanne Khamsi, *Angst About Exclusivity: The Potential Cost of Incentivizing Makers of Generic Drugs*, 23 NATURE MED. 1114, 1114 (2017).

212. *See id.*

213. Whatever the flaws of exclusivity for innovators, innovative exclusivity justifications like information asymmetry largely do not apply to generic exclusivity.

214. *See* Dave et al., *supra* note 103, at 2598 fig.1.

215. *See* FDA Reauthorization Act of 2017, Pub. L. No. 115-52, § 801, 131 Stat. 1068, 1069 (codified as amended at 21 U.S.C. § 355(j) (2017)).

IV. Value Agnostic by Design: Patent Buyouts to Promote Public Health

Innovation incentives matter. But they are hard for politically accountable actors to design and equitably implement, especially when social value is relative, difficult to measure, and inevitably resource constrained. Willingness to pay, as roughly measured by market price, is an imperfect proxy for social value. But unlike risk-adjusted R&D expenditures, willingness to pay is at least a proxy for value—one that sometimes captures nonhealth and societal benefits, like faster return to work or improved ability to act as a caregiver, better than other metrics such as QALYs.[216] Potentially more importantly for politically accountable actors, willingness to pay can be measured through black-box auctions without requiring politicians or bureaucrats to independently assess value.

Part III above argued that value-agnostic government programs are pervasive in U.S. pharmaceutical policy and may provide a framework for structuring short-term pharmaceutical reforms. This Part explains one potential program—sale-triggered option rights linked to public funding—that can influence pharmaceutical pricing without requiring preclusive judgments regarding the merits of specific-disease treatments.

A. Patent Buyout Scheme

The number of untreatable and inadequately treated diseases affecting Americans vastly exceeds the number of FDA-approved therapeutics, as well as the resources available for drug discovery.[217] Because reasonable minds differ on which pharmaceuticals are most needed, the proposed patent buyout system does not aim to kick-start development of a particular drug or alter existing incentives for early-stage research. Nor does it attempt to make drug discovery less competitive or lucrative[218] for the *developers* and *early-stage financiers* of

216. *Compare* DA Pettitt et al., *The Limitations of QALY: A Literature Review*, J. STEM CELL RES. & THERAPY 3 (Mar. 29, 2016), https://perma.cc/2A7J-7QUM (explaining benefits not accounted for in QALY metrics), *with* Jan Abel Olsen & Richard D. Smith, Theory *Versus* Practice*: A Review of "Willingness-to-Pay" in Health and Health Care*, 10 HEALTH ECON. 39, 47 (2001) (considering arguments that willingness to pay is a better value proxy than QALYs).

217. *See supra* notes 78-85 and accompanying text.

218. Reasonable minds can also differ on necessary profits for pharmaceutical innovation. Estimates of the elasticity of industry output (i.e., drugs marketed) "with respect to demand (or cashflow) shocks" vary from 0.3 to 4.0, predicting anything from a modest to large change in output with changing circumstances. *See* Joshua Krieger et al., *Developing Novel Drugs* 4-5 (Harvard Bus. Sch., Working Paper No. 18-056, 2017), https://perma.cc/BGT6-2UYM. However, rights to many investigational therapies are often sold by biotech firms to large pharmaceutical companies for under $1 billion. *See* Barbara Obstoj-Cardwell, *Pharmaceutical M&A Deals in 2017*, PHARMA LETTER

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novel therapeutics, who provide and fund, respectively, the inventive genius rewarded by the patent system. Instead, this example simply outlines one value-agnostic government program to influence drug pricing: sale-triggered government option rights prospectively tied to federal grant funding and new R&D-related tax incentives (such as a new pharmaceutical patent box[219] or a pharmaceutical R&D tax credit[220]).

1. Sale-triggered option rights

In this example, patentholders would be required by statute or agency funding agreement to invoke a patent buyout[221]—that is, an auction process to estimate the market value of a patent, with the government maintaining a right to purchase the patent at the estimated market price—if they chose to sell or exclusively license an investigational[222] or approved therapy developed with federal funding or connected to a U.S. tax credit.[223] During the patent

(Mar. 1, 2018), https://perma.cc/ZR5A-7G4Z. Thus, this Note assumes that at least some investigational therapies could be obtained from their developers for less than the government currently spends on similar pharmaceuticals, even accounting for clinical trial risk.

219. *See supra* text accompanying notes 179-82.

220. The orphan drug tax credit provides one model for a pharma-specific R&D tax incentive. *See supra* text accompanying notes 174-78. However, introducing a broader ex ante tax credit for pharmaceutical R&D could reduce the incentive effect of the orphan drug credit. This concern would be less applicable for a new pharmaceutical patent box because the ex ante and ex post incentives would stack. To improve public perception of a new pharmaceutical handout, the government could require credit value to be used to fund further R&D, similar to the reinvestment clause for grant recipients under the Bayh-Dole Act. *See* 35 U.S.C. § 202(c)(7)(C) (2017).

221. For discussions of patent buyout schemes not conditioned on federal funding, see Alberto Galasso et al., *Market Outcomes and Dynamic Patent Buyouts*, 48 INT'L J. INDUS. ORG. 207, 212-19 (2016) (describing literature on patent buyouts and a model for a dynamic patent buyout); and Michael Kremer, *Patent Buyouts: A Mechanism for Encouraging Innovation*, 113 Q.J. ECON. 1137, 1144-48 (1998) (explaining historical patent buyout experiences and proposing an expansion of patent buyouts to encourage innovation). While Ian Ayres and Lisa Larrimore Ouellette have proposed an auction-based market test to determine if exclusivity is necessary for commercialization of federally funded inventions, *see* Ian Ayres & Lisa Larrimore Ouellette, *A Market Test for Bayh-Dole Patents*, 102 CORNELL L. REV. 271, 301-04 (2017), the Author is unaware of any buyout proposals limited to recipients of federal drug discovery subsidies.

222. The definition of "investigational" could be debated, with "a molecular entity capable of having a biological effect" at one end of the spectrum and "the subject of a clinical trial" at the other. For convenience, an investigational therapy in this example refers to a therapy previously tested in an in vitro cell culture model or in vivo animal model of disease.

223. Prospectively tying pharmaceutical patent buyouts to receipt of a new government benefit is advisable for two reasons. First, restricting only pharmaceutical patent rights would likely violate articles 27 and 28 of the Agreement on Trade-Related Aspects of Intellectual Property Rights, which largely prohibit discrimination based on

footnote continued on next page

buyout, the beneficiary would offer the therapy under a sealed-bid, second-price auction to establish the therapy's market price.[224] In a sealed-bid, second-price auction, all bidders simultaneously submit sealed bids, so no bidder knows another's bid.[225] To incentivize bidders to bid their true value, the bidder who submits the highest bid typically wins the auction and pays the second-highest bid price.[226] However, if the government chooses to exercise its option rights, it would purchase the therapy at the second-highest bid price.[227]

Using patent buyouts, the government could purchase approved therapies that would otherwise be traded between for-profit pharmaceutical companies. For example, if Bristol-Myers Squibb had taken advantage of a pharmaceutical patent box for its diabetes medications, the government would have enjoyed first refusal rights when the company sold its global diabetes business in 2013,[228] with the purchase price set at auction. Thus, the government may have been able to purchase Bristol-Myers Squibb's diabetes drugs, including Onglyza, Byetta, and Farxiga, for about $4.1 billion, the price AstraZeneca paid.[229] This price would have been a steal for the U.S. government. Onglyza's annual U.S. sales totaled approximately $532 million in 2013,[230] and some of its patents will not expire until 2028.[231] And Farxiga, which is covered by at least one patent that will not expire until 2026,[232] may take in annual worldwide revenue exceeding $2 billion within the next few years.[233]

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technological area. *See* TRIPS Agreement, *supra* note 29, arts. 27-28. Second, because therapeutic developers and marketers could choose to opt out of the patent buyout system, it would be more politically and legally feasible to implement and enforce a prospective, rather than retroactive, program.

224. For a description of a second-price auction, see Jonathan Levin, Auction Theory 1-2 (2004), https://perma.cc/24RE-SAZ2.

225. *See id.* at 2.

226. *See id.*

227. For two discussions of potential enforcement challenges with auctions of this type, as well as options for limiting collusion, see Ayres & Ouellette, *supra* note 221, at 324-29; and Kremer, *supra* note 221, at 1157-62.

228. *See BMS Sells Diabetes Business to AstraZeneca for up to $4B+*, GENETIC ENGINEERING & BIOTECHNOLOGY NEWS (Dec. 19, 2013), https://perma.cc/HYB9-549Y.

229. *See id.* Notably, AstraZeneca and Bristol-Myers Squibb were collaboration partners in the diabetes business, *see id.*, so an auction may have established a higher market price for Bristol-Myers Squibb's diabetes drugs.

230. Press Release, Actavis plc, Actavis Confirms Generic Onglyza Patent Challenge (May 27, 2014), https://perma.cc/9BQE-7ZLF.

231. *See* AstraZeneca PLC, Annual Report and Form 20-F Information 2016 (Exhibit 15.1 to Form 20-F), at 212 (Mar. 7, 2017).

232. *See id.* at 211.

233. *See* Ludwig Burger, *Astra's Farxiga Results May Open Up Type 1 Diabetes Opportunity*, REUTERS (Sept. 14, 2017, 12:38 AM), https://perma.cc/46XH-KJJS.

For FDA-approved therapies, the government could immediately place U.S. patent rights in the public domain, allowing any generic manufacturer to seek marketing approval.[234] Worldwide rights might be more problematic, especially if the therapy was not yet approved elsewhere. Jurisdictional regulatory authorities, such as the FDA and the European Medicines Agency, operate independently and sometimes require distinct evidence for approval.[235] Obtaining worldwide marketing approval can thus become an expensive endeavor. Because the American public would not receive any direct benefits from foreign approvals, the U.S. government would need to decide whether to obtain approval itself or license its foreign rights.[236] One option would be to obtain approval and sell the therapy overseas at prices sufficient to compensate the government for the patent buyout price and the costs of obtaining approval. Another would be to view government-backed drugs as a form of foreign aid and either obtain approval before placing the therapy in the public domain or license the rights subject to a reasonable pricing clause.

Because investigational therapy prices reflect the risks and costs of clinical trials, investigational therapies would likely be cheaper to purchase in a patent buyout than approved products. However, investigational therapies purchased at auction may become more expensive for the federal government when the costs of clinical trials are added to the buyout price.[237] After purchasing rights,

234. Generic manufacturers could file an ANDA with a Paragraph II certification, indicating that the relevant patents effectively "expired" when the U.S. government dedicated them to the public. *See* 21 U.S.C. § 355(j)(2)(A)(vii)(II) (2017). The FDA can immediately act on an ANDA application containing a Paragraph II certification. *See id.* § 355(j)(5)(B)(i).

235. *See* Gail A. Van Norman, *Drugs and Devices: Comparison of European and U.S. Approval Processes*, 1 J. AM. C. CARDIOLOGY: BASIC TO TRANSLATIONAL SCI. 399, 401-04 (2016).

236. Alternatively, the government could elect to purchase only the U.S. rights and allow the original patentee to exploit its patent rights elsewhere. While intuitively appealing, splitting ownership might stall clinical trial progress as the government and original patentee debate who should pay for further trials that might benefit both parties. Additionally, international patent exhaustion rules, which regulate whether an authorized sale by a patent owner in one country exhausts patent rights for a second sale in a different country, might limit potential benefits for the original patentee if cheaper U.S. drugs could be imported and sold in some foreign countries.

237. While expensive in terms of direct, upfront costs, government-owned therapeutics could eliminate some pharmaceutical shadow taxes, possibly resulting in less deadweight loss for society at large. *See supra* notes 35-36 and accompanying text. Moreover, because pharmaceutical shadow taxes are large, and the federal government currently pays for prescription drugs through Medicare, Medicaid, and the Department of Veterans Affairs, *see Pharmacy Benefits Management Services*, U.S. DEP'T VETERANS AFF., https://perma.cc/KSZ5-RBA8 (last updated Dec. 4, 2018), the aggregate on-the-book costs may be lower for government-owned therapeutics than privately-owned therapeutics, even when patent buyout and clinical trial costs are considered.

the government would need to conduct more R&D to reap the value of its investment.[238] Specifically, intramural NIH researchers would need to conduct clinical trials,[239] or the government would need to contract out remaining development work. For example, the government could work with contract research organizations, which already provide clinical trial support to many large pharmaceutical companies,[240] or private nonprofit pharmaceutical companies, which have recently emerged as a minor player in drug development, to conduct clinical trials and seek initial approvals.[241] Like all other investigational therapies, many government-owned investigational therapies would likely fail in clinical trials. However, successful investigational candidates could be placed in the public domain after obtaining regulatory approval,[242] just like the FDA-approved therapies discussed above.

2. Contrasting patent buyouts with Bayh-Dole march-in rights

As explained in Part III.C.1 above, the federal government already possesses some rights in therapies developed with federal funds, including the right to issue compulsory licenses in limited circumstances. However, the

238. Government purchase of clinical candidates would partially address a puzzling aspect of current federal incentives. Namely, the U.S. government primarily subsidizes early-stage development through tax incentives and grants but provides minimal support for expensive clinical trials, even though the government may be better positioned to run clinical trials than to choose which early-stage projects to finance. *See* Daniel J. Hemel & Lisa Larrimore Ouellette, *Innovation Policy Pluralism*, 128 YALE L.J. 544, 570-71 (2019).

239. The federal government has experience financing and running clinical trials. Among clinical trials registered on ClinicalTrials.gov (a requirement for almost all drug clinical trials), at least 6% of trials starting in 2014 listed a U.S. federal agency as a sponsor or collaborator. *See* Stephan Ehrhardt et al., *Trends in National Institutes of Health Funding for Clinical Trials Registered in ClinicalTrials.gov*, 314 JAMA 2566, 2566 tbl.1 (2015); *see also* CLINICALTRIALS.GOV, https://perma.cc/JD8S-5CLV (archived May 9, 2019).

240. *See* Lina Wang & Eduardo F. Motti, *The Increasing Shift of Clinical Trials to CROs*, PHARMACEUTICAL OUTSOURCING (May 28, 2015), https://perma.cc/ER54-PQSG.

241. While the most influential nonprofit in the pharmaceutical space—if the idea gains its sea legs—will likely be Intermountain's planned generic drug company, *see* Reed Abelson & Katie Thomas, *Fed Up with Drug Companies, Hospitals Decide to Start Their Own*, N.Y. TIMES (Jan. 18, 2018), https://perma.cc/9GUY-8RK6, some innovative nonprofits already have work underway, *see* James Mitchell Crow, *Non-Profit Pharma*, CHEMISTRY WORLD (Sept. 24, 2013), https://perma.cc/2Z2Y-4DQP; *see also* Helen Liu, *Institute of OneWorld Health: A Nonprofit Pharmaceutical Company*, 19 QUINNIPIAC HEALTH L.J. 1, 5-11 (2016) (discussing one large nonprofit pharmaceutical company which focuses primarily on parasitic and diarrheal diseases).

242. While regulatory considerations are beyond the scope of this example, the FDA would need to establish ethical walls to prevent significant government investment from skewing approval decisions.

government appears to believe that only fools march in. Despite multiple requests[243] and proposals[244] to utilize march-in rights under Bayh-Dole to control drug prices, the U.S. government has never asserted its right to issue compulsory licenses to generic manufacturers.[245]

Critics of using Bayh-Dole for price control point to the number of FDA-approved, federally funded drugs before (0) and after (153) its enactment, asserting that price constraints on federally funded inventions would chill private-public partnerships.[246] Whether or not these fears are justified, no chilling effect should be observed for patent buyouts because no price controls attach—the government can only buy a federally funded therapy at market price from a willing seller, and firms that purchase rights at auction can develop and price the acquired therapies subject only to marketing and regulatory constraints.

Furthermore, march-in critics cite the unintended consequences of "reasonable pricing" clauses in exclusive licenses covering inventions made under NIH Cooperative Research and Development Agreements (CRADAs) between NIH intramural laboratories and collaborators in the private sector.[247] In 1989, the NIH adopted a policy requiring "a reasonable relationship between the pricing of a licensed product, the public investment in that product, and the health and safety needs of the public."[248] Private industry withdrew from CRADAs rather than agreeing to price constraints.[249] The policy was revoked in 1995,[250] and in a 2004 report to Congress, the NIH adopted the position that it has "has neither the mandate nor the authority to be the arbiter of drug affordability."[251] Congress has yet to appoint an alternative arbiter.

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243. *See* Whelan, *supra* note 150, at 1106 tbl.1 (summarizing five rejected march-in petitions).

244. *See* sources cited *supra* note 23.

245. *See* Lindsay Bednar, *Misusing Bayh-Dole "March-In Right" Could Result in Fewer New Drugs, New Report Shows*, INFO. TECH. & INNOVATION FOUND. (Mar. 4, 2019), https://perma.cc/MZ4C-AXSJ.

246. *See* Joseph Allen, *Bayh-Dole Under March-In Assault: Can It Hold Out?*, IPWATCHDOG (Jan. 21, 2016), https://perma.cc/C5VR-LSZK.

247. *See id.*

248. *See* NAT'L INSTS. OF HEALTH, DEP'T OF HEALTH & HUMAN SERVS., NIH RESPONSE TO THE CONFERENCE REPORT REQUEST FOR A PLAN TO ENSURE TAXPAYERS' INTERESTS ARE PROTECTED 10-11 (2001), https://perma.cc/F3MZ-55N6.

249. *See id.*

250. *Id.* at 10.

251. NAT'L INSTS. OF HEALTH, DEP'T OF HEALTH & HUMAN SERVS., REPORT TO CONGRESS ON AFFORDABILITY OF INVENTIONS AND PRODUCTS 4 (2004), https://perma.cc/3B64-37BQ.

By design, patent buyouts do not require an arbiter. The U.S. government could take or leave an auctioned therapy at its market price, but politicians could only control drug pricing if they purchased ownership rights. Nor is there any reason to believe that the auction mechanism—which provides a market-defined reward to willing sellers—would discourage companies from accepting federal subsidies, a choice that could impede innovation by reducing access to R&D funding.[252]

B. The Limits of Limited Intervention

Notwithstanding their virtues, sale-triggered patent buyouts for federal funding recipients are a form of limited government intervention in the pharmaceutical industry. Their impact is accordingly limited. Using patent buyouts, the government could only set prices for its approved therapeutics, which would take years to acquire or develop. In most instances, acquired investigational candidates would fail in clinical trials, dashing the hopes of patients eager for affordable treatments.[253] Moreover, a promising government-backed investigational candidate could chill early-stage R&D within a therapeutic class because successful approval of the candidate would constrain class pricing. For example, if the government successfully marketed a diabetes drug and charged a competitive, rather than supracompetitive, price, researchers might abandon alternative diabetes drug projects; the existence of a lower-cost product in the diabetes market might constrain pricing, with consumers choosing the lower-cost drug unless the alternative drug were markedly superior. Whether to continue R&D would be a strategic decision for potential competitors because many promising candidates fail and some competitors may have already sunk significant resources into similar products.

Additionally, patent buyouts require significant upfront expenditures, providing return on investment at best a few years later when early adopters of new R&D-related tax incentives decide to spin off therapeutic businesses. Given campaign realities for legislators elected to two- or six-year terms, delayed gratification may mean no gratification.

252. Companies might negate concerns about double taxation if they chose not to accept federal subsidies to avoid any transaction costs associated with a patent buyout scheme. In that case, reducing subsidies should not increase prices if marketers are already charging what the market will bear. Moreover, the government funds these companies would have received could be redirected to other researchers, potentially increasing overall R&D rates if some competent extramural researchers were willing to accept government funds with strings attached.

253. For a discussion of clinical trial failure rates, see note 47 above.

More fundamentally, patent buyouts would still require politically accountable actors to make or delegate some value-based decisions. Subject to budget constraints, a government official would need to review the therapies at auction in a given year and decide which to exercise option rights over, like an NIH program officer choosing grant applications to fund from a limited fisc. However, the connection between patient outcomes and patent buyouts is relatively attenuated, posing a difficulty similar to that faced by the NIH in its early-stage research funding decisions. The decisionmaker, after all, would only choose among existing treatments that owners wanted to sell and, barring collusion, would not pay a premium over market-perceived value. Accordingly, the decisionmaker would not decide which treatments exist in the first instance, although the decisionmaker may indirectly influence development priorities. Assume, for example, that the decisionmaker prioritized buyouts of therapies targeting common diseases. Under those circumstances, developers may be less incentivized to pursue therapies targeting common diseases if they believe a government-backed drug will compete with their therapy during its market exclusivity period, constraining price and potential profits. However, so long as therapeutically superior drugs targeting common diseases command a premium over orphan disease treatments, developers are unlikely to abandon the common disease market. Instead, the threat (or existence) of a government-backed therapy may push developers toward more innovative drugs for common diseases, rather than shifting initial development priorities toward rare diseases.

Moreover, the decisionmaker would not be the only judge dictating future therapies. In contrast to price control and government-initiated R&D regimes, the decisionmaker would only decide if an auctioned therapy's market price was a bargain for the government and, if so, whether the government could afford it. The decisionmaker would not decide the market value, or dictate the products developed. Moreover, companies would still have the option to further develop their treatments in-house, and private buyers could still develop overlooked therapies, like unsuccessful NIH grant projects later funded by private foundations and state agencies. As a result, coexisting private and public drug development might bring more therapeutics to market than the government could afford to develop on its own.

The NIH funding model, discussed in Part III.C.1 above, is instructive for predicting public response and envisioning how a government patent buyer might operate. The NIH is both risk averse[254] and prone to making decisions

254. *See* Nicholas Graves et al., *Funding Grant Proposals for Scientific Research: Retrospective Analysis of Scores by Members of Grant Review Panel*, BMJ 1-3 (Sept. 27, 2011), https://perma.cc/PD3K-79X8.

based on interest group pressure,[255] two concerning qualities that may also apply to patent buyout committees. But despite these traits, the NIH still funds basic, transformative biomedical research.[256] Moreover, even though the NIH only funds 18% of grant applications,[257] it is frequently lauded for backing scientists' "unraveling the mysteries of disease and generating scientific innovations that make new drugs and treatments possible."[258] By mimicking the NIH's funding model, which relies on peer review and does not close off alternative financing options for those left behind, a patent buyout committee making difficult choices affecting public health might still obtain public support, even in the current political climate.[259]

Conclusion

Although 25 to 30 million Americans suffer from as many as 7,000 rare diseases,[260] the FDA only approved 252 unique orphan drugs for marketing between 2008 and 2017.[261] Any proposal to reform the pharmaceutical industry must contend with the magnitude of this treatment gap and associated interest group pressures. In selecting specific diseases to target and individual patents over which to exert eminent domain, the U.S. government may increase net social welfare and reduce static inefficiencies in the pharmaceutical market. However, by selecting today's health care winners and losers, the government may inadvertently create a new generation of losing patients due to decreased or distorted innovation incentives and approval delays. That outcome may be socially beneficial, but it concentrates responsibility in people more answerable to those left behind than the current private-sector decisionmakers.

To date, the U.S. government has been loath to make direct value judgments regarding pharmaceuticals. Instead, it has embraced value-agnostic

255. *See* Bhaven N. Sampat et al., *New Evidence on the Allocation of NIH Funds Across Diseases*, 91 MILBANK Q. 163, 180-81 (2013).

256. *See* Jeffrey A. Bluestone et al., *The NIH Is in Danger of Losing Its Edge in Creating Biomedical Innovations*, STAT (Jan. 3, 2018), https://perma.cc/35QB-XSDD.

257. *See* Kendall Powell, *The Best-Kept Secrets to Winning Grants*, 545 NATURE 399, 400 (2017).

258. *See, e.g.*, Kenneth Davis, Opinion, *Congress Should Massively Ramp Up Funding for the NIH*, HILL (Dec. 5, 2017, 3:00 PM EST), https://perma.cc/358S-G45S.

259. The NIH is one of the only administrative agencies that still enjoys bipartisan support. *See For Some Republicans, NIH Cuts Are a Nonstarter*, KQED: SCI. (Mar. 17, 2017), https://perma.cc/9HMA-A2QC.

260. *See supra* text accompanying note 111.

261. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-19-83, ORPHAN DRUGS: FDA COULD IMPROVE DESIGNATION REVIEW CONSISTENCY; RARE DISEASE DRUG DEVELOPMENT CHALLENGES CONTINUE 23 (2018).

policies that rely on private parties to set prices and determine R&D directions, using targeted funding for disease classes to promote specific health care objectives and indiscriminate R&D-related tax benefits to encourage general innovation. These politically successful, value-agnostic programs increase social welfare without requiring bureaucrats to routinely arbitrate social value. This approach is not perfect and may be fundamentally less equitable than frameworks requiring more political courage. However, proposals harnessing private profit seeking to promote pharmaceutical innovation will likely obtain more legislative support in the short term than plans that require government actors to routinely value specific treatments for particular, currently untreatable diseases, helping some patients without time to wait.