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Does Pharma Need Patents?

ABSTRACT. Pharmaceuticals is the sector most widely thought to be in need of strong patent protection in order to sustain a robust level of innovative activity. This Feature comprehensively seeks to revise that assessment. It argues that a proper understanding of the actual informational resources at play in drugs reveals that pharmaceutical innovation can, significantly does, and entirely should proceed without any role played by patents.

The foundational plank of the argument is that innovation in pharmaceuticals consists of not one but two distinct information goods: (1) knowledge of a chemical or biological compound (the "compound information good"), and (2) knowledge of a compound's safety and efficacy for use in humans, as validated by clinical-trial data (the "data information good"). It is the latter information good, not the former, that is both the driver of the economics in this sector and the apt focal point of innovation-policy rules. Indeed, a close examination of how the doctrines of patent law map onto the pipeline of pharmaceutical innovation reveals a set of radically sector-specific doctrines that confer little protection during the preclinical research that generates the compound information good, contrary to a common view. Meanwhile, for the clinical testing that generates the data information good, revised regulatory-exclusivity rules can and entirely should suffice. Indeed, the protection presently afforded this good by patents is indirect, incomplete, and—owing to a basic misalignment between the patent system's focus and sensible aims for innovation policy in this sector—haphazard and highly costly.

Consequently, simply by phasing out patent protection for drugs and replacing it with a revised form of regulatory exclusivity, we would reap large gains in social welfare: better-tailored incentives, reduced access and duplication costs, and significantly curbed wastes from gaming of the present system. Many of these costs stem from "evergreening" practices and "me-too" drugs, which have both been the subject of sharp criticism. The present analysis offers a deeper diagnosis of the causes and extent of these problems, and it proposes more effective, better-tailored solutions.

This same analysis should also reorient broader debates in patent theory and innovation policy more generally by revising our understanding of the special case posed by drugs for innovation-policy support. The conventional view that pharma presents an especially strong case for patent protection turns out to be triply wrong. First, the innovation taking pride of place in judicial and scholarly attention—the compound information good—presents no special case for patents. Second, the innovation that does present a strong case for innovation-policy support—the data information good—is both sidelined by the patent system and in any case ill-suited for patent protection. Thus, the special case presented by pharma is not for patents but for an alternative innovation-policy intervention. Finally, the basis of that special case for innovation-policy support

lies in a regulatory regime rather than in any generalizable economic or technological features of drugs.

AUTHOR. Lecturer, University of California, Berkeley, School of Law. Thanks to Yochai Benkler, Oren Bracha, and Terry Fisher for invaluable comments on an earlier draft, and to Ken Ayotte, Colleen Chien, Seth Davis, Dhammika Dharmapala, Aaron Edlin, Mark Gergen, Katerina Linos, Peter Menell, Rob Merges, and Jonathan Simon for helpful discussion. For excellent research assistance, I thank Garreth McCrudden, Caressa Tsai, and Will Kirkland. I also wish to thank the editorial staff of the *Yale Law Journal*, in particular Deniz Arıtürk and Fred Halbhuber, for terrific comments that significantly improved the Feature. Research for this Feature was partly funded by a grant from the Institute for New Economic Thinking (INET), for which I am grateful.

FEATURE CONTENTS

INTRODUCTION

Does pharma need patents? The consensus view among scholars is a resounding "yes." The pharmaceutical industry is widely agreed to be the sector most in need of strong patent protection to sustain a robust level of innovative activity.[1] Study after study of the effects of patents on innovation—be they empirical surveys asking firms in different industries what they rely on to appropriate the benefits of innovation, historical studies of long-term patterns of innovation and patent protection, or synthetic theoretical-empirical treatments of the aggregate costs and benefits of the patent system as a whole—agree that, whatever other conclusions may be reached regarding the overall case for patent protection across the economy, such protection is crucial for innovation in drugs.[2]

1. *See, e.g.*, Richard A. Posner, *Why There Are Too Many Patents in America*, ATLANTIC (July 12, 2012), https://www.theatlantic.com/business/archive/2012/07/why-there-are-too-many-patents-in-america/259725 [https://perma.cc/L75J-3UZF] ("[P]harmaceuticals are the poster child for the patent system. But few industries resemble pharmaceuticals . . . ."); William Fisher, Intellectual Property and Innovation: Theoretical, Empirical, and Historical Perspectives 10 (2001) (unpublished manuscript), https://cyber.harvard.edu/people/tfisher/Innovation.pdf [https://perma.cc/MY4A-9X3V] ("[T]he pharmaceutical industry . . . has traditionally—and properly—been seen as the field in which the argument in favor of intellectual-property rights is the strongest.").

2. For empirical surveys noting the special importance of patents to pharmaceutical firms, see C.T. TAYLOR & Z.A. SILBERSTON, THE ECONOMIC IMPACT OF THE PATENT SYSTEM: A STUDY OF THE BRITISH EXPERIENCE 199, 263-65 (1973); Edwin Mansfield, Mark Schwartz & Samuel Wagner, *Imitation Costs and Patents: An Empirical Study*, 91 ECON. J. 907, 915-17 (1981); Edwin Mansfield, *Patents and Innovation: An Empirical Study*, 32 MGMT. SCI. 173, 174-75, 180 (1986); Richard C. Levin, Alvin K. Klevorick, Richard R. Nelson & Sidney G. Winter, *Appropriating the Returns from Industrial Research and Development*, 3 BROOKINGS PAPERS ON ECON. ACTIVITY 783, 796-97, 818 (1987); and Wesley M. Cohen, Richard R. Nelson & John P. Walsh, *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)* 2-3, 9, 23 (Nat'l Bureau of Econ. Rsch., Working Paper No. 7552, 2000), https://www.nber.org/system/files/working_papers/w7552/w7552.pdf [https://perma.cc/7G82-4PUA]. For theoretical-empirical syntheses of aggregate costs and benefits singling out pharmaceuticals as the strongest case for protection, see ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT 39-41 (2004); and JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS AND LAWYERS PUT INNOVATORS AT RISK 13-18, 27, 88-89 (2008). For historical studies of long-term patterns coming to overall ambivalent conclusions, but without specific reference to pharmaceuticals, see generally ELIZABETH PENROSE, THE ECONOMICS OF THE INTERNATIONAL PATENT SYSTEM (1951); STAFF OF SUBCOMM. ON PATS., TRADEMARKS & COPYRIGHTS OF THE S. COMM. ON THE JUDICIARY, 85TH CONG., AN ECONOMIC REVIEW OF THE PATENT SYSTEM, STUDY NO. 15 (Comm. Print 1958) (prepared by Professor Fritz Machlup) [hereinafter MACHLUP STUDY]; Josh Lerner, *Patent Protection and Innovation over 150 Years* (Nat'l Bureau of Econ. Rsch., Working Paper No. 8977, 2002), https://www.nber

This conviction holds not only for those most strongly endorsing the patent system as a whole,[3] but also for those more uncertain about the overall merits of patents.[4] Indeed, even the staunchest critics of the patent system in general accept that pharma remains a crucial exception.[5]

This Feature seeks to revisit that assessment comprehensively.[6] It argues that a proper understanding of the actual informational resources at play in drugs reveals that pharmaceutical innovation can, considerably does, and entirely should proceed without any significant role played by patent protection.[7] The foundational plank of the argument is to underline how innovation in

.org/system/files/working_papers/w8977/w8977.pdf [https://perma.cc/GJ74-F2AM]; and Petra Moser, *Patents and Innovation: Evidence from Economic History*, 27 J. ECON. PERSPS. 23 (2013).

3. *See, e.g.*, Richard A. Epstein & Bruce N. Kuhlik, *Is There a Biomedical Anticommons?*, 24 REGUL., no. 2, 2004, at 54, 56 (arguing that "strong" protection should be "the dominant approach in patent law," one that "take[s] on special urgency in connection with pharmaceutical products"); ROBERT P. MERGES, JUSTIFYING INTELLECTUAL PROPERTY 2-3, 282 (2004) (advancing nonutilitarian justifications for "the necessity and importance of IP law" in the face of general empirical uncertainty, while emphasizing that the empirical case remains strong for pharmaceuticals).

4. *See* JAFFE & LERNER, *supra* note 2, at 39-41; BESSEN & MEURER, *supra* note 2, at 13-18, 27, 88-89.

5. *See* MICHELE BOLDRIN & DAVID K. LEVINE, AGAINST INTELLECTUAL MONOPOLY 212-42 (2008) (in a book-length attack on intellectual-property (IP) rights, devoting a special chapter to more moderate treatment of pharmaceuticals); *cf.* Posner, *supra* note 1 ("[P]harmaceuticals are the poster child for the patent system. But few industries resemble pharmaceuticals . . . .").

6. For an important partial revisiting, see generally Rachel E. Sachs, *The Uneasy Case for Patent Law*, 117 MICH. L. REV. 499 (2018). Based on a searching case study of the relative unavailability of patents for microbiome-based therapies, Professor Rachel E. Sachs suggested that "[p]erhaps scholars should reconsider, *if only selectively*, our focus on patents as an irreplaceable driver of pharmaceutical innovation." *Id.* at 500 (emphasis added). The present analysis reinforces Sachs's conclusions by pointing to systematic misalignments between patent protection and pharmaceutical innovation in general, so as to make out a comprehensive case for phasing out patent protection for all drugs.

7. That all "innovations" are properly conceived as "information goods" from an innovation-policy point of view is an insight going back at least to Kenneth J. Arrow's foundational work. *See* Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, *in* THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609, 609 (Richard R. Nelson ed., 1962) ("Invention is here broadly interpreted as the production of knowledge."). For a systematic development of the point, see generally Yochai Benkler, *Intellectual Property and the Organization of Information Production*, 22 INT'L REV. L. & ECON. 81 (2002); and Hal R. Varian, *Markets for Information Goods* (Bank of Japan Inst. for Monetary & Econ. Stud., Discussion Paper No. 99-E-9, 1999), https://www.imes.boj.or.jp/research/papers/english/99-E-09.pdf [https://perma.cc/BR43-25F2]. For further discussion of the point in connection with the present argument, see *infra* Section I.A and text accompanying notes 71-73.

pharmaceuticals consists of not one but *two separate information goods*: (1) knowledge of a new chemical or biological compound, and (2) knowledge of the safety and efficacy of that compound for use in humans, as validated by clinical trials.[8] Moreover, not only is the latter information good a separate innovation from the former; it is one *very distinct* in its risk-cost profile, diverging sharply in those technical and economic features that are relevant to innovation-policy analysis. What these features reveal is that the first information good likely poses no stronger case for patent protection than innovation in most other sectors, while fitting quite well a model of decentralized, competitive development. Meanwhile, the second information good does require strong innovation-policy support, while fitting better a model of centrally coordinated development.

Two fundamental implications follow from this theoretical distinction. First, the distinction reveals a new understanding of existing patent practice in the pharmaceutical industry. Applying the insight of two information goods discloses a dramatically new picture of how patent and related laws map onto the pipeline of pharmaceutical innovation, including by revealing a set of highly sector-specific patent doctrines applicable only to pharma. The upshot of this picture is that patents provide only partial—and largely unnecessary—protection over the first information good, and indirect—and highly misaligned—protection over the second. Second, these explanatory implications of the distinction justify a deep reform of pharmaceutical innovation policy. A better innovation policy for this sector would be to phase out patents altogether and replace them with an alternative innovation-policy intervention, one better suited to the

8. This insight has been implicit in the work of a number of scholars, needing only explicit crystallization and systematic development. For the foundational works here, see generally Rebecca S. Eisenberg, *The Shifting Functional Balance of Patents and Drug Regulation*, 19 HEALTH AFFS. 119 (2001); Rebecca S. Eisenberg, *Patents, Product Exclusivity, and Information Dissemination: How Law Directs Biopharmaceutical Research and Development*, 72 FORDHAM L. REV. 477 (2003) [hereinafter Eisenberg, *Patents, Product Exclusivity, and Information Dissemination*]; Rebecca S. Eisenberg, *The Problem of New Uses*, 5 YALE J. HEALTH POL'Y L. & ETHICS 717 (2005) [hereinafter Eisenberg, *The Problem of New Uses*]; and Rebecca S. Eisenberg, *The Role of the FDA in Innovation Policy*, 13 MICH. TELECOMM. & TECH. L. REV. 345 (2007) [hereinafter Eisenberg, *The Role of the FDA*]. For subsequent scholars developing related insights, see generally Valerie Junod, *Drug Marketing Exclusivity Under United States and European Union Law*, 59 FOOD & DRUG L.J. 479 (2004); Stuart Minor Benjamin & Arti K. Rai, *Who's Afraid of the APA?: What the Patent System Can Learn from Administrative Law*, 95 GEO. L.J. 269 (2007); Benjamin N. Roin, *Unpatentable Drugs and the Standards of Patentability*, 87 TEX. L. REV. 503 (2009); and Talha Syed, *Should a Prize System for Pharmaceuticals Require Patent Protection for Eligibility?* (Incentives for Glob. Health, Discussion Paper No. 2, 2009), https://healthimpactfund.org/pdf/DP2_Syed.pdf [https://perma.cc/BUJ4-ZCAY].

distinctive technological and economic features of the second information good: a revised system of "regulatory exclusivity."[9]

At the heart of pharmaceutical innovation lie two information goods. The first is knowledge of a new drug product, which we may call the "compound information good."[10] The second is knowledge of that drug's safety and efficacy for humans as evinced by clinical-trial data, which we may call the "data information good."[11] Generating the compound information good involves the exploration of a highly uncertain possibility frontier: each step involves many risks—only about one in a thousand candidate compounds make it through the drug-discovery phases of "search, synthesis, and screening" to enter clinical trials[12]—so as to warrant comparatively low expenditures per step.[13] By contrast, generating the clinical information good is a comparatively low-risk, high-cost endeavor: roughly one out of five to ten drugs that enter clinical trials successfully navigate the process of testing and refinement to receive Food and Drug Administration (FDA) approval,[14] while the costs of phase 1, 2, and 3 trials dwarf those of each step of preclinical drug discovery.[15] This sharp divergence in the risk-cost profiles of these information goods carries two sets of crucial implications for their apt innovation-policy treatment.

First, from a purely *economic* point of view, it is the data information good—not the compound information good—that is the driver of the industry's innovation costs. While the cost of drug development remains a topic of fierce controversy,[16] what is not controversial is that clinical-trial expenditures comprise the lion's share of the costs, running around 70% according to the industry's own

9. The detailed contours of such a system of "regulatory exclusivity" are set out in Section III.B(2), *infra*.

10. A breakdown of the different kinds of pharmaceutical innovations that fall under the "compound information good" rubric—and the different forms of product or process patents they may be eligible for—is provided *infra* notes 88-93 and accompanying text.

11. A breakdown of the different kinds of clinical information that fall under the "data information good" rubric—and the different forms of regulatory requirements and data exclusivity that may pertain to them—is provided *infra* text accompanying notes 94-96, 149-150.

12. *See infra* note 154.

13. For a discussion of this point, see *infra* text accompanying notes 155-156.

14. *See infra* note 154.

15. *See* text accompanying notes 16-19.

16. The key sources and extent of the controversy are reviewed *infra* text accompanying notes 109-113.

preferred studies,[17] and even higher for others.[18] Indeed, a 2021 metareview of twenty-two studies of drug-development costs conducted over the past four decades found that over half (thirteen) of the studies reviewed did not even consider preclinical drug-discovery expenditures significant enough to factor in as a part of total costs.[19]

In addition to their very different economic significance for pharmaceutical innovation, these information goods also sharply differ in the *technological* features of the respective innovation processes that generate them. Preclinical drug discovery, with its high risks and lower costs, is well suited for a decentralized search, where "many minds" are given free rein to explore various different avenues, even at the risk of a fair bit of overlapping, duplicative activity.[20] Clinical trials, on the other hand, with their lower risks and high costs, are better suited for coordinated development to curb duplicative efforts that would be highly wasteful at this stage.[21] In other words, preclinical research should be a nonexclusionary zone, to enable many-minded exploration unencumbered by proprietary barriers. Meanwhile, for clinical trials, some mechanism is needed to call off the innovation race at their outset.

Integrating these distinct economic and technological features of the two innovations leads to the following pair of conclusions. First, the compound information good — generation of new knowledge of a chemical or biological product or process — poses no special incentive case for patent protection. Its share of overall industry innovation costs is relatively modest. Further, what is the really relevant focus for innovation-policy analysis is the differential between its average innovation costs and risks and its average imitation costs and speed (i.e., the cost and time involved in reverse engineering and being ready to manufacture a new or improved drug product or process). And that differential is likely no greater than in many other sectors where a combination of first-mover advantages and secrecy suffice to ensure a relatively robust level of innovative

17. *See* Joseph A. DiMasi, Ronald W. Hansen & Henry G. Grabowski, *The Price of Innovation: New Estimates of Drug Development Costs*, 22 J. HEALTH ECON. 151, 166 (2003) [hereinafter DiMasi et al., *The Price of Innovation*]; Joseph A. DiMasi, Henry G. Grabowski & Ronald W. Hansen, *Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs*, 47 J. HEALTH ECON. 20, 25 (2016) [hereinafter DiMasi et al., *Innovation in the Pharmaceutical Industry*].

18. *See* Michael Schlander, Karla Hernandez-Villafuerte, Chih-Yuan Cheng, Jorge Mestre-Ferrandiz & Michael Baunmann, *How Much Does It Cost to Research and Develop a New Drug? A Systematic Review and Assessment*, 39 PHARMACOECONOMICS 1243, 1245-46 (2021).

19. *Id.* at 1246.

20. *See* Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 873-74 (1990).

21. *See* Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 278-79 (1977).

activity.[22] In addition, patents also serve no useful "coordinating" function during the research phase leading to the generation of the compound information good: its comparatively high risks and low costs make that phase suitable for a competitive, decentralized search.

Second, the data information good — generation of new clinical results on a drug — *does* present a strong case for an innovation-policy intervention, but it is one for which patents are a highly unsuitable instrument. That strong case stems not only from the large share of overall industry innovation costs taken up by this activity but also from — what is again the relevant focus — the large difference between its average costs and risks of generation and its average costs and speed of replication (with the latter massively reduced by regulatory permission of imitator piggybacking on innovator data).[23] Yet the patent system provides little to no direct protection over this information good, as its doctrines center on the results of preclinical research, not clinical testing.[24] And it is not only that patents currently sideline the protection of clinical data; they also *cannot* effectively provide such protection. Given the technological features of this innovation, it would be untenable to try to reform the patent system to protect it; inquiries into its desirability and validity are simply not ones that the patent system is well suited to carry out.[25]

Consequently, patents serve their two primary functions in pharmaceutical innovation — coordinating innovation races and incentivizing innovative activity — only indirectly, with respect to an information good, clinical data, that they do not directly protect.[26] Meanwhile, for the information good that patents do directly cover — knowledge of the compound — they play little to no coordinating role and only a secondary incentive role.[27] A sounder innovation policy would be to replace the primary, yet indirect, role played by patents over data information with a form of regulatory exclusivity that specifically attends to the distinctive features of this innovation, while at the same time phasing out the direct but secondary role patents play over compound information.

The point of doing so is to bring our system of innovation-policy rules into better alignment with the underlying innovations that they seek to generate. This alignment would ensure that the rules directly attend to the relevant

22. *See infra* text accompanying note 48.

23. *See infra* text accompanying notes 187, 214-217.

24. *See infra* Section II.B.

25. *See infra* Sections II.A, III.B.

26. For the indirect coordinating and incentive roles played by patents for the data information good, see *infra* Sections II.B.2 and II.C.

27. For the negligible coordinating and secondary incentive roles played by patents for the compound information good, see *infra* Sections II.A.1 and B.1.

features of the information goods they govern and that they are better equipped to make the various tradeoffs facing any innovation policy. In particular, such a reform would significantly improve the performance of our innovation policy for drugs in tackling the two key tradeoffs facing any incentive system that uses exclusionary rights (such as patents or data exclusivity). First, it would reduce undue barriers to access that exclusionary rights erect over those innovations that would have been generated at lower levels of protection. Second, it would curb undue rent dissipation—that is, wastefully duplicative innovative activity—that exclusionary rights may incur for innovations that would have been incentivized by a lower level of protection.[28] Specific versions of each of these concerns have been prominently voiced in the critical literature on pharma, the first under the heading of "evergreening" practices[29] and the second under that of "me-too" drugs.[30] In both cases, analysis of the distinct information goods—and of how existing rules fail to align with their relevant features—immeasurably improves *both* our diagnosis of the precise causes and extent of the problems *and* our prospects for prescribing effective solutions.

In the case of evergreening and related practices such as "reverse settlement agreements" (RSAs), this analysis identifies the generative cause of such practices: the specific *industry structure* of pharma that stems from the regulatory treatment of the data information good.[31] This information-good analysis fills a gap in the literature by explaining why such practices are, indeed, pharma-specific. The Feature then specifies better ways of evaluating the extent of the social costs of such practices, anchored in the distinction between the compound and data information goods.[32] Finally, this same information-goods analysis also points the way to reforms that attack the problem at its root—the basic misalignment between patents and data information—as opposed to proposals that seek only to remedy surface ills with how patents currently operate.[33] And similarly

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28. For a discussion of these, see *infra* notes 52-54, 56-59 and accompanying text. Note that these are the main tradeoffs *internal* to exclusionary-rights incentive systems. There also exists a separate set of tradeoffs in choosing between such systems and alternative, nonexclusionary innovation policies. For a discussion of these as a general matter, see *infra* text accompanying notes 51-55, and, for how the present analysis may affect our evaluation of them in the case of pharmaceutical innovation policy, see *infra* Part IV.

29. "Evergreening" refers to practices by patentees to prolong the exclusivity enjoyed by their drug products beyond the expiration of their original patents. *See infra* text accompanying notes 205-209.

30. "Me-too" drugs refer to newly patented drugs that are similar to existing patented drugs, achieving the same mechanism of action but with a different compound. *See infra* text accompanying notes 234-237.

31. *See infra* text accompanying notes 212-217.

32. *See infra* text accompanying notes 223-232.

33. *See infra* text accompanying notes 233, 248-250.

for the duplication wastes incurred by me-too drugs, an analysis focused on the distinction between generating new compounds and generating new clinical data is better able to specify both the extent to which such drugs do incur such wastes and how to tailor remedies for effectively curbing them.[34]

In sum, an assessment of pharmaceutical innovation policy that trains its attention on the data information good lying at its heart leads to the following conclusions. The actual protection provided by patents over the key information goods in pharmaceuticals is partial, indirect, and — owing to a misalignment between what the patent system focuses on (the compound information good) and what sensible innovation policy would center (the data information good) — haphazard and highly costly. This protection would be radically improved by replacing patents' exclusionary rights with those of a revised — streamlined and tailored — form of data exclusivity. Such exclusivity should be streamlined to curb the gaming and administrative costs associated with misaligned patents, and tailored to realign the system's focus on the incentives that matter — those pertaining to the costs, risks, and desirability of generating different types of clinical data on drugs.

This analysis has major implications for lowering *both* the prices *and* the cost of drugs, and for improving *both* access to *and* incentives for pharmaceutical innovation. In 2022, the United States spent $406 billion on retail prescription drugs.[35] One source of this high price tag, on which critics of the industry have rightly focused their attention, is how RSAs and related evergreening abuses of patents unduly drive up drug prices, with estimates of their effects ranging between $3.5 billion to $6.2 billion in higher prices annually.[36] In response, the Federal Trade Commission (FTC) has called for reforms such as the "delisting" of over 100 drug patents from the "Orange Book" — to remove one evergreening obstacle to generic entry — as well as changing the antitrust burden for establishing the legality of RSAs, to remove another.[37] The present analysis not only provides a firmer basis for such reforms than has so far existed, but it also shows why they do not go far enough: not only should *some* patents be delisted from

34. *See infra* Section III.A.2.

35. Off. of the Assistant Sec'y for Plan. & Evaluation, *Prescription Drug Spending, Pricing Trends, and Premiums in Private Health Insurance Plans*, U.S. DEP'T OF HEALTH & HUM. SERVS. 5 (Nov. 2024), https://www.dol.gov/sites/dolgov/files/ebsa/laws-and-regulations/laws/no-surprises-act/2024-report-to-congress-prescription-drug-spending.pdf [https://perma.cc/BKC8-BKVQ].

36. *See infra* notes 223-224 and accompanying text.

37. For calls for delisting, see Press Release, Fed. Trade Comm'n, FTC Challenges More than 100 Patents as Improperly Listed in the FDA's Orange Book (Nov. 7, 2023), https://www.ftc.gov/news-events/news/press-releases/2023/11/ftc-challenges-more-100-patents-improperly-listed-fdas-orange-book [https://perma.cc/AZJ3-96F8]. For arguments on altering the legality of reverse settlement agreements (RSAs), see *infra* note 246 and accompanying text.

the Orange Book, but *all* such Orange Book linkage should be abolished,[38] and similarly for RSAs — they should be deemed per se, rather than merely presumptively, anticompetitive.[39] Doing so would dramatically reduce barriers to access from trivial or modest secondary drug patents and products.

At the same time, however, the foregoing estimates of the costs of evergreening practices are incomplete because they do not factor in possible incentive benefits from extended patent protection to be weighed against its access costs. And these estimates do not factor in the wastes associated with gaming the patent system to obtain such (indirect) incentives.[40] In addition, a focus on the role of evergreening — or trivial or modest secondary drug patents or productions — in driving up industry prices and costs needs to be supplemented with an analysis of the role of me-too — or duplicative primary drug patents and products — in doing the same. For both, the best metric of their costs is to step back from specific cases, take a comprehensive view of the industry's output, and analyze the types and extent of innovation they represent. Such a review, carried out here, reveals that, of the 2,872 new drugs approved in the years 1990 to 2023,[41] almost 70% were secondary products, and 86% of these were rated by FDA not to hold out a significant advance. In other words, 60% of the industry's output consists of secondary products securing patent protection that is likely incommensurate with the modest innovation they hold out. Moreover, of the roughly 30% of output that consisted of primary products, over half (51%) were similarly rated as standard — that is, held to be somewhat to highly duplicative of already-available treatments.

Both the high access and duplication costs incurred by evergreening practices and me-too drugs stem from the misaligned incentives of the present system of innovation-policy rules in place for pharmaceuticals. In each case, the cause lies in different aspects of how the central innovation in pharmaceuticals, the data information good, is handled by the present system of regulatory requirements, permissions, and data exclusivity. And for both, the solution lies in the same domain: to replace patent protection with a tailored system of regulatory

38. Why? Because Orange Book linkage intertwines, unnecessarily, what the present analysis shows are entirely distinct processes pertaining to entirely distinct information goods: patents over compound information and regulatory requirements for data information. *See infra* Section III.B.1.

39. Why? Because RSAs are, as the present analysis shows, a pharma-specific type of horizontal market division enabled by regulatory treatment of data information. *See infra* text accompanying notes 248-252.

40. For possible incentive benefits, see *infra* text accompanying note 224; for gaming costs, see *infra* text accompanying note 230.

41. With the exception of the years 2004 to 2007, for which refined data were not available. *See infra* note 232 and accompanying text.

exclusivity, one that retains strong incentives for truly socially valuable forms of drug innovations while curtailing them for others.

Turning from pharmaceutical innovation policy to broader debates in patent theory, this analysis also provides a distinct explanation for the consensus view that patents are especially important for pharmaceuticals. The special case for protection presented by pharma, this analysis reveals, is a *regulatory artifact* rather than, as is commonly thought, the result of any generalizable technological or economic features of the pharmaceutical industry. That is, this case stems from the gap between innovation and imitation costs with respect to the second, data information good, and not the first, compound information good.[42] More specifically, it is due to the combined effect of *two distinct regulatory features* with respect to data information: how regulatorily mandated clinical trials massively drive up innovation costs, and how regulatorily permitted piggybacking on clinical data massively drives down imitation costs.[43] Absent this combination, there

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42. The majority of explanations of what makes pharma special center on different aspects of the technological or economic features of the compound information good that affect innovator risks and costs, imitator costs and speed, the comparative role of patents versus alternative forms of private appropriability, and/or the comparative access costs of patents. *See, e.g.*, Mansfield et al., *supra* note 2, at 913 (emphasizing the role of patents in raising imitation costs for drug compounds); Levin et al., *supra* note 2, at 811 (same); Cohen et al., *supra* note 2, at 23 (emphasizing the comparative appropriability of patents on drug compounds); Eisenberg, *Patents, Product Exclusivity, and Information Dissemination*, *supra* note 8, at 479 (same); Merges & Nelson, *supra* note 20, at 897-98 (emphasizing the high risks and costs of innovation, and the ease of imitation for compounds); Merges & Nelson, *supra* note 20, at 880-83 (emphasizing the lower access costs of broad patents for drug compounds as "discrete" rather than "cumulative" innovations); Posner, *supra* note 1 (emphasizing the high risks, costs, and length of innovating and the low costs and time of imitating drug compounds); William W. Fisher III, *Regulating Innovation*, 82 U. CHI. L. REV. DIALOGUE 251, 253-54 (2015) (same). For partial exceptions that briefly mention the role of regulatory requirements alongside other factors in driving up innovator costs, but without emphasizing their centrality or attending to their equally significant role in driving down imitator costs, see Fisher, *supra* note 1, at 11; and BOLDRIN & LEVINE, *supra* note 5, at 212-13, 236-37. Finally, for fuller exceptions that do mention both roles of regulatory requirements, that is, driving up innovation costs and driving down imitation costs, see Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1616-17 (2003); JAFFE & LERNER, *supra* note 2, at 40; and BESSEN & MEURER, *supra* note 2, at 88. Note, however, that none of this latter set of authors draws out the implications of the point for patent theory and policy, perhaps due to their not registering that these regulatory features pertain to a *second, and very distinct*, information good. As a result, the point has been largely overlooked in the subsequent literature. *See, e.g.*, Sachs, *supra* note 6, at 506-07, 507 n.34 (citing Dan L. Burk and Mark A. Lemley's analysis for the special pharma case for patents, but without drawing out the implications for that case of the centrality of regulatory requirements and of the distinction between the two information goods); Roin, *supra* note 8, at 510-11, 510 n.20 (same).

43. This hypothesis was first ventured in Syed, *supra* note 8, at 14 ("[T]he case for strong patent protection for pharmaceuticals may be largely based on the combination of regulatorily-

is little reason to believe that pharma would be very different—that is, with respect to the compound information good—from other sectors in terms of the ability of first-mover advantages and secrecy to sustain a robust level of innovative activity. None of this is to query the regime of regulatory requirements and permissions. Far from it. Rather, it is to just underline that it is *this regime* that makes pharma special, putting it in need of special innovation-policy support.

This point has crucial import for general debates in patent theory. In those debates, pharma has long cast a shadow over the standard conclusion that the overall case for patents—across the economy as a whole—is uneasy,[44] and likely at its best for modest protection for small inventors at the margins.[45] Pharma has long operated as the key exception to that general rule, one that, so long as it remained unexplained, gnawed away at confidence in the rule. Showing that this exception can be not only explained, but explained *away*, reinforces the broader conclusion that for most sectors, strong patents are likely not needed for robust innovation, a conclusion that may now be retained in its original force, without qualification.

The rest of the Feature proceeds as follows. Part I lays the theoretical foundations by setting out a framework for the analysis of innovation policy, clarifying why all innovations need to be conceived as information goods, identifying the two distinct (compound and data) information goods at issue in pharmaceutical innovation, and specifying their divergent technological and economic features as relevant to innovation policy in theory. Part II then turns to analyzing how the two information goods are presently treated by pharmaceutical innovation policy in practice. It begins with a sketch of the technological and

mandated clinical trials for innovators and regulatorily-enabled piggybacking for imitators."). A substantiation of it will be offered in a follow-up article to the present.

44. *See supra* note 2 and accompanying text.

45. *See* Robert P. Merges, *Uncertainty and the Standard of Patentability*, 7 HIGH TECH. L.J. 1, 8-9 (1992) (arguing that even if the average innovator is not induced by patent protection, the proper focus of incentives is on "the inventor at the margin," and that "small firms may be more likely to be marginal inventors"); John M. Golden, *Biotechnology, Technology Policy, and Patentability: Natural Products and Invention in the American System*, 50 EMORY L.J. 101, 111, 177 (2001) (suggesting that biotechnology patents serve less to "spur" than to "enable" innovative activity, by facilitating technology-licensing agreements between upstream small biotech firms and downstream big pharma); ASHISH ARORA, ANDREA FOSFURI & ALFONSO GAMBARDELLA, MARKETS FOR TECHNOLOGY: THE ECONOMICS OF INNOVATION AND CORPORATE STRATEGY 261-62 (2004) (advancing a "markets for technology" rationale for patents, based on their role in facilitating a specialized division of labor between small inventive firms and large established ones); Ashish Arora & Robert P. Merges, *Specialized Supply Firms, Property Rights and Firm Boundaries*, 13 INDUS. & CORP. CHANGE 451, 471 (2004) (same); BESSEN & MEURER, *supra* note 2, at 185 ("The good news is that small inventors receive positive incentives from the patent system; this might, in fact, be one of the strongest rationales for having a patent system. The economic impact of important inventions from small inventors depends, however, on the market for technology.").

institutional pipeline of pharmaceutical innovation, and the roles played by patents, FDA regulatory requirements, and data exclusivity. It then details the coordination and incentive functions that patents and data exclusivity do (or do not) play with respect to each of the two information goods along the innovation pipeline. It shows that patents play only a modest role in directly protecting the compound information good. Meanwhile, patents serve more significant functions for the data information good, but they do so only indirectly.

Part III then evaluates how well this system of indirect—and thus misaligned—protection performs. It finds that for each of the two main tradeoffs raised by exclusionary incentives—access costs and rent dissipation—the system performs quite badly indeed. The undue access (and gaming) costs incurred by "evergreening" practices and the duplication wastes associated with "me-too" drugs are very high, and in each case they stem from the basic underlying misalignment between patents and data information. The most effective way to curb these costs, then, is not so much to improve how drug patents work but rather to attack the problem at its root and eliminate the basic misalignment by replacing pharma patents with a revised system of tailored regulatory exclusivity. Finally, Part IV briefly canvasses three issues broached by the present analysis that merit future investigation: how to determine the precise duration and scope of regulatory-exclusivity protection; whether and how to supplement such an improved system of regulatory-exclusivity incentives on the "supply" side with better pricing (signals) on the "demand" side; and whether the role of nonexclusionary innovation policies should be expanded in this area.

I. PHARMA'S TWO INFORMATION GOODS

This Part lays the analytical foundations of the Feature's argument. The first Section sets out a theoretical framework for the analysis of innovation policy that serves three related purposes. First, it identifies the relevant parameters of costs and benefits of exclusionary incentive systems, such as patents and data exclusivity, which provide the touchstone for the subsequent analysis of how well the present system of pharmaceutical innovation policy is working. Second, it distills the contours of the existing consensus in the literature—that pharma poses an especially strong case for patent protection—against which the present argument is directed. Finally, it provides the basis for the claim that all innovations are best conceived, for purposes of innovation-policy analysis, as intangible information goods. The second Section follows through on the last point by providing a reconceptualization of pharmaceutical innovations *as* information goods, which paves the way to seeing that at the heart of such innovation lie not one but two key information goods. The final Section then fully develops the point that these two information goods are indeed very distinct by specifying

their divergence in the economic and technological features relevant to policy analysis.

A. Innovation-Policy Analysis of Information Goods

Innovation-policy analysis of pharmaceuticals begins with the recognition of the intangible character of innovations as information goods.[46] Because information goods are intangible, it may be difficult to provide access to their benefits to some while excluding it for others.[47] This *nonexcludability*, in turn, may give rise to an appropriability problem. The innovator's inability to charge some or many for accessing the good may prevent them from recouping the (capitalized, risk-adjusted) costs of generating the innovation. To be sure, in many contexts a combination of secrecy and first-mover advantages (such as lead time, moving down the learning curve, establishing supply chains, brand-name loyalty, and fixed-cost barriers to entry) may suffice to sustain a robust level of innovative activity.[48] But in other contexts, the appropriability enabled by secrecy and first-

46. *See* Nancy Gallini & Suzanne Scotchmer, *Intellectual Property: When Is It the Best Incentive System?*, *in* 2 INNOVATION POLICY AND THE ECONOMY 51, 53 (Adam B. Jaffe, Josh Lerner & Scott Stern eds., 2002) ("Competitive markets may not be conducive to innovation, for a reason that was well articulated by Arrow (1962). Inventions are *information* . . . ."); Arrow, *supra* note 7, at 609-10 (analyzing innovation policy in terms of the "economic characteristics of information"); Benkler, *supra* note 7, at 83 (analyzing innovation policy in terms of "various strategies for organizing information production"); Varian, *supra* note 7, at 1 (analyzing innovation economics as centering on "information goods" as the "basic unit" of transactions).

47. *See* RICHARD A. MUSGRAVE, THE THEORY OF PUBLIC FINANCE: A STUDY IN PUBLIC ECONOMY 9-10 (1959) (developing the concept of nonexcludability in general); Benkler, *supra* note 7, at 83 & n.13 (developing how nonexcludability applies to information goods); Varian, *supra* note 7, at 4-5 (same).

48. *See* Roberto Mazzoleni & Richard R. Nelson, *The Benefits and Costs of Strong Patent Protection: A Contribution to the Current Debate*, 27 RSCH. POL'Y 273, 276 (1998) ("In a wide range of 'high-tech' industries, firms rated a head start, establishment of effective productions sales and service facilities, and rapid movement down the learning curve, as much more effective than patents in enabling them to profit from the R&D. Pharmaceuticals . . . are exceptions . . . ."); F.M. Scherer, *First Mover Advantages and Optimal Patent Protection* 1 (Harvard Kennedy Sch. Fac. Rsch., Working Paper No. RPP15-053, 2014), https://www.hks.harvard.edu/sites/default/files/centers/mrcbg/files/RPP_2015_05_Scherer.pdf [https://perma.cc/Y74R-8GM3] ("Empirical studies have shown repeatedly that on average, but with notable exceptions, patent protection is a relatively unimportant requisite for business firms' investment in research, development, and innovation. . . . This paper seeks to advance the theory of patent protection by quantifying approximations to the 'first mover advantages' that sustain investment in invention and innovation without formal patent protection."); *see also* TAYLOR & SILBERSTON, *supra* note 2, at 199, 263-65 (indicating that in most sectors, first-mover advantages and secrecy are more important than patents, with pharma as a crucial exception); Mansfield et al., *supra* note 2, at 915-17 (same); Mansfield, *supra* note 2, at 174-75, 180 (same); Levin et al., *supra* note 2, at 796-97, 818 (same); Cohen et al., *supra* note 2, at 2-3, 9, 23 (same).

mover advantages may not suffice in the face of high innovation costs, and a large enough gap may open up between typical innovation costs and risks and typical imitation costs and delay to warrant an innovation-policy intervention into competitive markets to address the concern.

Patents aim to solve this appropriability problem by making innovations more excludable, enabling innovators to charge more for access to the fruits of their innovative activity and thereby potentially recover its costs. Patents aim, in other words, to bolster "incentives to innovate."[49] But this patent solution raises a distinct problem of its own, stemming from the second key feature of information goods: their *nonrivalry*. Goods are nonrival to the extent that consumption by one does not subtract from consumption by another, and information goods are among the most highly (indeed, typically purely) nonrival.[50] As a

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49. "Incentives to innovate" include here both "incentives to invent" a new idea or prototype technology and "incentives to develop and commercialize" that idea or technology into a practically workable and marketable product or process. *See* Mazzoleni & Nelson, *supra* note 48, at 274-76. That innovation should be thought to include both aspects has been long understood in economics and is usually attributed to Schumpeterian analysis. *See, e.g.*, MACHLUP STUDY, *supra* note 2, at 9, 21, 23-24, 27, 55-56; Burk & Lemley, *supra* note 42, at 1615 n.128. That patents may serve to induce both, the first directly and the second *indirectly*, has a similarly long pedigree in legal analysis. *See, e.g.*, Giles S. Rich, *The Relation Between Patent Practices and Anti-Monopoly Laws*, 24 J. PAT. OFF. SOC'Y 159, 177 (1942); Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CALIF. L. REV. 803, 806-09 (1988). The relevance of this point for pharmaceutical innovation is taken up later. *See infra* text accompanying note 122. There also exists, with respect to postinventive activity, a subtheory of the "prospect" function of patents in coordinating such activity, which is taken up in Section III.A.2, *infra*. Finally, alongside "invent" and "innovate," the third canonical incentive function of patents is to "disclose." *See* MACHLUP STUDY, *supra* note 2, at 21 (listing incentives to invent, innovate, and disclose); Merges, *supra*, at 809-10 (same); Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1024-30 (1989) (same); CRAIG ALLEN NARD, THE LAW OF PATENTS 34-36 (2017) (same); Mazzoleni & Nelson, *supra* note 48, at 274-75, 279 (listing "incentives to "invent," "develop and commercialize," and "disclose," along with "prospect theory"); PETER S. MENELL, MARK. A. LEMLEY & ROBERT P. MERGES, 1 INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE 167 (2018) (identifying "incentive to invest in creating, developing, and marketing" as "the central theory behind patent law," and "prospect theory" as an "alternative to classical incentive theory"); DONALD. S. CHISUM, CRAIG ALLEN NARD, HERBERT F. SCHWARTZ, PAULINE NEWMAN & F. SCOTT KIEFF, PRINCIPLES OF PATENT LAW 70 (2001) (listing "(1) incentive to invent; (2) incentive to disclose; (3) incentive to commercialize; and (4) incentive to design around"). For discussion of disclosure's relevance, see *infra* note 265 and accompanying text.

50. *See* Paul Samuelson, *The Pure Theory of Public Expenditure*, 36 REV. ECON. & STAT. 387, 387-89 (1954) (developing the concept of nonrivalry in general); Benkler, *supra* note 7, at 83 & n.13 (developing how nonrivalry applies to information goods); Varian, *supra* note 7, at 4-5 (same). The radically distinct—indeed, opposed—roles of nonrivalry and nonexcludability in the policy analysis of information goods are juxtaposed in Oren Bracha & Talha Syed, *Beyond*

result, once such goods are created, it is wasteful to deny anyone access to them. More precisely, from an efficiency point of view, access should be given to anyone willing and able to pay the marginal costs of disseminating the information good.[51] Yet the entire point of patents is to enable their holders to charge a markup over that marginal cost, for the sake of recovering the sunk costs of generating the innovation in the first place.[52] And the effect of such supramarginal pricing will be to raise the costs of accessing the information good, for both end consumers[53] and, in contexts of cumulative innovation, follow-on innovators.[54]

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the Incentive-Access Paradigm? Product Differentiation and Copyright Revisited, 92 TEX. L. REV. 1841, 1849-50 (2014); and Oren Bracha, *Give Us Back Our Tragedy: Nonrivalry in Intellectual Property Law and Policy*, 19 THEORETICAL INQUIRY L. 633, 643-45 (2018). For the slow, halting recognition of both features as distinct aspects of "public goods," and for the collaborative yet distinct roles of Richard A. Musgrave and Paul Samuelson in forging this analysis, see generally Maxime Desmarais-Tremblay, *Musgrave, Samuelson, and the Crystallization of the Standard Rationale for Public Goods*, 49 HIST. POL. ECON. 59 (2017).

51. *See* Arrow, *supra* note 7, at 616-17; Benkler, *supra* note 7, at 84-86.

52. *See* MACHLUP STUDY, *supra* note 2, at 58-59; Eisenberg, *supra* note 49, at 1025-26.

53. Specifically, some consumers will pay more for the good than they would have under competitive conditions, while others will be priced out and forgo access entirely (this latter effect is referred to as "deadweight loss"). *See, e.g.*, William W. Fisher III, *Reconstructing the Fair Use Doctrine*, 101 HARV. L. REV. 1659, 1700-02 (1988) [hereinafter Fisher, *Reconstructing Fair Use*] (analyzing the twin price effects on consumers from IP rights). The extent of both effects will depend on the availability and costs of administering price discrimination. For debate on the merits and demerits of price discrimination in the context of intellectual property, see William W. Fisher III, *Property and Contract on the Internet*, 73 CHI.-KENT L. REV. 1203, 1234-40 (1998); Wendy J. Gordon, *Intellectual Property as Price Discrimination: Implications for Contract*, 73 CHI.-KENT L. REV. 1367, 1368-69 (1998); Julie E. Cohen, *Copyright and the Perfect Curve*, 53 VAND. L. REV. 1799, 1801-08 (2000); James Boyle, *Cruel, Mean, or Lavish? Economic Analysis, Price Discrimination and Digital Intellectual Property*, 53 VAND. L. REV. 2007, 2021-39 (2000); Yochai Benkler, *An Unhurried View of Private Ordering in Information Transactions*, 53 VAND. L. REV. 2063, 2070-79 (2000); Michael J. Meurer, *Copyright Law and Price Discrimination*, 23 CARDOZO L. REV. 55, 55-62 (2001); William W. Fisher III, *When Should We Permit Differential Pricing of Information?*, 55 UCLA L. REV. 1, 10-13 (2007); and Glynn S. Lunney, Jr., *Copyright's Price Discrimination Panacea*, 21 HARV. J.L. & TECH. 387, 396-98 (2008).

54. Specifically, some follow-on innovators will incur the transaction costs and royalty fees of licensing, while others may fail to secure a license or simply steer clear of that zone of research. For overall analysis of the effects of IP in cumulative-innovation contexts, see Merges & Nelson, *supra* note 20, at 870, 880-97; Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and Patent Law*, 5 J. ECON. PERSPS. 29, 31-32 (1991); and Mark Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 998-1000 (1997). For debate on the prospects of licensing as an effective solution, see generally Robert P. Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75 (1994); Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998); Gallini & Scotchmer, *supra* note 46; John P. Walsh, Ashish Arora & Wesley M. Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED

Recognition of the access costs attendant upon patent incentives gives rise, in turn, to two debates: one external to patent theory, or comparative, and the other internal. The comparative debate pertains to whether alternative innovation policies, such as public funding or prizes, may better solve the appropriability problem posed by information goods than patents with their access costs. Specifically, it centers on whether nonexclusionary ways of fostering innovation exist that may rival the decentralized information and incentive virtues of the market price signals that patents and related exclusionary mechanisms (such as trade-secret protection) are able to harness.[55]

Meanwhile, the debate internal to patents focuses on how best to maximize their incentive benefits while minimizing their access costs—the familiar "incentive/access" tradeoff.[56] More precisely, comprehensive analysis of the tradeoffs seeks to ascertain when (1) the incentive benefits of added patent protection, in terms of innovations that otherwise would have been generated later or not at all, (2) outweigh (a) the administrative costs of granting, monitoring, and enforcing patent rights;[57] (b) the access costs of such rights;[58] (c) rent dissipation,

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ECONOMY 285 (Stephen A. Merrill & Wesley Cohen eds., 2003); Fiona Murray & Scott Stern, *Do Formal Intellectual Property Rights Hinder the Free Flow of Scientific Knowledge?: An Empirical Test of the Anti-Commons Hypothesis* (Nat'l Bureau of Econ. Rsch., Working Paper No. 11465, 2005), https://www.nber.org/system/files/working_papers/w11465/w11465.pdf [https://perma.cc/44F8-8K8Y]; and Rebecca S. Eisenberg, *Anticommons, Transaction Costs, and Patent Aggregators*, *in* 1 RESEARCH HANDBOOK ON THE ECONOMICS OF INTELLECTUAL PROPERTY LAW 27 (Ben Depoorter & Peter S. Menell eds., 2019).

55. For the key works framing the modern debate between public funding, patents, and prizes in these terms, see Arrow, *supra* note 7, at 623-25, which emphasizes the nonexclusionary benefits of public funding of information goods, given their nonrivalry; Harold Demsetz, *Information and Efficiency: Another Viewpoint*, 12 J.L. & ECON. 1, 1-4 (1969), which replies to Arrow by pointing to the allocative virtues of exclusionary rights, given their harnessing of market price signals; and Brian W. Wright, *The Economics of Invention Incentives: Patents, Prizes, and Research Contracts*, 73 AM. ECON. REV. 691, 696-700 (1983), which suggests that prizes may provide a nonexclusionary way of tracking market signals.

56. *See, e.g.*, William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 J. LEGAL STUD. 325, 326 (1989) ("Striking the correct balance between access and incentives is the central problem in copyright law."); Glynn S. Lunney, Jr., *Reexamining Copyright's Incentives-Access Paradigm*, 49 VAND. L. REV. 483, 485-86 (1996) (documenting the "enduring and widespread" reliance by "Congress, courts, and commentators . . . on [the] incentives-access balance in defining some of copyright's most basic parameters").

57. *See, e.g.*, BESSEN & MEURER, *supra* note 2, at 14-19, 130-38.

58. Access costs refer to unnecessary barriers to consumers and follow-on innovators over those innovations that would have been induced at lower levels of protection anyway. For incentive/access analyses that focus on these parameters, see WILLIAM NORDHAUS, INVENTION, GROWTH, AND WELFARE: A THEORETICAL TREATMENT OF TECHNOLOGICAL CHANGE 86-90 (1969); Fisher, *Reconstructing Fair Use*, *supra* note 53, at 1700-18; and Landes & Posner, *supra* note 56, at 326-44. For some leading works exploring tradeoffs between different aspects

or waste from duplicative innovative activity;[59] and (d) global distortions, or diversion of resources away from other sectors with higher social value but lower private returns.[60]

In sum, then, innovation-policy analysis centers on three key questions.[61] First, to what extent is *any* innovation-policy intervention in competitive markets merited, as opposed to simply relying on secrecy and first-mover advantages to suffice?[62] Second, where the administrative costs and risks of an intervention are deemed necessary, should that intervention take the form of patents or some

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of these parameters for patents, see generally NORDHAUS, *supra*; F.M. Scherer, *Nordhaus' Theory of Optimal Patent Life: A Geometric Reinterpretation*, 62 AM. ECON. REV. 422 (1972); Richard Gilbert & Carl Shapiro, *Optimal Patent Protection and Breadth*, 21 RAND J. ECON. 106 (1990); Paul Klemperer, *How Broad Should the Scope of Patent Protection Be?*, 21 RAND J. ECON. 113 (1990); and BESSEN & MEURER, *supra* note 2.

59. Rent dissipation refers to duplication wastes from any overlapping innovative activity lured by the excess returns ("rents") held out by the stronger levels of protection accorded to some innovations than was needed to recover their generation costs. For incentive/access frameworks that fold in this further set of incentive effects, see MACHLUP STUDY, *supra* note 2, at 62-73; Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1823-29 (1984); and Bracha & Syed, *supra* note 50, at 1848-59. For brief recognition of wastes from patent races, see NORDHAUS, *supra* note 58, at 17, 19-21. For some leading works exploring different facets of rent-dissipation analysis and their implications for patent rights, see generally Yoram Barzel, *Optimal Timing of Innovations*, 50 REV. ECON. & STAT. 348 (1968); Kitch, *supra* note 21; Donald G. McFetridge & Douglas A. Smith, *Patents, Prospects and Economic Surplus: A Comment*, 23 J.L. & ECON. 197 (1980); Donald G. McFetridge & Mohammed Rafiquzzaman, *The Scope and Duration of the Patent Right and the Nature of Research Rivalry*, 8 RSCH. L. & ECON 91 (1986); Merges & Nelson, *supra* note 20; Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation*, 78 VA. L. REV. 305 (1992); Robert P. Merges, *Rent Control in the Patent District: Observations on the Grady-Alexander Thesis*, 78 VA. L. REV. 359 (1992); and John F. Duffy, *Rethinking the Prospect Theory of Patent Rights*, 71 U. CHI. L. REV. 439 (2004). For a synthesis of the economic literature on innovation races, see DENNIS W. CARLTON & JEFFREY W. PERLOFF, MODERN INDUSTRIAL ORGANIZATION 539-54, 560-66 (4th ed. 2005).

60. For incentive/access frameworks that fold in this final set of incentive effects, see MACHLUP STUDY, *supra* note 2, at 62-65; and Oren Bracha & Talha Syed, *Beyond Efficiency: Consequence-Sensitive Theories of Copyright*, 29 BERKELEY TECH. L.J. 229, 237-44 (2014). For some leading works exploring diversionary distortions from IP rents, see Arnold Plant, *The Economic Theory Concerning Patents for Inventions*, 1 ECONOMICA 30, 38-43, 45-46 (1934); Lunney, *supra* note 56, at 492-98; and Lunney, *supra* note 53, at 425-33. *See also* Kapczynski & Syed, *supra* note 47, at 1942-50 (discussing patents' potential to distort incentives).

61. *Cf.* Gallini & Scotchmer, *supra* note 46, at 52 ("For all these technologies, the same questions arise: Are there natural market forces that protect inventors so that formal protections or other incentives are not necessary? If not, is intellectual property the best incentive system, or would the technology more appropriately be developed by a public sponsor and offered freely in the public domain? How should intellectual property be designed so as to minimize deadweight loss due to monopoly pricing without undermining incentives to innovate?").

62. *See supra* notes 2, 48 and accompanying text.

alternative innovation policy?[63] Third, where patents are the instrument of choice, how should their rights be shaped so as to weigh their benefits and costs properly across innovations?[64] And for all three questions, the inquiry may be pursued at an aggregate or a more fine-grained level—that is, for the economy as a whole or as contextualized to specific industries or sectors.[65]

Each of these questions remains hotly contested in the literature, both with respect to the economy as a whole and for many specific sectors. However, in the case of pharmaceuticals, a strong consensus has settled on all three fronts. First, that some innovation-policy intervention *is* needed, over and above first-mover advantages and secrecy.[66] Second, that the comparative case for patents versus alternative policies is quite strong here.[67] And, finally, that the rights conferred

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63. *See supra* note 55 and accompanying text.

64. *See supra* notes 56-60 and accompanying text.

65. For contextualization of the first inquiry, see Bhaven N. Sampat, *A Survey of Empirical Evidence on Patents and Innovation* 19-21 (Nat'l Bureau of Econ. Rsch., Working Paper No. 2538, 2018), https://www.nber.org/system/files/working_papers/w25383/w25383.pdf [https://perma.cc/8PHX-9E8F], which argues that field-specific empirical studies provide a basis for moving past general indeterminacy regarding the case for patent interventions in competitive markets. For the second and third inquires, see generally Fisher, *supra* note 1, which argues for contextualized, sectoral analysis of both comparative innovation policies and internal-to-IP concerns. Additionally, for the third, see also Merges & Nelson, *supra* note 20, at 880-84, which contextualizes analysis of patent scope within different industries; and Burk & Lemley, *supra* note 42, at 1615, which argues that to advance patent debates, we must shift from aggregate to field-specific application of different theories.

66. *See supra* notes 1-5, 42 and accompanying text.

67. This statement needs qualification in two respects. First, many recent prize proposals are motivated by the improved performance these hold out over patents for pharmaceuticals in the international context of incentives for neglected diseases and access in developing countries. *See* AIDAN HOLLIS & THOMAS POGGE, THE HEALTH IMPACT FUND: MAKING MEDICINES ACCESSIBLE FOR ALL 83-95 (2008); William W. Fisher III & Talha Syed, *A Prize System as a Partial Solution to the Health Crisis in the Developing World*, *in* INCENTIVES FOR GLOBAL PUBLIC HEALTH: PATENT LAW AND ACCESS TO ESSENTIAL MEDICINES 181, 181-90 (Thomas Pogge, Matthew Rimmer & Kim Rubenstein eds., 2010). These issues are not germane to the present analysis, which focuses on the domestic performance of patents for drugs. Second, there exist some important exceptions to the general consensus, which argue for public funding or prizes to replace patents for drugs in the domestic U.S. setting. *See* Dean Baker, *Financing Drug Research: What Are the Issues?*, CTR. FOR ECON. POL'Y RSCH. 2-4 (Sept. 22, 2004), https://www.cepr.net/documents/publications/intellectual_property_2004_09.pdf [https://perma.cc/HQ46-L3TW]; Aidan Hollis, An Efficient Reward System for Pharmaceutical Innovation 1 (Jan. 17, 2005) (unpublished manuscript), https://www.keionline.org/misc-docs/drugprizes.pdf [https://perma.cc/6DBE-U626]; James Love & Tim Hubbard, *The Big Idea: Prizes to Stimulate R&D for New Medicines*, 82 CHI.-KENT L. REV. 1519, 1520 (2007). The present analysis pursues a different course than the analyses and proposals of these authors, and in particular its arguments for phasing out drug patents do not depend on any increased role for public funding or prize alternatives.

upon pharmaceuticals should be relatively strong in terms of scope, duration, and remedies.[68]

The analysis that follows aims to revisit that consensus along all three dimensions. What is presently worth emphasizing, however, is that its starting point will be simply to follow through, in the specific context of drugs, on the point that all innovations are, indeed, information goods. Doing so in a systematic way opens up a new picture of pharmaceutical innovation and the role that patents and alternative policies do, can, and should play in sustaining it.

B. Two Information Goods in Pharma

Innovation in pharmaceuticals consists of not one but two key sets of information goods. Behind this claim lies, of course, a prior and more basic point: namely, that the resources at issue in pharmaceuticals are indeed, for innovation-policy purposes, to be seen as information goods. The basis for this argument was set out in the previous Section: it is the *intangible* character of innovations that (1) renders them potentially nonexcludable enough as to perhaps give rise to an appropriability problem requiring some innovation-policy intervention; and (2) renders them so highly nonrivalrous as to pose problems with the patent solution. Absent these two features of innovations—that is, absent their intangibility as *information goods*—none of the distinctive questions that innovations pose for policy analysis get off the ground. To fail to conceive of innovations in solely intangible terms, as information goods, is to fail to get in focus the apt subject matter of the relevant policy analysis.

For many, this point may seem straightforward enough.[69] But for others, there may exist two lingering sources of skepticism, which are worth addressing at the outset. First, whatever the underlying purpose or spirit of patent law, the letter of many of its key texts—both statutory material and judicial opinions—contain *physicalist* formulations of the subject matter of patent rights, namely that patents obtain in some "thing" itself rather than *knowledge of* something.[70] In previous work, I have argued that these are terminological slips that, while sometimes harmless, also often enable conceptual errors that hobble sound

68. *See, e.g.*, Burk & Lemley, *supra* note 42, at 1615-17 (concluding that the pharmaceutical industry presents the best case for "[s]trong patent rights"); Epstein & Kuhlik, *supra* note 3, at 56 (stating that the case for "strong" patent protection "take[s] on special urgency in connection with pharmaceutical products").

69. And they are invited to skip past the next four paragraphs to the text accompanying *infra* note 84.

70. *See* Talha Syed, *Reconstructing Patent Eligibility*, 70 AM. U. L. REV. 1937, 1942-45 (2021).

analysis of patent doctrine or policy.[71] And in that work, I also proposed a prophylactic remedy against such errors: whenever confronted with a physicalist formulation of the object of patent rights, as obtaining in some "product" or "process" itself, we should always insert the phrase "knowledge of" before the relevant article.[72] This helps to install a properly *dephysicalized* conception of the subject matter of patents, as always and only obtaining in *knowledge of* the structure or property of some "thing" (for "product" patent claims) or *knowledge of* some way of making or doing something (for "process" patent claims).[73] It is "knowledge" of a particular sort—namely, of an applied, technological sort—that is the specific "information good" relevant to analysis of patent law and policy, the one apt for its protections.[74]

Against this dephysicalization claim and its "knowledge of" prophylactic, however, some may lodge a second, less terminological and more substantive objection: certain features of how patent law actually functions push against the claim of dephysicalization. On this view, such features indicate that in fact patents do not obtain merely in knowledge of some product or process but rather in the product or process "itself." Four such features, in particular, may be pressed in support of this view, and in each case, there is a straightforward enough reply.

One feature is the doctrine that not all knowledge "disclosed" in the patent is protected, but only that knowledge specifically marked out in the patent "claims."[75] However, while only use of that knowledge set out in the claims is infringing, it remains the case that it is use of *knowledge* that is infringing. That a patent may contain some knowledge that is free for all to use does not affect the point that what a patent restricts the use of is some other knowledge.[76] A

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71. *See id.* at 1942-45, 1956-57, 1978-80, 2005-10 (documenting recurring physicalist terms in statutory and judicial construal of patented inventions and their hobbling effects in the analysis of eligible subject matter).

72. *Id.* at 1942-45.

73. *See id.* at 1956-58, 1977-80 (dephysicalizing statutory and judicial subject-matter categories); *id.* at 2003-20, 2027-36 (reconstructing, after dephysicalization, more plausible rationales for statutory and judicial subject-matter bars).

74. For elaboration on these delimitations on the sort of knowledge that is aptly judged eligible for protection by the patent system—"applied" rather than "basic" knowledge, and of a "material" or technological, rather than "social" or cultural, sort—see *id.* at 1951-52, 1980-2042. In a nutshell, patents obtain in "spaces of knowledge" and, in particular, "spaces of functional knowledge," where "functional" is a stand-in for "applied knowledge of a material or technological sort." *Id.* at 2035.

75. *See* 35 U.S.C. § 112(a)-(b) (2018).

76. As I have put the point previously: "[W]hile patents do not cover *all* uses of *disclosed* knowledge—but only *some* uses of *claimed* knowledge—nevertheless what they cover does remain use of *knowledge*." Syed, *supra* note 70, at 1955.

second feature is a requirement that was once imposed on patent claims (but presently is not), that they must take an *embodied* form, as tied to some "machine or transformation," to be eligible for protection.[77] But even if we wished to impose (as we currently do not) a requirement that the knowledge in patent claims must take an embodied form to be protected, it would remain the case that it was embodied *knowledge* that was protected.[78] A third feature is that patents cover the *practice* of knowledge, not merely its contemplation.[79] But that patents only cover the practice of knowledge does not change the point that they nevertheless cover the practice of *knowledge*.[80] Finally, we may wish to require that to be found infringing, a practice of knowledge must be "physical" or externally manifested in the world, and not merely involve mental processes.[81] Yet even if we wished to delimit as infringing only those practices of knowledge that are physically embodied or externally manifest in the world (as we may have good reason to), it remains the case that it is the embodied or otherwise externally manifested practice of *knowledge* that is infringing.[82]

Each of these objections betrays what we may call the lingering spell of *physicalism* in our understanding of the subject matter of patent law, namely, the misconception that patents protect some concretely tangible product or process.[83] And the reasons for dwelling on, at the risk of belaboring, the need to cast out this spell and dephysicalize our conception of the innovations at issue in innovation policy and patent law, as "information goods" and "knowledge," are twofold. A first is to show that even the core innovation standardly taken to lie at the heart of pharmaceutical innovation—a new drug "product"—must be conceived in a fully dephysicalized way, in terms of not the product *itself* but rather *knowledge of* the product. How this works for the different types of patent claims typically filed in relation to drug product and process innovations is taken up next. The salient point here is that all these innovations are usefully grouped under a single umbrella category: "compound information goods." And this realization then paves the way for another: innovation in pharmaceuticals also involves a *second* information good—knowledge of the safety and efficacy of a drug for human use, as shown by clinical trials. It is the radically distinct character of

77. Such a "machine or transformation" requirement for "process" claims was once adopted by the Federal Circuit but was subsequently rejected as a strict requirement by the Supreme Court. *See* Bilski v. Kappos, 561 U.S. 593, 604, 612 (2010).

78. *See* Syed, *supra* note 70, at 1951-54.

79. *Id.* at 1955.

80. *Id.*

81. *See id.* at 2023-24.

82. *Id.* As discussed therein, the reasons for delimiting infringing conduct to external manifestations lie in privacy concerns. *See id.*

83. *Id.* at 2040-42 (discussing the underlying reasons for the spell of physicalism in patents).

this "data information good," and its centrality to the theory and practice of pharmaceutical innovation policy, that form the spine of the present argument. And here the salient point is that one possible reason why this second information good has tended to be missed as a distinct innovation in pharma is because *all* innovations in pharma—as in patents more generally—have tended not to be seen as information goods or "knowledge," owing to a lingering physicalism.

The innovations typically seen to lie at the core of pharmaceuticals—new or improved drug products or processes—are helpfully broken down into several main subcategories of patent claims.[84] The first category contains new or improved *chemical or biological compounds*, including both parent claims on a new *active pharmaceutical ingredient* (API) and secondary claims on various *chemical forms* taken by the API (e.g., isomers, salts, crystals, polymorphs, and metabolites).[85] The second category includes new or improved *pharmaceutical formulations* of such compounds (e.g., modes of administration such as capsules, gels, patches, or inhalers; or dosage forms such as extended release or extra strength).[86] The third category includes new or improved *methods of using* such compounds (e.g., for different conditions).[87] And the fourth category includes new or improved *methods of making* such compounds.[88] Each of these types of drug innovations should be conceived in fully dephysicalized ways. In other words, they should be understood as involving not the generation of a new "product" or "process" per se but rather the generation of new *knowledge of* a product or process. More precisely, for each of the first three "product" innovations—of a new API, or a new or improved chemical or pharmaceutical formulation thereof—their statutory "composition of matter"[89] claims should be

84. *See* OFF. OF TECH. ASSESSMENT, OTA-H-522, PHARMACEUTICAL R&D: COSTS, RISKS, AND REWARDS 290 (1993) ("For most newly discovered pharmaceutical chemical entities, a patent applicant can make four types of claims . . . .").

85. *See id.* ("A *compound claim* covers the chemical entity per se, including any and all formulations and uses of the chemical entity."); JOHN R. THOMAS, PHARMACEUTICAL PATENT LAW 40-45 (4th ed. 2020) (breaking out compound claims into a parent active pharmaceutical ingredient (API) claim and subsidiary claims over various distinct chemical forms that the API might take).

86. *See* OFF. OF TECH. ASSESSMENT, *supra* note 84, at 290 ("A *composition claim* covers a chemical entity for use as a pharmaceutical.").

87. *See id.* ("A *method-of-use claim* covers the use of a chemical compound or composition in a specified way.").

88. *See id.* ("A *process claim*, or *method of manufacture claim*, covers the way in which the compound or composition is produced.").

89. 35 U.S.C. § 101 (2018) (providing that a "new and useful . . . composition of matter, or any new and useful improvement thereof" is eligible for patent protection).

construed as *knowledge of the structure* of a compound or formulation.[90] And for the latter two innovations—of a new method of using or making a compound—their statutory "process"[91] claims should be construed as *knowledge of a way of using or making* a compound.[92] Any other construal of the claims, as going to some physical thing or process rather than knowledge of a thing or process, would fail to keep our analysis of patent law in touch with its underlying purposes of protecting information goods.[93]

Fully internalizing that drug product and process innovations consist in generation of *new knowledge* with respect to compounds and methods also paves the way to recognizing the existence of a second, discrete set of innovations in pharmaceuticals: the generation of new (knowledge of) clinical data on the safety and efficacy of such products and processes for humans. And this second set of information goods, as discussed next, is *very distinct* from the first, differing radically in those technological and economic features relevant to the analysis of innovation policy.

C. *Two* Distinct *Information Goods in Pharma*

To appreciate the distinct existence and character of data information goods from those of compound ones, consider examples of each of the two main types of pharmaceutical innovation. The first is a "new molecular entity" (NME): a compound for which the active pharmaceutical ingredient (API) has not been previously approved for any uses by FDA.[94] The second is an "incrementally

90. More precisely, the knowledge must be of not only the structure but also at least one property of the compound, given the combined effect of patent eligibility and utility doctrines, as discussed in Syed, *supra* note 70, at 2038. But we may abstract from that refinement here, while we return to it in note 159, *infra*.

91. 35 U.S.C. § 101 (2018) (providing that a "new and useful process . . . or any new and useful improvement thereof" is eligible for patent protection).

92. For a full elaboration of how the Patent Act's four categories of subject matter—"process, machine, manufacture, or composition of matter," laid out in 35 U.S.C. § 101—should be construed as dephysicalized knowledge goods, see Syed, *supra* note 70, at 1956-58, 2036-37.

93. The farther they depart from their underlying rationales, the more we risk that patent doctrines—ranging from eligibility, novelty, and nonobviousness, to analysis of claim scope and infringement—will become increasingly under- or overinclusive. For under- and overinclusiveness in the case of eligibility doctrine, see Syed, *supra* note 70, at 1979-80, 2007-08.

94. New molecular entities (NMEs) so defined are referred to as "type 1" products by the Food and Drug Administration (FDA) in its classification scheme for new drug-product approvals. Off. of Pharm. Quality, U.S. Food & Drug Admin., MAPP 5018.2, NDA Classification Codes 2-3 (2022), https://www.fda.gov/media/94381/download [https://perma.cc/T2R7-ZMT2]. There has been some change in the terms used to define these products by FDA recently. *See* Cong. Rsch. Serv., R46110, Defining Active Ingredient: The U.S.

modified drug product" (IMP): a specific chemical form, pharmaceutical formulation, combination product, or new use of one or more compounds whose API has been previously approved by FDA but not in this variant.[95] NMEs and IMPs are commonly taken to be the two main categories of drug innovations.[96] Not only do they adhere to FDA's division of its new drug product approvals, but they also track the distinction, commonly drawn in the literature on drug patents and products, between pioneer and improvement products—the former being "primary" products with parent-patent claims and the latter being "secondary" products with subsidiary-patent claims.[97] In both contexts, what shapes the distinct contours of these innovation types is the respective intensity of the research and development (R&D) processes that generate their compound and data information goods. And that of course is of direct concern from an innovation-policy point of view.

For each of these main types of drug innovation, consider the following examples. In both cases, suppose we have an early-stage candidate drug that shows some initial promise for treating an important condition. In one case, it is an NME in embryo: an antiviral for treating hepatitis C that is an analogue (i.e., a human-modified version) of a naturally occurring nucleoside, with the modification having the therapeutic property of interfering with viral DNA replication.[98] In the other, it is an incrementally modified formulation of an existing drug (i.e., an IMP): a new once-a-week dosage form of an osteoporosis drug that may considerably reduce its side effects (severe stomach irritation and

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Food and Drug Administration's Legal Interpretation of Regulatory Exclusivities 4 (2023) (shifting the meaning of the terms "API" and "active moiety"). The present analysis will retain the API term, while using it in the stricter, narrow sense of what FDA now refers to as an "active moiety," so as to be limited to NMEs.

95. Incrementally modified drug products (IMPs) so defined are referred to as "type" 2-6 and "type 10" products by FDA in its classification scheme for new drug-product approvals. Off. of Pharm. Quality, *supra* note 94, at 3-7.

96. *See, e.g.*, Nat'l Inst. for Health Care Mgmt. Found., Changing Patterns of Pharmaceutical Innovation 5-6 (May 2006) (identifying three types of chemical innovation: NMEs, IMDs, and "other drugs"); Cong. Budget Off., Pub. No. 2589, Research and Development in the Pharmaceutical Industry 1-2 (2006), https://www.cbo.gov/sites/default/files/109th-congress-2005-2006/reports/10-02-drugr-d.pdf [https://perma.cc/RE75-DH9J] (differentiating between IMPs and "innovative drugs").

97. *See supra* notes 83-87 and accompanying text; *infra* Section III.A.1 (discussing the role in "evergreening" of parent patents on primary products and subsidiary patents on secondary products).

98. This example is drawn from *Bristol-Myers Squibb Co. v. Teva Pharmaceuticals USA, Inc.*, 752 F.3d 967, 969-70 (Fed. Cir. 2014).

toxicity) and may thereby result in far greater patient compliance (by reducing the number of times you have to fast before taking the pill).[99]

In each case, two questions need to be answered in the course of developing the relevant drug innovation. First, what specific chemical variant of the compound or formulation is promising enough to work with and make various modifications and refinements to in devising a treatment? Second, will the refined version of the drug prove safe and effective for human use, as validated by clinical trials?[100] And the answers to these two questions will involve, it is the present point to establish, the generation of *two very distinct* innovations or information goods.

The point may be easiest to see in the case of the IMP drug product, the new formulation of a once-a-week osteoporosis drug. Suppose that both the idea of a new dosage form that leads to better compliance *and* the specific formulation that may be best were relatively easy to discover.[101] Suppose, in other words, that the generation of the compound information good was quite straightforward. Nevertheless, before the drug product is ready for human use—that is, before the drug innovation is complete—we need to verify that this specific dosage form is indeed safe and effective in humans by passing it through mandated clinical testing. And this holds even more strongly in our NME case, where the required clinical testing is likely to be rather more intensive.[102] In both cases, that is, we need to generate a distinct second innovation: the data information good.

It may be objected that to call this data information an "innovation" is somehow strange. And not because innovations need to be tangible or embodied—the present objection is based less on lingering physicalism than a sense that to qualify as an "innovation," an information good must have special features. In particular, its generation should involve a risky undertaking "in the dark" that may not pan out—an exploration of various options facing uncertain prospects,

99. This example is drawn from *Merck & Co. v. Teva Pharmaceuticals USA, Inc.*, 395 F.3d 1364, 1366-67 (Fed. Cir. 2005).

100. There are also, of course, a series of more "upstream" questions, the answers to which may inform the development of the drug. While our focus here is on the "downstream" questions, we return to how they relate to the more upstream ones in Section II.A, *infra*.

101. This was the case in the real-world events from which this example is drawn, where both the idea and the specific formulation ratio were suggested in a trade publication by someone other than the patentee. *Merck*, 395 F.3d at 1368 (quoting *Update: Bisphosphonate*, LUNAR NEWS, Apr. 1996, at 31, 31; *Update: Bisphosphonate*, LUNAR NEWS, July 1996, at 23, 23).

102. NAT'L INST. FOR HEALTH CARE MGMT. FOUND., *supra* note 96, at 4 ("The development of a medicine using an active ingredient whose safety and efficacy have already been established may be less time consuming, expensive, and risky than that of one using a compound about which little is known.").

all of which may ultimately result in failure.[103] And to sharpen the objection, suppose that at the start of clinical testing, the prospects of success for the IMP formulation were high, say 50% or perhaps even 80% or 90%. The answer to this objection is that to eliminate the residual risk that the drug will not prove safe and effective is both costly and socially valuable. And it is *this*, from an economic point of view, that constitutes an "innovation" or policy-relevant "information good": namely, a socially valuable information good that is costly to generate.[104] Here, the socially valuable information is the elimination of the residual risk—that is, attaining the knowledge that the drug is, indeed, to our satisfaction safe and effective enough for human use.

A final objection: accepting that the data information good does qualify as an "innovation" despite being purely intangible and often low risk in its generation, is it really a *distinct* innovation from the compound information good? Aren't the two information goods so closely related as not to merit separating out the latter as distinct from the former? To be sure, the two goods *are* closely related: the generation of the data information good depends on the existence of a prior compound information good, while the compound information good's social value depends on the generation of the data information good. But it would be a mistake to conclude from this that the goods are closely *similar*. In fact, they are very distinct, sharply diverging in their *technological* and *economic* features as relevant to innovation-policy analysis. And, despite being closely related, they are also not necessarily *correlated* in the social desirability of their generation.

The generation of new knowledge of a compound and new knowledge of its safety and efficacy have dramatically different risk-cost profiles. As elaborated in the following Section's review of the biopharmaceutical pipeline, investment in drug development obeys a "step function": early steps in the space of an uncertain innovation-possibility frontier come with a high risk of error, and hence warrant relatively low costs per step, while later steps warrant greater expenditures as the risk or uncertainties begin to be winnowed out.[105] Specifically in the case of drug development, generating the compound information good involves exploration of a *highly* uncertain possibility space: only about one in one thousand candidate compounds makes it through the drug-discovery phases of "search, synthesis, and screening" and preclinical testing to enter clinical trials.[106] This high risk warrants relatively low expenditures per step. In contrast,

103. For a discussion of something like this view and its effects on patent doctrine, see *infra* notes 118-120 and accompanying text.

104. Such that, once generated, its costs of generation may not be recoverable owing to high non-excludablility—so as to perhaps justify a policy intervention—while it remains highly (typically, purely) nonrival, so that exclusionary policy interventions come with a downside.

105. *See infra* notes 155-157 and accompanying text.

106. *See infra* note 154 and accompanying text.

generating the data information good is a comparatively low-risk, high-cost endeavor. By the time we arrive at clinical testing, most of the risks have been winnowed out, and roughly one in five to ten drugs that enter trials make their way to FDA approval.[107] At the same time, and correspondingly, the costs of phase 1, 2, and 3 trials massively outstrip those of each step of preclinical drug discovery.[108]

This stark divergence in their risk-cost profiles bears two crucial implications for the apt innovation-policy treatment of these two information goods. The first goes to the difference in the *economic* significance of the two goods, in terms of their respective contributions to the industry's R&D costs and thus the industry's need for innovation-policy support. The driver of the industry's innovation economics is not the compound but rather the data information good—that is, the generation of clinical-trial results. To be clear, the *overall* cost of drug development remains an ongoing topic of fierce controversy.[109] A 2021 metareview of

107. *See infra* note 154 and accompanying text.

108. *See infra* notes 111-113 and accompanying text.

109. *See* Steve Morgan, Paul Grootendorst, Joel Lexchin, Colleen Cunningham & Devon Greyson, *The Cost of Drug Development: A Systematic Review*, 100 HEALTH POL'Y 4, 11 (2011) ("Despite three decades of research in this area, no published estimate of the cost of developing a new drug can be considered a gold standard."). Key sources of controversy include: (1) whether the data are industry-supplied or audited; (2) whether the drug projects are self-selected by firms or aggregated; (3) what the right estimates of failed projects are; (4) for what time periods investments are tied up without seeing a return; and (5) what capitalization rates should be applied (i.e., the apt risk-adjusted time discounts). There are sharply varying assessments on these scores, resulting in sharply varying overall estimates. *Compare* DiMasi et al., *The Price of Innovation*, *supra* note 17, at 151 (estimating the total average preapproval cost of developing a new drug at between $403 and $802 million in 2000 dollars), *and* DiMasi et al., *Innovation in the Pharmaceutical Industry*, *supra* note 17, at 20 (estimating the total average preapproval cost of developing a new drug at between about $1.4 and $2.6 billion in 2013 dollars), *with* Donald W. Light & Rebecca Warburton, *Demythologizing the High Costs of Pharmaceutical Research*, 6 BIOSOCIETIES 34, 36-43, 46 (2011) (critiquing the method of DiMasi et al., *The Price of Innovation*, *supra* note 17, and estimating the mean and net corporate research and development (R&D) costs for new-drug development to be between $43.4 and 80.3 million, depending on the calculation method), *and* Donald W. Light & Joel R. Lexchin, *Pharmaceutical Research and Development: What Do We Get for All That Money?*, 345 BRIT. MED. J. art. e4348, at 2 (2012) (arguing that the "hidden business model for pharmaceutical research, sales, and profits" depends not on massive investment but instead on "turning out scores of minor variations, some of which become market blockbusters"), *and* James Love, *Evidence Regarding Research and Development Investments in Innovative and Non-Innovative Medicines*, CONSUMER PROJECT ON TECH. 3-14 (Sept. 22, 2003), https://www.cptech.org/ip/health/rnd/evidenceregardingrnd.pdf [https://perma.cc/A6XF-SYW7] (expressing skepticism about the methods used and conclusions drawn by DiMasi et al., *The Price of Innovation*, *supra* note 17, and summarizing alternatives), *and* James Love, *The 2016 Tufts Estimates of the Risk Adjusted Out-of-Pocket Costs to Develop a New Drug*, KNOWLEDGE ECOLOGY INT'L (Apr. 12, 2016),

twenty-two individual studies spanning four decades found that estimates continue to range wildly, from a low of $161 million to a high of $4.54 billion in 2019 U.S. dollars.[110] What is *not* controversial, however, is that clinical-trial expenditures comprise the lion's share of development costs: about 70% according to industry-sponsored studies,[111] and even higher for some others.[112] Indeed, the same metastudy found that over half (thirteen) of the twenty-two studies reviewed did not even consider preclinical drug-discovery expenditures—those generating the compound information good—in calculating total costs.[113]

A second set of implications derives from the fact that the compound and data information goods also strongly diverge in the *technological* features of the innovation processes generating them. Preclinical drug discovery, with its higher risks and lower costs, is well suited for a decentralized search, with "many minds" given free rein to explore various different avenues, even at the risk of a fair bit of overlapping, duplicative activity.[114] Clinical trials, on the other hand, with their lower risks and high costs, are better suited for coordinated development to curb duplicative efforts that would be highly wasteful at this stage.[115]

Integrating these distinct economic and technological aspects of the two innovations leads us to the following pair of policy insights. First, from an *incentive* point of view, it is the data, not the compound, information good that should be at the center of pharmaceutical innovation policy. Yet the patent system *entirely sidelines* this good, providing no direct protection over it, as we will see. Meanwhile, what patents directly protect—the compound information good—likely poses no special incentive case for patent protection. Not only is its share of

https://www.keionline.org/23054 [https://perma.cc/J4MZ-7MQ9] (critiquing the methods and lack of transparency in DiMasi et al., *The Price of Innovation*, *supra* note 17). For a critique of a pervasive drug-industry claim that developing a new drug costs $500 million, see *Rx R&D Myths: The Case Against the Drug Industry's R&D "Scare Card,"* PUB. CITIZEN 1-7 (July 2001), https://www.citizen.org/wp-content/uploads/rdmyths.pdf [https://perma.cc/U2TZ-ET98].

110. *See* Michael Schlander et al., *supra* note 18, at 1263.

111. DiMasi et al., *The Price of Innovation*, *supra* note 17, at 166 (calculating preclinical costs of R&D at 30% of total R&D costs); DiMasi et al., *Innovation in the Pharmaceutical Industry*, *supra* note 17, at 25 (calculating preclinical costs of R&D at 30.8% of total R&D costs). It bears noting that even these estimates understate the full contribution of clinical trials to industry R&D costs: since the figures are for capitalized costs rather than out-of-pocket cash outlays, the share estimated to be taken by preclinical R&D costs includes the time such expenditures are tied up without seeing a return, which is significantly added to by the length of clinical trials.

112. Schlander et al., *supra* note 18, at 1250 tbl.1 (citing Christopher Paul Adams & Van Vu Brantner, *Spending on New Drug Development*, 19 HEALTH ECON. 130 (2010)).

113. *Id.* at 1246.

114. *See* Merges & Nelson, *supra* note 20, at 874; Lemley, *supra* note 54, at 1059.

115. *See* Kitch, *supra* note 21, at 265; McFetridge & Smith, *supra* note 59, at 197; Grady & Alexander, *supra* note 59, at 305.

overall industry innovation costs relatively minor, but—what is really the relevant focus for innovation-policy analysis—the differential between its average innovation costs and imitation costs and speed (i.e., the time and costs involved in reverse engineering and getting ready to manufacture a new or improved drug product or process) is likely no greater than in many other sectors where a combination of first-mover advantages and secrecy suffice to ensure a relatively robust level of innovative activity.[116]

Second, from a *coordinating* point of view, patents serve no useful function with respect to the compound information good. The research phase leading to this innovation is suitable for competitive, decentralized search owing to its comparatively high risks and low costs. On the other hand, while data information does need a strong coordinating mechanism, patents, if they are to serve it, can only play that role indirectly, given their sidelining of this good. Patent doctrines focus their inquiries on the results of preclinical research, not clinical testing.[117] And it is not just that patents *presently* ignore the results of clinical trials, providing no direct protection over clinical data. It would also be highly implausible to try to reconfigure the patent system to provide such protection, given the technological profile of this innovation: inquiries into its desirability and feasibility are simply not ones that the patent system is well suited to carry out, as discussed next.

This takes us to a crucial third difference between these innovations, which is that very distinct *institutional tools* are needed for assessing them, given their distinct character as outputs. The preclinical research that generates knowledge of a new drug product or process is, again, marked by a high degree of risk, even uncertainty.[118] As such, it results in a paradigm of the type of "innovation" recognized by the patent system, which requires not only the "novelty" but also the "nonobviousness" of an invention.[119] The latter requires, if not quite a "flash of genius," typically more than a trial-and-error elimination of finite

116. The full elaboration of this claim is the task of a follow-up article. For present purposes, even if we suppose the compound information good does need an innovation-policy intervention to secure adequate protection, regulatory exclusivity over the data information good will suffice to protect it, as a new compound information good has no commercial value without the new data information good. The converse, however, is not true.

117. As discussed *infra* note 142 and accompanying text, firms typically file for a patent on a compound before they have generated any clinical data, so patent inquiries into novelty, nonobviousness, utility, and so forth will focus on the compound and preclinical results.

118. By "risk" is meant a state where probabilities of different possible outcomes are known, while "uncertainty" denotes a state where not even the probabilities of all the possible outcomes are known. *See* FRANK H. KNIGHT, RISK, UNCERTAINTY AND PROFIT 224-25 (1921).

119. *See* 35 U.S.C. §§ 102, 103 (2018).

possibilities.[120] By contrast, clinical development involves precisely the latter sort of activity: testing and refining a drug candidate's toxicity and therapeutic properties to ensure it is safe and effective for humans, a determination that is successful in roughly one out of five to ten trials.[121] Indeed, it may be precisely this comparatively "low risk" feature of clinical testing that, along with physicalist misconceptions, has led some not to appreciate that the knowledge it generates is a distinct information good or "innovation."

The same technological features of clinical data—that tend to get it sidelined by the patent system and overlooked as an "innovation" by observers—also point to the infeasibility of trying to revise the patent system to extend patent protection over it.[122] Any system of innovation policy requires mechanisms in place to assess the desirability and validity of innovations submitted for its support. The patent system's main mechanisms are its doctrines of nonobviousness and utility, as applied to innovations after they have been generated and then submitted to the patent system for protection. To try to apply these to the generation of clinical data on safety and efficacy would be untenable, for two reasons. First, the determination of the desirability of a new clinical trial has little to do with patent inquiries into "nonobviousness"—with the latter's focus on "uncertainty" rather than mere trial-and-error elimination of "risks." However, the relevant issue is precisely what sorts of likely risks are worth reducing or eliminating through costly trial-and-error testing. Second, the validity of such tests—that is, their reliability and generalizability across patient populations—can hardly be assessed by the patent system and its tools, such as patent examiners and courts

120. A leading pharmaceutical case in this regard is *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1363 (Fed. Cir. 2007), which held that a chemical salt formulation of a drug was "obvious" because it was one of a finite number of fifty-three possible variants that were identified in a prior article as options to explore. The "flash of creative genius" language is from a 1941 Supreme Court decision, *see* Cuno Eng'g Corp. v. Automatic Devices Corp., 314 U.S. 84, 91 (1941), which was legislatively overruled by the 1952 Patent Act's codification of the nonobviousness requirement, Act of July 19, 1952, ch. 950, § 102, 66 Stat. 792, 797-98 (codified as amended at 35 U.S.C. § 103). There has since been continued controversy regarding how "qualitative" (or "synergistic") versus "quantitative" (or "trial-and-error") a view to take of the "ingenuity" needed to satisfy nonobviousness. *See* KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406-07, 413-19 (2007) (reviewing the post-*Graham* history of competing views and tests of the Supreme Court, the Court of Appeals for the Federal Circuit, and its predecessor the Court of Customs and Patent Appeals).

121. *See infra* note 154.

122. For similar reasons, these distinctive technological features also point to the untenability of relying on patent protection over the compound information good, as an "invention," to "indirectly" provide apt incentives for generation of the data information good, as an "innovation"—as a subliterature on patent theory has suggested may often take place. *See supra* note 49.

applying the "utility" doctrine.[123] In both respects, FDA is the better institutional system, not only for the substance but also for the timing of these determinations—that is, for deciding which potential trials are merited and which actual ones are successful.[124] Similarly, the FDA system is also better placed to determine the apt reward or incentive for carrying out such innovative activity in the form of data-exclusivity protection. While the form that protection should take merits significant revisions in light of the present system's misalignments, as discussed in Part III, it remains the case that the two information goods vary sharply in the determination of their *social desirability*.[125]

II. PRESENT INNOVATION POLICY FOR THE TWO INFORMATION GOODS

This Part turns to how existing pharmaceutical innovation policy treats the compound and data information goods in practice. It begins with an overview of the pipeline of biopharmaceutical innovation: its key technological phases, institutional actors, and the basic roles played by patents, FDA regulatory requirements, and data exclusivity therein. It then dives more deeply into precisely how patents and data exclusivity operate here: Section II.B analyzes the coordination functions that patents do (and do not) serve for each of the two information goods, while Section II.C does the same for the incentive functions of patents and data exclusivity.

A. The Biopharmaceutical Pipeline

Biopharmaceutical innovation[126] in the United States takes place in what is often called a "triple helix" institutional setting, in which government,

123. *See infra* note 156 (discussing the utility doctrine).

124. Regarding timing, FDA can also, to anticipate an issue taken up later, replicate the coordinating function of patents, since alongside greenlighting one firm's clinical trials, it can also redlight any other firm's duplicative trials. *See infra* Sections II.B, III.B.2.

125. This crucial point tends to be overlooked by those who treat patent and data-exclusivity protection as functional equivalents. *See, e.g.*, Maxwell R. Morgan, *Regulation of Innovation Under Follow-On Biologics Legislation: FDA Exclusivity as an Efficient Incentive Mechanism*, 11 COLUM. SCI. & TECH. L. REV. 93, 97-98 (2010) (treating data exclusivity as a functional substitute for patent protection without attending to the differences in the respective information goods they cover and their implications for shaping sound innovation policy); Yaniv Heled, *Patents vs. Statutory Exclusivities in Biological Pharmaceuticals—Do We Really Need Both?*, 18 MICH. TELECOMM. & TECH. L. REV. 419, 424 (2012) (same).

126. The term *bio*pharmaceutical innovation reflects the impact of transformations in molecular biology, biotechnology, and cognate fields on how drug development is carried out today, as discussed later.

universities, and private industry all play significant roles.[127] This Section briefly sketches the roles of each sector along the main stages of drug development: basic and applied research, translational research shading into drug discovery, preclinical testing, and clinical trials.[128] Both these stages and the roles of the respective sectors, it should be noted, have increasingly tended to overlap as transformations in molecular biology, biotechnology, genomics, and combinatorial chemistry continue to reorient drug development away from "trial-and-error" strategies and toward "rational drug design" models that rely on greater understanding of human physiology and the actions of chemical and biological materials.[129]

Basic and Applied Research. The process begins with the creation or refinement of fundamental knowledge concerning mechanisms of disease and biochemical processes. Most of this activity is undertaken in universities and government labs, but an increasing portion is done in university-industry partnerships—that is, in faculty-led biotech labs clustered in research parks around campuses.[130] Research at the more "basic" end focuses on mechanisms

127. *See* Henry Etzkowitz & Loet Leydesdorff, *The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University-Industry-Government Relations*, 29 RSCH. POL'Y 109, 111-12 (2000); Golden, *supra* note 45, at 132.

128. The following Section synthesizes accounts provided in the following sources: OFF. OF TECH. ASSESSMENT, *supra* note 88, at 3-6; RICK NG, DRUGS: FROM DISCOVERY TO APPROVAL 3-5, 43-72 (2004); Jürgen Drews, *Drug Discovery: A Historical Perspective*, 287 SCIENCE 1960, 1960-63 (2000); Gary P. Pisano, *Pharmaceutical Biotechnology*, *in* TECHNOLOGICAL INNOVATION AND ECONOMIC PERFORMANCE 347, 347-61 (Benn Steil, David G. Victor & Richard R. Nelson eds., 2002); CONG. BUDGET OFF., *supra* note 96, at 19-21; *Biopharmaceutical Research & Development: The Process Behind New Medicines*, PHARM. RSCH. & MFRS. OF AM. 3-14 (2015) [hereinafter *Biopharmaceutical Research & Development*], https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/P-R/rd_brochure.pdf [https://perma.cc/XP7M-ZZXZ].

129. *See* ALFONSO GAMBARDELLA, SCIENCE AND INNOVATION: THE US PHARMACEUTICAL INDUSTRY DURING THE 1980S, at xiii (1995) ("[T]he 1980s attested a clear shift from largely empirical industrial research processes (based on trial and error of many compounds) to a more rational search for innovation, based on effective use of scientific knowledge and computerized research technologies."); Pisano, *supra* note 128, at 354-55 ("*Rational drug design* is an approach that emerged during the 1980s that sought to 'design' drugs based on detailed knowledge of the biochemical pathways of diseases."); Arti K. Rai, *The Information Revolution Reaches Pharmaceuticals: Balancing Innovation Incentives, Cost, and Access in the Post-Genomics Era*, 2001 U. ILL. L. REV. 173, 174-75 ("In this new era . . . researchers should be able to develop drugs in a faster, more streamlined fashion, through computerized analysis of the genes, proteins, and biochemical pathways that cause particular diseases."); NG, *supra* note 128, at 44 ("There are two main approaches to discovering small molecule drugs: the irrational approach, or the most recent structured rational approach.").

130. In 2017, the share of basic research carried out by public-sector institutions of government labs, universities, and nonprofits was 71%. NAT'L SCI. BD., NSB-2020-1, THE STATE OF U.S.

of disease and regeneration in the body, while the more "applied" end focuses on specific "targets" or receptors for diseases and "mechanisms of action" or pathways to attack such targets.[131] But a sharp basic/applied distinction would in any case be overdrawn here, as much of this activity takes place in "Pasteur's Quadrant" of dual-purpose or "use-inspired basic research."[132] The "basic" outputs of this research likely are (and should be) ineligible for patent protection due to subject-matter bars on knowledge of "laws" or "products" of nature.[133] Outputs toward the more "applied" end—or lying in Pasteur's Quadrant—*may* qualify if their claims are strictly delimited to applications.[134]

Translational Research and Drug Discovery. Next, basic and applied research needs to be "translated" into the concrete specifics of preventing, diagnosing, or treating particular diseases. Much of this activity still takes place in universities, but an increasing share is done by small biotech and genomics firms, led by former faculty and involving university-based scientists.[135] Large pharmaceutical firms may also enter at the later "drug discovery" phase of this stage.[136] This

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Science and Engineering 11 fig.18 (Jan. 2020), https://ncses.nsf.gov/pubs/nsb20201/assets/nsb20201.pdf [https://perma.cc/RR56-BM4G]. Meanwhile, the share of university-based research funded by the federal government came to 53%, with most of the rest coming from state and local governments, nonprofits, and in-house, and with private-sector funding comprising 6%. Nat'l Sci. Bd., NSB-2020-2, Academic Research and Development 12 fig.5B-5 (Jan. 2020) [hereinafter Nat'l Sci. Bd., Academic Research and Development], https://ncses.nsf.gov/pubs/nsb20202/assets/nsb20202.pdf [https://perma.cc/NWY6-8EJ2].

131. In 2018, while the majority (62%) of academic R&D was classified as "basic," *see* Nat'l Sci. Bd., Academic Research and Development, *supra* note 130, at 10, a sizeable share of 38% went to "applied research" and "development," *see id.* at 35 n.5 ("Applied research has increased from 25% to 28%, and development has increased from 9% to 10%.").

132. *See* Donald E. Stokes, Pasteur's Quadrant: Basic Science and Technological Innovation 6, 80 (1997).

133. For a distillation of how subject-matter doctrine currently operates with respect to biotech outputs at the basic/applied interface, including a discussion of its ambiguities and suggestions for how to resolve them in the manner suggested in the text, see Syed, *supra* note 70, at 2003-27. For the leading Supreme Court cases on the doctrine as relevant to the biotechnology sector, see generally *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, 566 U.S. 66 (2012); and *Association for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013).

134. *See supra* note 133.

135. *See, e.g.*, Kate H. Kennedy, Krisstel Gomez, Natalie J. Thovmasian & Dennis C. Chang, *Small Biotechs Versus Large Pharma: Who Drives First-in-Class Innovation in Oncology?*, 28 Drug Discovery art. no. 1034561, at 2 fig.1 (2023) (finding that of the fifty first-in-class cancer drugs approved from 2010 through 2020, small biotech was the sole originator of 46%, academic labs 14%, and large pharma 14%, with medium pharma accounting for 4% and the remaining 22% consisting of collaborations among the actors).

136. *See id.* at 4 (finding that although large pharma firms originated only 14% of fifty new cancer drugs, they were responsible for launching 76%).

involves the three substeps of "search, synthesis, and screening": (1) searching for molecular targets for a specific disease; (2) synthesizing potentially active chemical or biological compounds; and (3) screening the compounds against the targets for pharmacological activity.[137] Patents are likely available for a subset of the biotech "research tools" created in this phase, although much depends on the vagaries of the aforementioned subject-matter bars,[138] and their timing and scope may also be affected by the practical utility and regulatory research exemptions discussed later.[139]

Preclinical Testing. Drug discovery shades into preclinical testing, where lead candidate compounds undergo further evaluation for pharmacological activity and toxicity in wet labs, animal models, and computer simulations.[140] At this stage, public-sector activity tends to dwindle and private firms, both small

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137. For excellent descriptions of the "search, synthesis, and screening" phases, including the roles of advances in biotech in reorienting their character and improving their chances of success, see Pisano, *supra* note 128, at 354-58; and Rai, *supra* note 129, at 189-92.

138. *See* Syed, *supra* note 70, at 2003-27.

139. *See infra* Section III.B.1. The function of such biotech patents—whether on research tools or embryonic drug candidates—is sometimes thought to be less to provide incentives to innovate than to facilitate licensing, and thereby sustain a "markets-for-technology" division of labor between smaller, entrepreneurial biotech firms and larger, incumbent pharma ones, in which the former generate "inventions" in embryo before passing the baton to the latter for subsequent "developmental" work. *See* Golden, *supra* note 45, at 110-11, 144; Arora & Merges, *supra* note 45, at 32-33; ARORA ET AL., *supra* note 45, at 45-89. On this view, incumbent firms may be driven to innovate less by the "pull" of patent returns than the "push" of the drive for competitive advantage over rivals, with the benefits of innovative activity being privately appropriable by first-mover advantages and secrecy or downstream patents. And these benefits may suffice to recoup not only the late-stage developmental activity but also the royalties paid for the early-stage inventive activity by their upstream partners. Thus, the role of the upstream patents would be less to *incentivize* the early-stage invention than to facilitate its licensing to later-stage developers, by solving Arrow's "information paradox" in contracting over information goods (the prospective buyer of the good may not be able to assess its value until "he has the information, but then he has in effect acquired it without cost"). Arrow, *supra* note 7, at 615; *see also* Mazzoleni & Nelson, *supra* note 48, at 275-76 (describing how small firms can use patents to avoid Arrow's paradox and sell to larger companies where they might not otherwise have an advantage). The extent to which patents are necessary to prevent such leakage has always been uncertain, given the availability of trade-secret protection combined with nondisclosure agreements, and subsequent work has cast some doubt on this rationale. *See* Michael J. Burstein, *Exchanging Information Without Intellectual Property*, 91 TEX. L. REV. 227, 232-34 (2012). For present purposes, we may set aside this issue, since the reforms proposed in Section III.B.2, *infra*, retain patent protection for midstream biotech outputs, be it over research tools or early-stage drug candidates themselves.

140. For the role of advances in biotech-related fields in enhancing preclinical testing through computer models, to add to the traditional toolkit of in vitro (test tube) and in vivo (animal model) tests, see NG, *supra* note 128, at 16, 43-66; and Victor Gilsing & Bart Nooteboom, *Exploration and Exploitation in Innovation Systems: The Case of Pharmaceutical Biotechnology*, 35 RSCH. POL'Y 1, 10-11 (2006).

biotech and big pharma, play the predominant role.[141] If a candidate compound makes it through this stage, the firm will typically file both for a patent[142] and, to get the green light for clinical trials, an investigational new drug (IND) application with FDA.[143]

Clinical Trials. If the IND passes muster, the drug proceeds to clinical trials on human subjects. These consist of three to four "phases."[144] Phase 1 involves testing for toxicity and safe-dosage ranges, as well as early evidence on effectiveness and side effects, usually on a group of fewer than one hundred healthy volunteers.[145] If the results are promising enough, controlled phase 2 tests are carried out on a small number of people (typically between fifty to two hundred individuals) who actually suffer from the disease the drug aims to treat.[146] Phase 2 tests reveal the effectiveness of the compound and short-term side effects and risks.[147] Finally, in phase 3, much larger controlled and uncontrolled trials of the drug's safety, effectiveness, and optimal dosage are undertaken in hospitals and outpatient settings, usually involving thousands of patients.[148] If an entity successfully navigates phase 3, a new drug application (NDA) is submitted to FDA.[149] If it is approved, the drug is ready for market entry and typically also

141. *See* Steven Simoens & Isabelle Huys, *How Much Do the Public Sector and the Private Sector Contribute to Biopharmaceutical R&D?*, 27 DRUG DISCOVERY TODAY 939, 942 (2022) ("Analyses of the R&D history of selected samples of clinically significant new medicines in the United States show that both the public and the private sectors support different R&D stages, but that the public sector predominantly contributes to basic research related to medicines, whereas the private sector mainly targets medicine discovery and development.").

142. The timing of drug-patent applications is affected by two doctrines. First, the utility requirement as applied to chemical compounds requires applicants to provide information on the drug's properties that is typically only available around this stage. *See infra* Section III.B.1. Second, if applicants delay much past this stage, they risk running afoul of the "public use" bar. *See* 35 U.S.C. § 102(a)(1) (2018); JOHN R. THOMAS, PHARMACEUTICAL PATENT LAW 123-28 (2d ed. 2010).

143. *See Investigational New Drug (IND) Application*, U.S. FOOD & DRUG ADMIN. (Nov. 18, 2024), https://www.fda.gov/drugs/types-applications/investigational-new-drug-ind-application [https://perma.cc/5C6B-UWVV].

144. *See Step 3: Clinic Research*, U.S. FOOD & DRUG ADMIN. (Jan. 4, 2018), https://www.fda.gov/patients/drug-development-process/step-3-clinical-research [https://perma.cc/5B95-3ZYU].

145. *See id.*

146. *See id.*

147. *See id.*

148. *See id.*

149. There are three main types of new drug applications (NDAs): (1) 505(b)(1) applications, for those reporting full investigations of a candidate drug's safety and efficacy based on wholly original or authorized clinical studies, *see* 21 U.S.C. § 355(b)(1) (2018); (2) 505(b)(2)

eligible for a form of "data exclusivity" on the results of its clinical trials—that is, a period of time during which no other firm may rely on its data for abbreviated approval.[150] Finally, postclinical and postmarketing phase 4 testing may be done to investigate longer-term or undetected side effects, especially in population samples that were not adequately represented in the clinical phases, including children, the elderly, and pregnant women.[151] This phase is sometimes required by FDA and sometimes undertaken by the firm on its own.[152]

Figure 1 summarizes these stages and actors.

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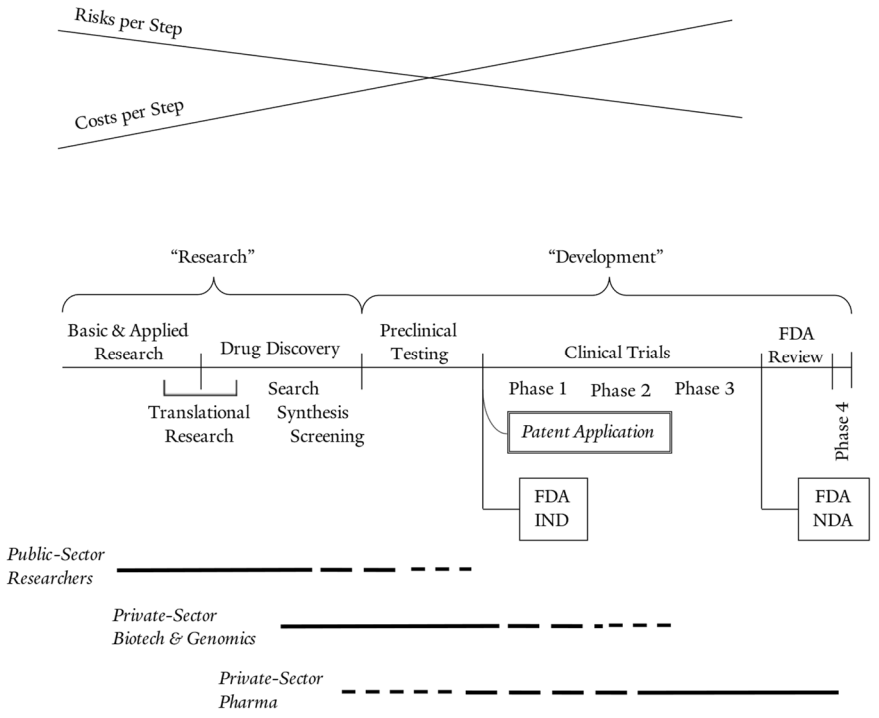
applications, for those reporting full investigations of a candidate drug's safety and efficacy, but now based at least in part on outside studies for which authorization has not been obtained, *see id.* § 355(b)(2); and (3) 505(j) applications that duplicate previously reported, outside safety and efficacy findings, and must show "bioequivalence" between their variant of the product and the original drug whose data they are relying on, *see id.* § 355(j). The main type of originator NDA is 505(b)(1), applicable to both NME and IMP drugs. 505(j) applications are abbreviated new drug applications (ANDAs), made available starting in 1984 to allow generic firms to piggyback on originator clinical data after a period of data exclusivity has expired. *See Abbreviated New Drug Application (ANDA)*, U.S. Food & Drug Admin. (Mar. 28, 2025), https://www.fda.gov/drugs/types-applications/abbreviated-new-drug-application-anda [https://perma.cc/BG2R-26JX]. 505(b)(2) applications, also referred to as "paper NDAs," were a key quasi-generic variant available prior to 1984, and their relevance has faded, although not eclipsed. For a history tracing the origins, decrease, and a recent resurgence in 505(b)(2) "paper NDAs," see generally Jonathan J. Darrow, Mengdong He & Kristina Stefanini, *The 505(b)(2) Drug Approval Pathway*, 74 Food & Drug L.J. 403 (2019). For this latter point, see Ctr. for Drug Evaluation & Rsch., U.S. Food & Drug Admin., Determining Whether to Submit an ANDA or a 505(b)(2) Application: Guidance for Industry 2-3 (2019), https://www.fda.gov/media/124848/download [https://perma.cc/TV2C-W2QA]; and Beth Goldstein, *Overview of the 505(b)(2) Regulatory Pathway for New Drug Applications*, U.S. Food & Drug Admin. 3-5, https://www.fda.gov/media/156350/download [https://perma.cc/7V6K-V47X].

150. The main types of data exclusivity relevant here are: (1) for NMEs, between five and roughly seven-and-a-half years; and (2) for IMPs, three years. There also exist other types of exclusivity for "orphan drugs," phase 4 pediatric trials, and a distinct regime for biologic drugs. For details and refinements, see *infra* text accompanying notes 169-173. These exclusivities are limited to firms filing originator NDAs, principally 505(b)(1) applications, but also (more partially) for those filing 505(b)(2) applications. Generic firms—that is, those filing ANDAs—are not eligible for data exclusivity, but as discussed later, a "first filer" of a "paragraph IV" ANDA (one involving a patent challenge) is eligible for a six-month "generic bounty" during which time it is the sole ANDA-based firm on the market. *See infra* text accompanying notes 189-190.

151. *See* Viraj Suvarna, *Phase IV of Drug Development*, 2 Persps. on Clinical Rsch. 57, 58-59 (2010).

152. And where undertaken, the drug typically qualifies for another six months of data exclusivity. 21 U.S.C. § 355a(b) (2018).

FIGURE 1. BIOPHARMACEUTICAL INNOVATION[153]



Three aspects of this process bear emphasis. First, while highly uncertain at the start, and in a sense risky throughout, the uncertainties of drug development successively decrease as we move down the pipeline. Roughly only one in a thousand compounds initially chosen for screening and preclinical testing make it through to clinical trials, while about one in five to ten of those selected for clinical testing receive FDA approval.[154] Second, while research becomes less risky

153. The dashed lines at the bottom represent the relative level of involvement at the various stages in the process for each sector.

154. *See* NG, *supra* note 128, at 5 ("[O]f 5000 compounds that show initial promise, five will go into human clinical trials, and only one will become an approved drug."); *Biopharmaceutical Research & Development*, *supra* note 128, at 8 ("After starting with thousands of candidate compounds, preclinical testing is used to identify one or more lead compounds that will go on to be studied in clinical trials."); *Biopharmaceutical Research & Development*, *supra* note 128, at 1 ("[T]he likelihood that a drug entering clinical testing will eventually be approved . . . is

as we move down the pipeline, it also becomes more costly per unit of activity. This interaction between risks and costs in biopharmaceuticals comports well with the general insights developed in the economic literature on innovation.[155] As that literature discloses, the investment curve for R&D does not involve one sweeping decision but rather a series of sequentially related decisions, in a kind of step function: while each subsequent decision requires a higher rate of

estimated to be less than 12%." (emphasis omitted)). Three points about these estimates bear noting. First, the figures for success rates prior to clinical trials vary considerably, depending on how early in the process of drug development one starts to identify the number of candidates being chosen, be it the "screening" phase of drug discovery or that of preclinical "testing." *See* NG, *supra* note 128, at 5 ("Typically, tens of thousands of compounds are screened and tested, and only a handful make it into the market as drug products."); *Biopharmaceutical Research & Development*, *supra* note 128, at 1 ("[O]f the thousands and sometimes millions of compounds that may be screened and assessed early in the R&D process, only a few . . . will ultimately receive approval."); Shingo Yamgamuchi, Masayuki Kaneko & Mamoru Narukawa, *Approval Success Rates of Drug Candidates Based on Target, Action, Modality, Application, and Their Combinations*, 14 CLINICAL TRANSLATIONAL SCI. 1113, 1114 (2020) ("The drug research and development process . . . is associated with an extremely low success rate, ~1 in 20,000-30,000."); Attila A. Seyhan, *Lost in Translation: The Valley of Death Across Preclinical and Clinical Divide—Identification of Problems and Overcoming Obstacles*, 4 TRANSLATIONAL MED. COMMC'NS art. no 18, at 4 (2019) ("[F]or every drug that gains FDA approval, more than 1000 were developed but failed."). Second, the figures for success rates in clinical trials vary considerably less (understandably given their more determinate starting point), with most ranging between 10-20%. *See* NG, *supra* note 128, at 5 (giving a 20% figure); *Biopharmaceutical Research & Development*, *supra* note 128, at 1 (giving a "less than 12%" estimate); Yagamuchi et. al, *supra*, at 1114 (noting a success rate of "10%-20%"); Seyhan, *supra*, at 4 (giving a 10-20% range); *see also* J.A. DiMasi, L. Feldman, A. Seckler & A. Wilson, *Trends in Risks Associated with New Drug Development: Success Rates for Investigational Drugs*, 87 CLINICAL PHARMACOLOGY & THERAPY 272, 272, 274 (2010) (updating historical estimates of "approval rates averaging approximately one in five" from the 1970s to the mid-1990s with an estimate of 19% for the 1993-2009 period); Chi Heem Wong & Kien Wei Siah, *Estimation of Clinical Trial Success Rates and Related Parameters*, 20 BIOSTATISTICS 273, 277 (2019) (suggesting that a 10-14% success rate is more accurate than the 20% range of earlier studies). Finally, whatever the variance in particular estimates given for preclinical and clinical success rates, studies tend to converge in finding an overall "funneling" effect across these, whereby the uncertainties or risks reduce over time to result in successively lower rates of failure. *See* Steven M. Paull, Daniel S. Mytelka, Christopher T. Dunwiddie, Charles C. Persinger, Bernard H. Munos, Stacy R. Lindborg & Aaron L. Schacht, *How to Improve R&D Productivity: The Pharmaceutical Industry's Grand Challenge*, 9 NATURE REVS. DRUG DISCOVERY 203, 206 (2010); Richard C. Mohs & Nigel H. Greig, *Drug Discovery and Development: Role of Basic Biological Research*, 3 ALZHEIMER'S & DEMENTIA 651, 656 (2017); Tohru Takebe, Ryoka Imai & Shunsuke Ono, *The Current Status of Drug Discovery and Development as Originated in United States Academia: The Influence of Industrial and Academic Collaboration on Drug Discovery and Development*, 11 CLINICAL TRANSLATIONAL SCI. 597, 599 (2018). The main possible exception to this generalization—a possible uptick in risk that may take place during the translational phase of research, referred to as the "valley of death"—is discussed *infra* note 157.

155. *See* NORDHAUS, *supra* note 58, at 36, 70; F.M. SCHERER, INNOVATION AND GROWTH: SCHUMPETERIAN PERSPECTIVES 161, 165 (1984).

investment, it also increases the information available for later decisions.[156] With each step, the uncertainties winnow out.[157] Finally, the respective roles of public- and private-sector actors also shift as we move down the pipeline. Public-sector activity is concentrated at the earlier stages of upstream research activity—with its farther-off and more diffuse, uncertain payoffs[158]—and then gradually tapers off. Private-sector firms pick up the baton at the midstream developmental phases, with their expenditures most heavily concentrated at the lower-risk, higher-cost downstream testing phases.

B. Coordinating Innovative Activity

We now turn to examining more closely how patents and data exclusivity presently operate with respect to their twin functions of incentivizing and coordinating drug development. When undertaken with a refined understanding that there are two distinct information goods lying at the heart of pharmaceutical innovation, such a reexamination reveals some surprising features of how patents work.

1. Patents' Absence at the Preclinical Stage

First, with respect to research at the preclinical drug-discovery phase, the policy prescribed by innovation analysis in theory turns out to be surprisingly close to the one put in place by patent law in practice. In theory, again, the

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156. *See* NORDHAUS, *supra* note 58, at 36, 70; OFF. OF TECH. ASSESSMENT, *supra* note 84, at 279 ("R&D projects are in reality *sequential* investments that buy opportunities for further R&D along the way. . . . Therefore, early R&D projects are riskier than later projects and have a higher [opportunity] cost of capital. . . . [T]he investment in early R&D can be viewed as an investment in information that allows the firm to reduce the uncertainty of its later investments.").

157. A possible exception here is a potential spike in risk during the translational phase between basic/applied research and preclinical and clinical testing, referred to as "the valley of death." *See* Arti K. Rai, Jerome H. Reichman, Paul F. Uhlir & Colin Crossman, *Pathways Across the Valley of Death: Novel Intellectual Property Strategies for Accelerated Drug Discovery*, 8 YALE J. HEALTH POL'Y L. & ETHICS 53, 58 (2008); Seyhan, *supra* note 154, at 4. The relevance of this spike here is to reinforce the present argument in both its prescriptive aspects—namely, that research activity prior to clinical trials is comparatively high-risk and merits a many-minded decentralized search—and its descriptive aspects, namely that existing patent rules largely comport with this analysis, by only calling off the patent race near the end of preclinical testing, and allowing follow-on innovative activity a "freedom-to-operate" zone prior to clinical trials. *See infra* Section II.B.1.

158. For a discussion of the far-off time horizons, high uncertainty, and large spillover effects of upstream research, all of which militate against adequate private-sector investments and provide strong support for public investment, see Syed, *supra* note 70, at 1987-88.

comparatively high uncertainty and lower costs of each step of this phase of innovation counsels a decentralized exploration of the possibility frontier, with the benefits from "many minds" trying out different options tending to be greater than the costs of duplication from overlapping successes or failures.[159] And patent law, through a pair of sector-specific doctrines primarily applicable only to pharma, provides roughly as much in practice. Decentralized exploration in this phase proceeds relatively unencumbered by drug patents, both (1) for pioneering or new compounds, owing to a sector-specific "practical utility" doctrine that pushes the patenting of these further downstream;[160] and (2) for improvement or follow-on compounds, owing to a sector-specific "regulatory research" exemption that keeps this phase of research largely a freedom-to-operate zone for follow-on innovators.[161] With this pair of sector-specific doctrines, patent law

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159. *See* Merges & Nelson, *supra* note 20, at 873-74 (developing the point that in zones of highly uncertain technological exploration, "[t]he only way to find out what works and what does not is to let a variety of minds try"); *see also* F.A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 519-20 (1945) (explaining that in a "rational economic order . . . knowledge . . . never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess"). *See generally* CASS SUNSTEIN, INFOTOPIA: HOW MANY MINDS PRODUCE KNOWLEDGE (2009) (describing the benefits and costs of information aggregation).

160. *See* Brenner v. Manson, 383 U.S. 519, 528-30, 535-36 (1966); *In re* '318 Pat. Infringement Litig., 583 F.3d 1317, 1325, 1329 (Fed. Cir. 2009). By contrast, for almost all other sectors, the utility doctrine operates simply as a "low bar" requirement of showing the bare operability of the claimed invention, that is, that it works for some "use," without any further requirement that the "use" itself be of relatively downstream character. *See* NARD, *supra* note 49, at 234 ("The utility requirement . . . looks to whether the claimed invention simply works . . . ."); ROBERT P. MERGES & JOHN F. DUFFY, PATENT LAW AND POLICY 193 (7th ed. 2017) (stating that for the "vast majority" of cases "the test for utility sets the bar at a very low level" of "bare operability"). The only other sector where the doctrine has similar "downstream" bite is one adjacent to pharma: biotechnology. The reasons biotech has a similar "downstream" bite dovetail with the present analysis of the divergence between preclinical and clinical information goods and the special innovation-policy problems they pose: in biotech, too, there are concerns that patents should not reach too far upstream into zones more suitable for decentralized, many-minded searches. *See In re* Fisher, 421 F.3d 1365, 1370-76 (Fed. Cir. 2005); *see also* Utility Examination Guidelines, 66. Fed. Reg. 1092, 1098 (Jan. 5, 2001) (requiring that "[a] claimed invention . . . have a specific and substantial utility" rather than "'throw-away,' 'insubstantial,' or 'nonspecific' utilities"); *cf. Fisher*, 421 F.3d at 1378 (identifying, but declining to consider, policy concerns raised by the government and amici that "allowing [expressed sequence tag] patents without proof of utility would discourage research, delay scientific discovery, and thwart progress in the 'useful Arts' and 'Science'" (quoting U.S. CONST. art. I, § 8, cl. 8)).

161. *See* Merck KGaA v. Integra Lifesciences I, Ltd., 545 U.S. 193, 195, 202 (2005) (quoting 35 U.S.C. § 271(e)(1) (2000)). The statutory "regulatory review" exemption to patents at issue in *Merck* was traditionally thought to be limited in its purview to allowing generic firms to use a patented drug in the course of preparing their ANDA application, so as to be ready for

has in effect carved out for pharmaceuticals something available nowhere else: a freedom-to-operate zone for many minds during a phase of research, that, while practically oriented, remains upstream and comparatively high risk and low cost.[162] This reflects and finds its rationale in the fact that innovation in pharma is bifurcated into two distinct information goods, corresponding to distinct stages of innovative activity. The innovative activity generating the compound information good does not require patents' coordinating function.

2. *Patents' Coordinating Role at the Clinical Stage*

Next, when we turn to the development stage of clinically testing promising compounds, here too the policy prescribed by theory closely resembles that put in place in practice. Again, in theory the lower risks yet much higher costs of each step of this stage counsel a shift from decentralized to coordinated activity, with the costs from duplication now tending to be greater than those from error. And this is largely what we find in practice, as it is typically when a firm has promising-enough preclinical results on a compound to file an Investigational New Drug (IND) application with FDA—for purposes of starting clinical trials

market entry upon patent expiration—something passed as part of the Hatch-Waxman Act's compromise between innovator and imitator firms, to overrule a Federal Circuit decision to the contrary. *See infra* note 192 and accompanying text. The Court's decision in *Merck* expanded this exemption's purview to cover the use of patented inventions by rival innovator firms as well, so long as such use was "reasonably related" to generating data relevant to submitting any application to FDA, that is, an NDA as well, not just an ANDA. *Merck*, 545 U.S. at 206-08; *see also* Classen Immunotherapies, Inc. v. Biogen IDEC, 659 F.3d 1057, 1071-72 (Fed. Cir. 2011) (recognizing that *Merck* interpreted 35 U.S.C. § 271(e)(1) to exempt from infringement any preclinical research that may reasonably produce information relevant to an FDA submission); Momenta Pharma., Inc. v. Teva Pharms. USA Inc., 809 F.3d 610, 618-19 (Fed. Cir. 2015) (same); Classen Immunotherapies, Inc. v. Elan Pharms., Inc., 786 F.3d 892, 897 (Fed. Cir. 2015) (same). For almost no other sector does such a research exemption exist, after the common-law "experimental use" doctrine was gutted by the Federal Circuit. *See* Madey v. Duke Univ., 307 F.3d 1351, 1362 (Fed. Cir. 2003). Yet the statutory regulatory-research exemption *does* extend beyond pharma to any other sector also subject to FDA regulatory requirements, such as medical devices. *See* Eli Lilly & Co. v. Medtronic, Inc., 496 U.S. 661, 678 (1990); Edwards Lifesciences Corp. v. Meril Life Scis. Pvt. Ltd., 96 F.4th 1347, 1351 (Fed. Cir. 2024), *cert. denied*, No. 24-428, 2025 WL 76453 (U.S. Jan. 13, 2025). Given that such regulatory requirements result in a similar bifurcation of preclinical and clinical information goods, this reinforces the present point that the special innovation-policy problems posed by pharma are largely a regulatory artifact. For further discussion of medical devices in this connection, see *infra* note 168.

162. As discussed in notes 159 and 160, *supra*, each of the two discrete aspects of the upstream research carve-outs are also applicable to the pharma-adjacent sectors of, respectively, biotech and medical devices, for reasons that reinforce the present analysis since they dovetail with the reasons why each carve-out is available in pharma. The two carve-outs in tandem are applicable only to pharma.

on humans—that it will also qualify for patent protection on the compound, with the practical-utility doctrine calling off the race so as to coordinate further developmental activity in the hands of a single patentee.[163]

C. Incentivizing Innovative Activity

1. Patents' Commercial Role at the Market-Entry Stage

Upon FDA approval of a drug product's NDA for purposes of market entry, the main value of its patents kick in, enabling the firm to exclude others from making, using, or selling the compound, leaving it to be the only one free to commercially exploit it.[164] There are two special features of drug patents to flag here that go to aspects of patent protection available only to pharma.

The first concerns the length of patent protection. While the general patent term in the United States is twenty years from the date of filing the original application,[165] drug patents have special "patent term restoration" provisions.[166] Passed as part of the 1984 Hatch-Waxman Act, these provide for extensions to patents on drugs that undergo a period of regulatory review prior to market entry—that is, for drugs that have some part of their patent life tied up in a pre-commercial waiting period, prior to commercial drug sales.[167] Section 156 of the Patent Act provides that for drugs undergoing clinical trials, patent terms may be extended (1) by tacking on a clinical-term extension of one-half of the time spent in clinical trials, up to a five-year cap, (2) to result in a total patent term of no more than fourteen years after clinical trials.[168]

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163. *See* Nelson v. Bowler, 626 F.2d 853, 856 (C.C.P.A. 1980); Cross v. Iizuka, 753 F.2d 1040, 1046-47 (Fed. Cir. 1985); *In re* Brana, 51 F.3d 1560, 1569 (Fed. Cir. 1995); U.S. Pat. & Trademark Off., Manual of Patent Examining Procedure § 2107.03 (9th ed. Rev. 01.2024, Nov. 2024), https://mpep.uspto.gov/RDMS/MPEP/current#/current/d0e200058.html [https://perma.cc/3XP9-TCG5].

164. *See* 35 U.S.C. § 271(a) (2018).

165. *Id.* § 154(a)(2).

166. *See* Gerald J. Mossinghoff, *Overview of the Hatch-Waxman Act and Its Impact on the Drug Development Process*, 54 Food & Drug L.J. 187, 190 (1999).

167. *See id.* at 188.

168. 35 U.S.C. § 156(c), (g)(6)(A) (2018). More precisely, the provision provides that any inventions—not only "drug products"—subject to regulatory review are eligible for these patent term extensions or restorations. The main other category of inventions so subject to FDA regulatory processes are medical devices and, similar to the "regulatory review exemption" discussed *supra* note 161, their eligibility for this doctrine renders its characterization as "pharma-specific" not quite accurate. *See Small Business Assistance: Frequently Asked Questions on the Patent Term Restoration Program*, U.S. Food & Drug Admin. (Feb. 4, 2020), https://www.fda

A second specific feature of drug patents is how their protection is "linked" to an entirely separate system, that of FDA regulatory approval. This "Orange Book" FDA regulatory linkage applies only to patents and not to data-exclusivity periods. Nevertheless, data-exclusivity periods form another part of the overall compromise between the innovator and generic sectors of the industry in the 1984 Hatch-Waxman Act. And since it is as part of that compromise that the patent linkage is best understood, we first briefly detail data-exclusivity protection before turning to the overall compromise put in place by the Hatch-Waxman Act and the place of Orange Book linkage therein.

2. *Data Exclusivity*

Upon its approval of a drug product's NDA, FDA will also typically grant that product a period of "data exclusivity." During this period, no other firm is permitted to rely on its original data for purposes of gaining approval for its own product.[169]

Data exclusivities vary in two central dimensions: duration and scope. As to duration, NMEs receive roughly 7.5 years of exclusivity or more, depending on how long FDA's abbreviated new drug application (ANDA) approval process takes for the first generic applicant. IMPs receive a strict three-year period.[170] By

.gov/drugs/cder-small-business-industry-assistance-sbia/small-business-assistance-frequently-asked-questions-patent-term-restoration-program [https://perma.cc/6NZW-XASK] ("[H]uman drug products, medical devices, food additives, or color additives, and animal drug products are eligible for patent extension."). But as also discussed there, the reasons why medical devices are eligible for similar treatment goes precisely to the underlying point that is the heart of the present analysis, namely that what makes pharma special, from an innovation-policy point of view, is the regulatory aspects of its data information. That another sector may be similarly special, for similar reasons, is beyond the scope of the present analysis.

169. *See supra* text accompanying note 150.

170. The difference between these lies in the statutory language governing them: for NMEs, the statute stipulates that FDA may not *accept* an ANDA application until the expiration of five years from the approval of the NDA of the originator, *see* 21 U.S.C. § 355(j)(5)(F)(ii) (2018), while for IMPs, it provides that FDA may not *approve* an ANDA application until the expiration of three years from the approval of the originator's NDA, *see id.* § 355(j)(5)(F)(iii). Since the approval time for an ANDA ranges roughly between thirty and forty months, the resulting effective exclusivity for NMEs is between roughly 7.5 to 8.33 years. *See Generic Drugs Program Activities Report—FY 2024 Monthly Performance*, U.S. FOOD & DRUG ADMIN. (Dec. 5, 2024), https://www.fda.gov/drugs/abbreviated-new-drug-application-anda/generic-drugs-program-activities-report-fy-2024-monthly-performance [https://perma.cc/KUY4-RJPX] (reporting quarterly mean ANDA approval times yielding annual averages of 33.94 months in 2022, 34.17 months in 2023, and 41.42 months in 2024). In the case of "paragraph-IV" ANDAs (i.e., those challenging patents on the drug, *see infra* note 189), the five-year delay in

contrast, new biologic drugs receive twelve years of exclusivity.[171] As to scope, NMEs and IMPs are identical: FDA may not allow any other firm to rely on the protected data in their own (abbreviated) NDA. This differs from the broader scope accorded "orphan drugs," whose data exclusivity is not only longer (seven years) but also forbids FDA from accepting even originally generated data on the same drug by a rival firm during the exclusivity period—this broader protection may be better referred to as "product exclusivity" in contrast with the weaker form of merely "data exclusivity."[172] Finally, a third distinct dimension of exclusivity is whether it is extendable: both for NMEs and IMPs (and biologics), there is a six-month extendable option for pediatric testing.[173]

Our concern here, as throughout, is with chemical drugs, bracketing biologics.[174] Further, our focus here will be on the NME and IMP exclusivities (without attending to orphan drugs).[175]

3. The Orange Book System

The present system of combined innovation-regulatory policy for pharmaceuticals consists of four distinct but interlocking regimes of institutional rules:

(1) Patents, as administered by the Patent and Trademark Office (PTO) and the courts;
(2) Regulatory requirements and permissions, as administered by FDA;
(3) Data-exclusivity rights, as administered by FDA; and

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acceptance for NMEs is shortened to four. *See* 21 U.S.C. § 355(j)(5)(F)(ii) (2018). But even here, where the patentee timely files an infringement suit in response to the paragraph-IV challenge, this triggers a further automatic thirty-month stay in FDA's approval of the ANDA, and in the case of NMEs, that delay is to be extended until the expiry of 7.5 years from the date of approval of the originator's NDA. *See id.*

171. The exclusivity protection is set out at 42 U.S.C. § 262(k)(7)(A)-(B) (2018).

172. The exclusivity protection is set out at 21 U.S.C. § 360cc(a) (2018).

173. For chemical drugs, see 21 U.S.C. § 355a(b)-(c) (2018). For biologics, see 42 U.S.C. § 262(m)(2)-(3) (2018).

174. Our scope is restricted to chemical drugs for reasons of length. Biologic drugs differ in key respects along the central dimensions relevant to the present analysis, in ways that merit special attention. But it may be noted briefly that these differences likely do not challenge so much as reinforce the central claims of the present analysis, namely that: (1) it is the gap between the costs of generation and replication of the data information good that is central to the innovation economics and policy of pharmaceuticals; and (2) phasing out patent protection, including the biologic "patent dance" version of Orange Book linkage, and replacing it with a revised form of tailored data exclusivity would significantly curb access and gaming costs, while retaining apt innovation incentives.

175. Orphan drugs raise a host of their own very specific and important concerns that merit a separate analysis.

(4) At the direct intersection of the previous three, FDA's "Orange Book" system.

The Orange Book "lists" two things: generic equivalents for approved brand-name drugs, as guidance for pharmacies where state "automatic substitution" laws exist,[176] and existing patents over such drugs.[177] It is this second feature that accounts for much of the inordinate complexity of the system.

To get a proper handle on the system's present complexity, it is helpful to proceed in stages. Table 1 first summarizes how the three core systems—patent protection, regulatory requirements and permissions, and data exclusivity—relate to one another. The FDA system of regulatory requirements was first put in place in 1938 with the introduction of required "safety" testing for drugs prior to market entry.[178] In 1962, "efficacy" testing was added.[179] In 1984, an "abbreviated" regulatory approval pathway for generics was added, permitting firms to piggyback on innovator data (an "abbreviated" NDA or "ANDA") rather than have to generate their own data ("NDA") or rely on a mix of published studies and supplemental trials ("paper NDA").[180] That same Act, the Hatch-Waxman Act, then also provided for data-exclusivity protection to delay generic reliance on data for periods varying according to whether the newly approved innovator drug was an NME or IMP.[181]

176. A key feature of the FDA regulatory system for generics is not just the grant of ANDA-based approval for bioequivalent versions of already-approved brand-name drugs but also the listing of these generics as "therapeutically equivalent" in FDA's "Orange Book." *See* U.S. Food & Drug Admin., *Approved Drug Products with Therapeutic Equivalence Evaluations*, U.S. DEP'T OF HEALTH & HUM. SERVS., at vii (45th ed. 2025), https://www.fda.gov/media/71474/download?attachment [https://perma.cc/9JVZ-J38F]. The effect of that classification is to trigger "automatic substitution" laws where states have passed them, which either permit or require pharmacists to substitute a generic for a brand-name drug when filling out a doctor's prescription for a patient (unless the doctor or patient expressly stipulates otherwise). *See id.* at iv.

177. *See id.* at v.

178. Federal Food, Drug, and Cosmetic Act, ch. 675, § 201(p)(1), 52 Stat. 1040, 1041-42 (1938) (codified as amended at 21 U.S.C. § 321(p)(1)).

179. Drug Amendments of 1962, Pub. L. No. 87-781, § 105(f), 76 Stat. 780, 786 (codified as amended at 21 U.S.C. § 355(d)).

180. 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(j)).

181. *See* 21 U.S.C. § 355(j)(5)(F)(ii) (2018) (providing data exclusivity for NMEs); *id.* § 355(j)(5)(F)(iii) (providing data exclusivity for IMPs).

TABLE 1. PATENTS, REGULATORY REQUIREMENTS AND PERMISSIONS, AND DATA EXCLUSIVITY

Drug Product	Patent Law	FDA Regulatory Requirements	FDA Data Exclusivity
NME	Parent patents	Stringent safety and efficacy testing	About 7.5 years
IMP	Secondary patents	Lighter safety and efficacy testing	Exactly 3 years
Generic	N/A[182]	ANDA piggybacking and bioequivalence	N/A[183]

Next, we must inject into this scheme FDA's Orange Book system. This system—the subject of ongoing controversy and reforms—was also created by the Hatch-Waxman Act.[184] And to get a proper handle on it, it helps first to have the full structure of that statutory scheme in view. The Hatch-Waxman Act was a watershed compromise between generic and innovator sides of the pharmaceutical industry, and the structure it put in place set in motion most of the dynamics taken up in Part III.[185] The foundation of the Act was the understanding that it is socially wasteful to require generic firms to replicate the clinical data of an

182. Strictly speaking, generic firms may well engage in innovative (manufacturing) activity that results in outputs that might garner "process" or "method" patents. But we can abstract from that here, for two reasons. First, such patents play virtually no role in any of the innovation-policy questions taken up below. Second, and relatedly, such patents would remain untouched by the reform proposed below, as that reform requires firms to waive their drug patents in return for data-exclusivity protection: since generic firms would not be eligible for the latter, they would not have to give up the former. *See infra* Section III.B.2.

183. But see the 180-day "generic bounty" granted to the first patent-challenging generic entrant, detailed *infra* note 189.

184. *See* U.S. Food & Drug Admin., *supra* note 176, at v ("The Hatch-Waxman Amendments amended the FD&C Act to establish, among other things, the 505(b)(2) and 505(j) approval pathways. The Hatch-Waxman Amendments require that FDA, among other things, make publicly available a list of approved drug products with monthly supplements. The Orange Book and its monthly Cumulative Supplements satisfy this requirement. The Addendum to this publication identifies drugs that have qualified under the FD&C Act for periods of exclusivity and provides patent information concerning the approved drug products in the Orange Book.").

185. *See* Mossinghoff, *supra* note 166, at 187-91. The article is part of a twenty-five-year-anniversary symposium on the Hatch-Waxman Act in the *Food and Drug Law Journal*, with its theme being precisely that of its watershed compromise. *See generally* Symposium, *Striking the Right Balance Between Innovation and Drug Price Competition: Understanding the Hatch-Waxman Act*, 54 Food & Drug L.J. 185 (1999) (presenting a symposium issue about the Hatch-Waxman Act).

innovator drug, when they seek to sell a bioequivalent version.[186] Consequently, we should allow them to "piggyback" on the innovator's clinical data—to result in enormous social savings.[187] At the same time, however, it was understood that such savings should not come at the cost of unduly eating into innovators' returns, and thus their incentives to innovate.[188] The resulting compromise consists of an interlocking system of essentially eight components, four that facilitate generic entry and four that offset it by strengthening innovator exclusivity, as shown in Table 2.

TABLE 2. THE STRUCTURE OF THE HATCH-WAXMAN COMPROMISE

(A) Facilitating Generic Entry	(B) Strengthening Innovator Exclusivity
(1) Piggybacking on innovator clinical data	(1) Innovator data exclusivity (~7.5 years NME; 3 years IMP)
(2) Regulatory-review exemption to patent rights	(2) Patent term extensions of up to 5 years
(3) Orange Book listing of therapeutic equivalence	(3) Orange Book listing of patents on drugs
(4) 180-day exclusivity for first "paragraph-IV" entrant[189]	(4) 30-month stay for ANDAs challenging patents[190]

The first two rows are relatively straightforward. In return for massively lowering the costs of imitative entry through ANDA trials, the Act protects innovator returns with data exclusivity.[191] And, to facilitate generic firms being ready

186. Mossinghoff, *supra* note 166, at 187.

187. The savings come in two distinct forms: (1) removing the duplicative wastes involved in running clinical trials on a product already validated as safe and effective; and (2) increasing the price competition resulting from the entry of generic rivals having lower average total costs, owing to such savings. The form that piggybacking takes is the ANDA application, as described earlier. *See supra* note 149.

188. *See* Eisenberg, *The Problem of New Uses*, *supra* note 8, at 725-27.

189. The Hatch-Waxman Act not only *enables* generic piggybacking on innovator-trial data but also *encourages* generic challenges to innovator patents, by giving a "generic bounty" in the form of a 180-day exclusivity period to the first generic firm that enters by successfully challenging patents still in force, as either invalid or not infringed, by filing a so-called "paragraph-IV ANDA." *See* 21 U.S.C. § 355(j)(2)(A)(vii)(IV), (5)(B)(iv)-(v) (2018).

190. When a generic firm files a paragraph-IV ANDA, the Act provides for an automatic thirty-month stay in FDA's approval of the ANDA should the patentee, upon notice of the paragraph-IV challenge, timely file an infringement claim. *Id.* § 355(j)(5)(B)(iii).

191. *See id.* § 355(j)(5)(F)(ii)-(iii).

for market at the date of patent expiration, the Act provides a regulatory-review exemption from patent rights—overruling the Federal Circuit's *Bolar* decision that disallowed use of a patented drug by a generic firm for purposes of preparing its ANDA application.[192] From the other side, the Act extends the duration of the patent rights themselves, through the system of patent-term adjustments detailed above.[193]

It is the next two rows that merit careful attention here. Three of these features raise troubling questions. Only the Orange Book's listing of therapeutically equivalent generic drugs to guide pharmacies has a straightforward rationale. Each of the other three are perplexing—"Doctrine in Search of Justification,"[194] if there ever was.

Take first the "generic bounty": a six-month exclusivity period where the firm is the sole competitor to the patentee.[195] A statutory incentive, in other words, to challenge granted patents. This, in effect, treats the challenge of already-granted patents as a "public good," one requiring a special incentive to undertake or provide, lest others "free ride" on one's efforts. A statutory admission, it would seem, that many of the industry's drug patents are "weak."[196]

Yet right alongside this incentive or admission comes a check: the grant of an automatic extension of 2.5 years (thirty months) in the approval of an ANDA should the patentee accept the challenge and file a lawsuit.[197] Quite apart from the generic bounty's puzzle, this feature raises a distinct troubling question of its own: what justifies intertwining two seemingly entirely separate systems—patent protection over the compound information good and regulatory approval for the data information good—in this way? Why shouldn't they simply be delinked, so that even if a patentee takes up the generic challenge, the generic firm can continue to proceed on its merry way with the FDA regulatory process,

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192. *See* 35 U.S.C. § 271(e)(1) (2018); Roche Prods., Inc. v. Bolar Pharm. Co., 733 F.2d 858, 867 (Fed. Cir. 1984).

193. *See supra* text accompanying notes 165-168.

194. Robert G. Bone, *A New Look at Trade Secret Law: Doctrine in Search of Justification*, 86 CALIF. L. REV. 241 (1998).

195. *See* 21 U.S.C. § 355(j)(5)(B)(iv)-(v) (2018).

196. Indeed, it is in the legislative history of the Act where the term "evergreening" first arises in the patent literature. *See Patent Term Restoration Act of 1981: Hearing on H.R. 1937, H.R. 6444, and S. 255 Before the Subcomm. on Cts., C.L. & the Admin. of Just. of the H. Comm. on the Judiciary*, 97th Cong. 195 (1982) (statement of Rep. Robert W. Kastenmeier, Chairman, H. Subcomm. on Cts., C.L. & the Admin. of Just.); *id.* at 401, 409, 410, 414 (statement of Gerald J. Mossinghoff, Comm'r of Patents & Trademarks, U.S. Patent & Trademark Office); *Patent Term Extension and Pharmaceutical Innovation: Hearing Before the Subcomm. on Investigations and Oversight of the H. Comm. on Sci. & Tech.*, 97th Cong. 132, 177-78 (1982) (statement of Peter Barton Hutt, Counsel, Pharmaceutical Manufacturers Association).

197. *See* 21 U.S.C. § 355(j)(5)(B)(iii) (2018).

getting its bioequivalent drug ready for market entry, and leaving the patent barriers and risks to such entry entirely outside FDA's purview?[198]

Finally, a third troubling feature is the way Orange Book listing of patents invites abuse or gaming, such as by listing multiple patents on the same NDA-approved product to enjoy multiple automatic thirty-month stays—that is, de facto 2.5-year extensions on a product's data exclusivity. To be sure, some of the troubling abuses have been curbed by subsequent legislative reform. In 2003, for example, Congress intervened to end the practice of granting multiple stays, so as to limit each product to a single thirty-month delay.[199] But other abuses may remain.[200] And in any case, the central puzzles remain to be addressed: Why provide a statutory incentive to challenge granted drug patents? And even supposing that is a good idea, why should the patent processes for handling infringement claims be intertwined with those of FDA for conferring regulatory approval?

The Orange Book system has come under much scrutiny, playing a starring role in concerns raised over two related industry practices that have been strongly criticized: "evergreening" practices in general and, what are a specific subvariant of these, "reverse settlement agreements." We turn to these next, as part of a general assessment of the potentially high costs incurred by the present system, in terms of barriers to access, duplication wastes, and gaming. But it is important to note at the outset that while the Orange Book system certainly merits critical scrutiny, it itself is a surface effect, and not the underlying cause, of the system's deeper misalignments.

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198. Note that this is a separate matter from another, more justified intersection, which is that the statute also provides that where a patentee does not file an infringement suit, a generic filer of an ANDA may proceed to "obtain patent certainty"—so as to avoid at-risk market entry—by seeking a declaratory judgment of invalidity or noninfringement. 21 U.S.C. § 355(j)(5)(C) (2018).

199. *See* Medicare Prescription Drug, Improvement, and Modernization Act of 2003, Pub. L. No. 108-173, § 1101, 117 Stat. 2066, 2448-57 (codified as amended at 21 U.S.C. § 355(j)(5)).

200. The principal controversies center on whether (1) a first filer of a paragraph-IV application should be able to reach a settlement agreement with the patentee (i.e., not to pursue their patent challenge to completion) and still enjoy the six-month exclusivity upon the date of entry stipulated in the agreement; and (2) thereby not only retain the challenger bounty while striking a deal with the patentee, but also, by "parking" their ANDA until the stipulated time of entry, cause a "bottleneck" of subsequent generic firms, whose later-filed ANDAs FDA will have to sit on. For the legislative revisions to what counts as a "forfeiture" of the bounty, and reviews of the ensuing controversies in agency and judicial interpretations of these, see 21 U.S.C. § 355(j)(5)(D) (2018); U.S. Food & Drug Admin., Guidance for Industry: 180-Day Exclusivity: Questions and Answer 14-26 (Jan. 2017), https://www.fda.gov/media/102650/download [https://perma.cc/C69G-LD2X]; and Robin Feldman & Evan Frondorf, Drug Wars: How Big Pharma Raises Prices and Keeps Generics off the Market 38-40 (2017).

III. REVISING PHARMA INNOVATION POLICY

Part II disclosed two key aspects of how the present system of pharmaceutical innovation policy works in relation to its two central information goods. First, of the two primary functions that patents serve in pharmaceutical innovation—coordinating innovation races and incentivizing innovative activity—they do so only indirectly, with respect to an information good, data, that they do not directly protect.[201] Meanwhile, for the compound information good that patents do directly cover, they play little to no coordinating role and a secondary incentive one.[202] A sounder innovation policy would change both aspects. First, it would replace the primary, yet indirect, role played by patents over data information with a form of regulatory exclusivity that directly attends to the distinctive features of this innovation. Second, it would phase out the direct but secondary role played by patents over compound information.

The point of these reforms is, fundamentally, to better align our system of innovation policy with the underlying innovations they seek to incentivize. Only by directly attending to the relevant features of the information goods that they govern can our innovation-policy rules squarely face the various tradeoffs facing any innovation system. In particular, such reforms would significantly improve the performance of our innovation policy for drugs along the two central tradeoffs facing any incentive system that uses exclusionary rights (such as patents or data exclusivity): (1) the undue barriers to access such rights erect for innovations that could have been generated at lower levels of protection;[203] and (2) the undue duplication costs that such rights may incur with respect to those innovations that would have been incentivized by a lower level of protection.[204]

Each of these concerns have been prominently aired in the critical literature, the first under the heading of "evergreening" practices and the second under the heading of "me-too" drugs. And in both cases, it is possible to improve vastly both our diagnosis of the causes and extent of the problems and our ability to propose effective solutions by focusing our analysis on the centrality of the data information good to pharmaceutical innovation and the misalignment of existing rules with respect to that information good.

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201. *See supra* Sections II.B.2, II.C.2.

202. *See supra* Sections II.B.1, II.C.1.

203. *See supra* note 58 and accompanying text.

204. *See supra* note 59 and accompanying text.

A. Problems: Undue Access Costs and Rent Dissipation

1. Access Costs: Evergreening and Reverse Settlement Agreements (RSAs)

We turn first to "evergreening." The concerns associated with this practice in pharma have generated a massive literature in recent years, spawning over three hundred scholarly articles on the topic.[205] While the term has been used to cover a bewildering array of different practices,[206] at its core we may take "evergreening" to refer to efforts by drug companies to prolong the effective period of exclusivity enjoyed by a drug beyond the formal expiration of its core patents on the compound. Such efforts come in two principal forms: (1) efforts to obtain and defend "secondary patents" on a drug that expire at a later date than that of the primary or core patents that originally covered it; and (2) efforts to obtain and defend patents on new "secondary products" that can effectively compete with generics of the original.[207] The extent to which such practices can be

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205. Erika Lietzan, *The "Evergreening" Metaphor in Intellectual Property Scholarship*, 53 AKRON L. REV. 805, 808 (2019) (reviewing a "scholarly literature" of "342 articles in legal, medical and scientific, and economic journals" that address "'evergreening'").

206. For a criticism of how the term is often used vaguely, even inchoately, in the literature, see *id.* at 854. For an incisive effort at clarifying the different possible meanings of the concept, see Uri Y. Hacohen, *Evergreening at Risk*, 33 HARV. J.L. & TECH. 479, 484-91 (2020). The following builds on Erika Lietzan and Uri Y. Hacohen's analyses to offer a clear and cogent conceptualization of the notion and associated practices.

207. There are key subvariants within each of these. (1) *Single-product lifetime extensions* may be pursued either by: (a) "Submarine patents," whereby secondary patents are filed at the same time as the parent ones, but then "lie low" during the application process, only to resurface at a later date, to enjoy a later expiration. This practice was effectively undermined when the United States switched from a patent term starting at the date of issue to one starting at the date of filing. *See* 35 U.S.C. § 154(a)(2) (2018). (b) "Secondary patents" on the same primary product that, while not representing a significant technological advance (and hence subject to being ruled "obvious"), can enjoy some significant measure of protection on account of infirmities in the processes of granting, challenging, and invalidating patents — such as those involved in Orange-Book listing and thirty-month automatic stays, *see supra* text accompanying notes 189-190, 199, and RSAs, *see infra* text accompanying notes 219-221. (2) *Multiple-product life cycle extensions* may be pursued either by: (a) "Secondary products" that, while obtaining both their own patents *as well as* NDA-based IMP drug approval, nevertheless hold out either a modest or even trivial advance over the primary product, one that, again, escapes (for a time at least) the filters of the patent system. The question this case raises is: if the IMP is not a genuine advance over the parent product, then why, after the expiration of the parent's patents, does a generic variant of the parent not provide effective price competition with the (not so) "new and improved" variant? One set of answers lies in infirmities in the price signals of the healthcare market, owing to the presence of health insurance (resulting in fewer patients being less price-sensitive at the point of purchasing treatments), formulary managers (who may be "captured"), and provider incentives (which may be price-insensitive and excessively

successful and why they should be troubling remain contested issues.[208] The core concern, however, is that when successful, such practices might provide an

cautious or risk-averse in not wanting to choose the "latest" drug over a generic of the older one). Another set of answers goes to the other subvariant here: (b) "Product hopping," whereby the patentee switches out the parent for the improvement product sometime before the expiration of the parent's patent—thus at a time where there is no generic competition for either—so as to make patients, providers, and payers accustomed to the "new and improved" variant as to make it "sticky" to switch "back" to the (generic version) of the "original" when it goes off patent. As these subvariants of this latter category show, the problems with multiple-product extensions only lie partly with the patent system; the other part lies with the way price signals are muffled in the healthcare market.

Examples of these kinds of patent practices abound in the literature. A prominent example of "submarine patents" in the legislative history of the Hatch-Waxman Act was the case of Valium, where continuation applications allowed a patent with a priority date of 1959 to be issued in 1968 and hence expire only in 1985. 128 CONG. REC. 20313 (1982) (statement of Rep. Gore). Notorious examples of trivial "secondary patents" are the case of metabolites of a drug, such as Claritin, that are produced automatically as a chemical byproduct of the drug's ingestion into the body. *See* Schering Corp. v. Geneva Pharms., Inc., 339 F.3d 1373, 1380 (Fed. Cir. 2003). For illustrative examples of modest "secondary patents" on specific chemical or pharmaceutical formulations of the same drug, see Eisenberg, *The Role of the FDA*, *supra* note 8, at 354; C. Scott Hemphill & Bhaven N. Sampat, *When Do Generics Challenge Drug Patents?*, 8 J. EMPIRICAL LEGAL STUD. 613, 615, 621 (2011); Amy Kapczynski, Chan Park & Bhaven Sampat, *Polymorphs and Prodrugs and Salts (Oh My!): An Empirical Analysis of "Secondary" Pharmaceutical Patents*, 7 PLOS ONE art. no. e49470, at 1-2 (2012); Tahir Amin & Aaron S. Kesselheim, *Secondary Patenting of Branded Pharmaceuticals: A Case Study of How Patents on Two HIV Drugs Could Be Extended for Decades*, 31 HEALTH AFFS. 2286, 2286-87 (2012); and 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, 315-16 (2010). For illustrative examples of patents on modest "secondary-product" patents on "new and improved" variants of a pioneer drug product—ranging from new dosage forms (e.g., from tablet to capsule), or strengths (e.g., extended release), or methods of delivery (e.g., pill to patch), or combinations, to distinct chemical variants (such as a single-enantiomer of a racemic mixture, as Nexium is to Prilosec)—see Hemphill & Sampat, *supra*, at 619-24; Kapczynski et al., *supra*, at 1-8; and Lietzan, *supra* note 205, at 841-45. For illustrative examples of "product hopping," see Michael A. Carrier, *A Real-World Analysis of Pharmaceutical Settlements: The Missing Dimension of Product Hopping*, 62 FLA. L. REV. 1009, 1022-30 (2010); Michael A. Carrier & Steve D. Shadowen, *Product Hopping: A New Framework*, 92 NOTRE DAME L. REV. 167, 192-200 (2016); and Robin Feldman & Evan Frondorf, *Drug Wars: A New Generation of Generic Pharmaceutical Delay*, 53 HARV. J. ON LEGIS. 499, 516-24 (2016). For an illustrative study of the various infirmities in the healthcare market that facilitate product hopping, see generally Federico J. Piñeiro, *A Case Study of AstraZeneca's Omeprazole/Esomeprazole Chiral Switch Strategy*, 11 GENERICS & BIOSIMILARS INITIATIVE J. 57 (2022).

208. Thus, regarding the extent to which such practices can be effective or successful, critics of the evergreening concern may argue as follows against each of the four variants canvassed: (1)(a) the concern over "submarine" patents is no longer a live one as the United States now has a date-of-filing patent term under 35 U.S.C. § 154(a)(2); (b) the concern over "secondary patents" should be effectively remedied by proper patent enforcement; (2)(a) the concern with "secondary products" is, first, only partly a patent problem and that, again, should be

unduly long buffer for parent or improvement drug products against effective generic price competition, which would price some out of access and price hike others.[209]

redressed by proper patent enforcement and, second, the other part is either not much of a concern (as it merely reflects consumer preferences) or, if so, requires reform outside the patent system, to address infirmities in the healthcare market; and (b) similarly for "product hopping." *See generally* Jonathan J. Darrow, *Debunking the "Evergreening" Patents Myth*, 131 HARV. L. REC., Dec. 8, 2010, at 6 (arguing that consumer preferences often sustain evergreened drugs, even when cheaper generic options are available); Dorothy Du, Novartis AG v. Union of India*: "Evergreening," TRIPS, and "Enhanced Efficacy" Under Section 3(d)*, 21 J. INTELL. PROP. L. 223 (2014) (dismissing several theories of evergreening and suggesting that the only instances in India where evergreening secondary patents delay generic-drug marketing are when those patents are genuinely more effective); Emily Michiko Morris, *Much Ado About the TPP's Effect on Pharmaceuticals*, 20 SMU SCI. & TECH. L. REV. 135 (2017) (discussing concerns surrounding the Trans-Pacific Partnership Agreement regarding its expansion of patentable subject matter to enable evergreening and suggesting that its effects are not clearly detrimental to consumers); Christopher M. Holman, *In Defense of Secondary Pharmaceutical Patents: A Response to the UN's Guidelines for Pharmaceutical Patent Examination*, 50 IND. L. REV. 759 (2017) (disputing a United Nations report's assertions that many types of pharmaceutical inventions are obvious or undeserving of patent protection); Lietzan, *supra* note 205 (suggesting that scholarly discussion of "evergreening" has been too undisciplined to serve as the basis for policymaking); Israel Agranat & Hili Marom, *In Defense of Secondary Pharmaceutical Patents in Drug Discovery and Development*, 11 ACS MED. CHEMISTRY LETTERS 91 (2020) (arguing that pharmaceutical formulations with "unexpected results" should not be disqualified from patentability merely because they were "obvious to try"); McKenzie E. List, *The Hollow Rhetoric of Evergreening*, 61 JURIMETRICS 495 (2021) (arguing that evergreening is socially beneficial). To each of the last three defenses, however, there are effective replies: the problem with both "secondary patents" and "secondary products" is precisely that the patent system is not in good working order, and evergreening-type practices of Orange Book linkage and RSAs exacerbate the difficulties. This also partly addresses the patent aspect of "product hopping." While the healthcare-market-infirmities aspects of this and "secondary-product" concerns are, to be sure, outside the proper province of patent or even general innovation policy, that is no reason for infirmities in the latter to reinforce the former. More generally, the fundamental reply is that secondary patents and products do not represent genuine innovations in proportion to the increased prices they incur, and this merits redress by directly curbing skewed innovation incentives. What the critics of evergreening concerns point to, thus, is the need for better ways both to assess and to curb the skewed incentives properly—and it is precisely these tasks that, as argued in the rest of this Section, the present analysis enables us to do, being anchored in the centrality of the data information good and its regulatory treatment as the key to explaining, evaluating, and addressing the sources, extent, and ills of evergreening.

209. These two distinct ways that higher prices affect access—namely, pricing some out of access and charging others higher prices for such access—tend to be treated differently in the literature of IP and antitrust: the former being a "deadweight loss" or "inefficiency" and the latter merely a "surplus transfer" or "distributive" effect. *See, e.g.*, Fisher, *Reconstructing Fair Use*, *supra* note 53, at 1701-02 (distinguishing between the deadweight-loss and surplus-transfer effects from IP-enabled raised prices); RICHARD POSNER, ECONOMIC ANALYSIS OF LAW 256 (3d ed. 1986) ("[T]he transfer of wealth from consumers to producers brought about by

The judgment that protection of a parent drug against generic competition beyond the formal expiry of its core patents is "unduly long" rests on either one of two premises. First, that a drug's core patents reflect the amount of "innovation" it embodies, and thus the protection afforded by these patents tracks the amount of "incentive" such innovation merits, with any more eating too far into the "access" side of the tradeoff. Alternatively, even if the added protection afforded by secondary patents or products confers incentives for innovating the primary product that are valuable net of their access costs, such incentives are being obtained in very indirect ways. These incentives thus incur extra administrative costs (of obtaining and defending secondary patents) and distortions to innovative activity (by skewing incentives toward developing indirectly valuable secondary products, which derive much of their value parasitically from the primary product). Such administrative and distortionary costs may be referred to as the costs of "gaming" the system.

The judgment that protection of an improvement drug product against generic competition is "unduly strong" rests on either one of two *different* premises. First, where the protection is against generic variants of its parent drug, the concern is with infirmities in the healthcare market that muffle the effectiveness of price signals (including health insurance, formulary managers, and healthcare providers' incentives).[210] Second, where the protection is against generic variants of its own "new and improved" secondary product, the concern is that the "improvement" represented by this variant is not as great as that reflected in the amount of patent protection conferred on it, owing to infirmities in the processes of granting, enforcing, and invalidating patents. And, to anticipate the discussion that follows, more fundamentally the concern is that even a well-functioning patent system is simply unable to provide the properly calibrated incentives, since its focus is on the "innovativeness" (or lack thereof) of the compound information, while the more significant question of innovation policy here is the social desirability of the data information.[211]

Clarifying how evergreening works, however, raises its own puzzle: why is the practice so heavily concentrated in, even specific to, pharma? A firm's basic incentive to try to extend the effective protection from competition that its product enjoys, beyond the formal life of its core patents, would seem to be present more generally, in all sectors that enjoy robust patent protection. Yet the literature on evergreening has focused its attention exclusively on pharma, but without adducing a satisfactory explanation for why it is *this* sector, more than others,

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increasing the price from the competitive to the monopoly level [is] a wash [for] . . . the economic conception of welfare."). The present analysis makes no such sharp distinction.

210. *See supra* note 207.

211. *See infra* text accompanying notes 227-230.

that engages in the practice.[212] That explanation lies in the *specific industry structure* of pharma, namely a sharp bifurcation into innovator/imitator profiles of its firms and products, with patented products made and sold as "brand name" ones by firms in one sector of the industry, and fully imitative ones made and sold as "generics" by firms in another sector.[213] With this sharp bifurcation comes a sharp — indeed massive — differential in the prices of the competing brand-name and generic products, with the latter being 75-85% cheaper than the former on average.[214] It is this steep drop in price — operating upon a base of product sales in the millions to hundreds of millions per year[215] — that the generic form of competition threatens in pharma and that provides its firms the massive extra

212. As discussed in note 196, *supra*, the term "evergreening" was introduced in the patent literature in the drug context. For the exclusive concentration on pharma in the evergreening literature, see Lietzan, *supra* note 205, at 807-10, which reviews the literature and its pharma-specific focus. For partial but unsatisfactory explanations for why the practice is especially prominent and concerning in the case of drugs, see S. Sean Tu & Charles Duan, *Pharmaceutical Patent Two-Step: The Adverse Advent of* Amarin v. Hikma *Type Litigation*, 12 N.Y.U. J. INTELL. PROP. & ENT. L. 1, 2-4 (2022), which focuses on Orange Book-enabled practices; and Jeffrey Wu & Claire Wan-Chiung Cheng, *Into the Woods: A Biologic Patent Thicket Analysis*, 19 CHI.-KENT J. INTELL. PROP. 93, 98, 153-63 (2019), which suggests that evergreening is more intensive for biologics than for chemical drugs, something explained by higher sunk costs and greater technological complexities.

213. The rise of "authorized generics" — subsidiaries of brand-name firms that make and sell imitative variants of the firms' products upon expiration of their patents — does not alter so much as reinforce the present point, as they are an attempt by patentees to compete in the generic sector without altering the overall bifurcated structure of the industry. *See generally* Annabelle C. Fowler, Ruben Jacobo-Rubio & Jing Xu, *Authorized Generics in the U.S.: Prevalence, Characteristics, and Timing, 2010-19*, 42 HEALTH AFFS. 1071 (2023) (discussing trends in the launches of authorized generics).

214. *See* Seema Ledan, *Discussing Brand Versus Generic Medications*, U.S. PHARMACIST, June 2020, at 25, 25 ("Generics range from 80% to 85% lower in cost when compared with their brand product."); CONG. BUDGET OFF., PUB. NO. 4043, EFFECTS OF USING GENERIC DRUGS ON MEDICARE'S PRESCRIPTION DRUG SPENDING 8-9 (2010), https://www.cbo.gov/sites/default/files/111th-congress-2009-2010/reports/09-15-prescriptiondrugs.pdf [https://perma.cc/X3JA-7DG5] ("On average, the retail price of a generic drug is 75 percent lower than the retail price of a brand-name drug.").

215. One study of 361 out of 558 new therapeutic agents introduced in the period between 1995 to 2014 found mean sales to come to a little over $1 billion per year (i.e., mean total sales of $15.2 billion over a mean average of 13.2 years on the market). Olivier J. Wouters, Aaron S. Kesselheim, Jouni Kuha & Jeroen Luyten, *Sales Revenues for New Therapeutic Agents Approved by the United States Food and Drug Administration from 1995 to 2014*, 27 VALUE HEALTH 1373, 1373, 1375 (2024). Another estimate of "the average peak sales" for each new drug product introduced by the top twenty firms by R&D between 2013 to 2023 ranged from $362 million to $573 million per year. *Unleash AI's Potential: Measuring the Return from Pharmaceutical Innovation — 14th Edition*, DELOITTE 6 (Apr. 2024), https://www2.deloitte.com/content/dam/Deloitte/us/Documents/life-sciences-health-care/us-rd-roi-14th-edition.pdf [https://perma.cc/67T9-76P8].

fuel, on top of the basic incentive shared by all patentees, to extend effective patent life on their products. And what explains this steep price differential? It is the gap between innovator and imitator costs with respect to clinical data: ever since the passage in 1984 of the Hatch-Waxman Act, generic firms have been allowed to regulatorily "piggyback" on the data originally generated by the brand-name firm.[216] Indeed, the effect of the Hatch-Waxman Act has been not just to lower entry costs for specific generic firms but to have made such entry widely feasible enough as to create a *generic industry*.[217]

What explains the pharma-specific character of intensive evergreening, then, is precisely the centrality of data information to pharmaceutical innovation: the gap between its generation and replication costs explains not only the steep price differential between particular brand-name and generic products that provides individual firms with the special fuel to engage in evergreening, but also the generalized industry structure that has made the practice pervasive in this sector in its wake.

This explanation of the underlying causes of evergreening practices allows us, in turn, to better understand both the character and extent of the problems they raise—and, ultimately, to fashion more effective solutions for their redress. The point is best illustrated by considering a key aspect of evergreening that has garnered a sizeable critical literature of its own over the past two decades: "reverse settlement agreements" (RSAs) between brand-name plaintiffs and generic defendants involved in patent litigation.[218] In typical litigation settlements, it is the defendant who pays the plaintiff some amount to drop the lawsuit, so as to avoid higher prospective damages should they be found liable for infringement. In RSAs, by contrast, it is the reverse (thus the moniker): the plaintiff patentee pays the defendant(s) to drop the suit. This raises the specter that the plaintiffs are "buying off" a challenge to their (potentially weak) patents—that

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216. *See* 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(j)).

217. *See* Mossinghoff, *supra* note 166, at 194 ("The robust generic drug industry owes its very existence to the Act . . . ."); *What is Hatch Waxman?*, PHRMA (June 2018), https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/D-F/Fact-Sheet_What-is-Hatch-Waxman_June-2018.pdf [https://perma.cc/K3U4-CRGQ] ("The Hatch-Waxman Act established the legal and economic foundation for today's generic pharmaceutical industry.").

218. *See, e.g.*, Einer Elhauge & Alex Krueger, *Solving the Patent Settlement Puzzle*, 91 TEX. L. REV. 283, 284-85 (2012); Traci Aoki, *The Problem of Reverse Payments in the Pharmaceutical Industry Following* Actavis, 67 HASTINGS L.J. 259, 262-64 (2015); Erik Hovenkamp, *Antitrust Law and Patent Settlement Design*, 32 HARV. J.L. & TECH. 417, 434 (2019); Erik Hovenkamp & Jorge Lemus, *Antitrust Limits on Patent Settlements: A New Approach*, 70 J. INDUS. ECON. 257, 258 (2022).

they are, in the words of the other moniker common for such agreements, "paying for delay" of generic entry.[219]

As with evergreening more generally, there remains debate about the extent to which RSAs should trouble us. Critics of the agreements charge that they are a way for pharma firms to insulate "weak" patents—that is, secondary patents on a parent product or primary patents on a secondary product—from effective challenge.[220] Defenders point to various possible benefits, ranging from reduced costs of litigation or uncertainty to firming up necessary patent incentives.[221] What has been missing from the literature, however, is a satisfactory explanation for the one feature of such agreements that all recognize: that they are specific to pharma patent litigation.[222] And that missing explanation is supplied, again, by the fact that the key distinguishing innovation in pharma is the data information good and its regulatory treatment: *this* is what explains the price gap fueling patentees in this sector (alone) to seek to ward off (generic) competition with such intensity.

Explaining what drives pharma-specific RSAs (and evergreening in general) equips us to better assess their costs. In 2010, the FTC estimated the costs of RSAs to be $3.5 billion annually in raised prices for American consumers.[223] A more recent study suggests that this is a significant underestimate and offers

219. *See, e.g.*, C. Scott Hemphill, *Paying for Delay: Pharmaceutical Patent Settlement as a Regulatory Design Problem*, 81 N.Y.U. L. Rev. 1553, 1573-77 (2006); Aaron Edlin, Scott Hemphill, Herbert Hovenkamp & Carl Shapiro, *Activating* Actavis, 28 Antitrust, no. 1, 2013, at 16, 16-21; Robin Feldman, *The Price Tag of "Pay-for-Delay,"* 23 Colum. Sci. & Tech. L. Rev. 1, 2-5 (2022); Kevin J. Hickey & Erin H. Ward, Cong. Rsch. Serv., R46679, The Role of Patents and Regulatory Exclusivities in Drug Pricing 56-59 (2024).

220. For some examples of these criticisms, see generally sources cited *supra* notes 218-219.

221. *See, e.g.*, Note, FTC v. Actavis, Inc., 127 Harv. L. Rev. 358, 367 (2013); FTC v. Actavis, Inc., 570 U.S. 136, 160-77 (2013) (Roberts, C.J., dissenting); Daniel A. Crane, *Ease over Accuracy in Assessing Patent Settlements*, 88 Minn. L. Rev. 698, 699-702 (2004).

222. For examples of incomplete partial explanations of why RSAs are specific to pharma, see Hemphill, *supra* note 219, at 1560-61, 1579-86, which ties the prevalence of RSAs in pharma to the specifics of the Hatch-Waxman Act's first-filer generic "bounty" provisions but does not address the fact that RSAs often extend beyond the first filer eligible for the bounty; *Actavis*, 570 U.S. at 154-56; and Elhauge & Krueger, *supra* note 218, at 285-93, which attributes RSAs to when patents confer "market power" on their holder but does not explain why it is specific to pharma that patented brand-name products ubiquitously enjoy such strong pricing power.

223. *Pay-for-Delay: How Drug Company Pay-offs Cost Consumers Billions*, Fed. Trade Comm'n 2 (Jan. 2010), https://www.ftc.gov/sites/default/files/documents/reports/pay-delay-how-drug-company-pay-offs-cost-consumers-billions-federal-trade-commission-staff-study/100112payfordelayrpt.pdf [https://perma.cc/3SKW-VUVD].

instead a figure of $6.2 billion annually for the period of 2006 to 2017.[224] While useful as estimates of the overall "access costs" of RSAs, these figures face two gaps. First, to fully account for the access costs to consumers, we need to consider the effects of higher prices not only on those paying more (which these studies do consider) but also on those priced out (which they do not). Second, any consideration of the access costs of intellectual-property rights due to higher prices must also, to be complete, consider any possible "incentive benefits" of such prices, in terms of new innovations lured by the prospects of higher returns. To be sure, the entire thrust of the criticisms of evergreening practices is that they erect barriers to access not justified by any corresponding incentive benefit. But the basis of that criticism must lie in an assessment that the secondary patents and products involved in evergreening represent trivial or nonexistent innovations, or at best modest ones that are disproportionate to their formal patent protection.[225] And to make *that* assessment, we need some metric of the *innovativeness* of the products apart from their formal patent protection.

The main metric deployed in the literature is to attempt to assess the innovativeness of the patents at issue in evergreening cases in light of their ultimate validity and scope as determined by litigation—by looking, in effect, at the win/loss rates of the patents at issue in generic challenges.[226] This approach faces two difficulties. The first, and less serious, is well recognized in the literature: selection bias, whereby those patents that are litigated to trial may well be the ones that patentees had higher confidence would ultimately hold up, an effect that—as the literature discloses—may increase over time as settlement rates go up (partly in response to greater opportunities for entering such settlements).[227]

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224. Feldman, *supra* note 219, at 5. The author also provides an upper-bound estimate of "as high as $37 billion per year—ten times higher than the FTC's estimate." *Id.*; *see also* Robin Feldman, *May Your Drug Price Be Evergreen*, 5 J.L. & BIOSCIENCES 590, 596 (2018) (presenting an expansive study of evergreening in the drug-development market).

225. More precisely, as discussed *supra* in the text following note 209, the basis of that assessment must be (1) that the direct innovations embodied in such secondary patents and products are disproportionate to their formal patent protection, and (2) that any *indirect* incentives they provide for innovations embodied in the original parent patents and products is purchased at too high a price, in terms of the gaming costs involved.

226. *See, e.g.*, C. Scott Hemphill & Mark Lemley, *Earning Exclusivity: Generic Drug Incentives and the Hatch-Waxman Act*, 77 ANTITRUST L.J. 947, 978 (2011) ("If the patent is valid and infringed, the patentee should be able to exclude others and command a supracompetitive royalty . . . .")

227. *Id.* at 979 ("The drop in generic win rate is likely traceable to two changes we think occurred in challenge and settlement practice. The first is an increase in settlements in weak-patent cases after the FDA's earned-exclusivity rule was rejected, a change that would further strengthen our view that those settlements are problematic. The second is an increase in the filing of weak generic claims, motivated in part by the prospect of a future settlement payoff.").

Thus, while earlier studies (in 2002 and 2006) found that generic challengers won almost three-quarters of such cases,[228] later studies (in 2010 and 2014) found the ratio had dropped to under half.[229] And this trend has been confirmed by the author: a review carried out for the purposes of this Feature shows that of all 109 drug-patent cases involving generics litigated to judgment in the period from 2013 to 2022, the generic challenger won only 45, just under 40%.[230]

The second, and more serious, difficulty facing this approach is that the innovativeness of the *patents* at issue in such cases is a highly imperfect metric of the innovativeness of the *products*. And this is because the core "innovation"—or information good—embodied in such products is fully sidelined by the patent system's inquiries: the data information good. It is this information good that, again, is the driver of the industry's economics and the apt focus of its innovation-policy rules. And whether a patent is merited on the preclinical results for any drug is a highly imperfect indicator of whether—or, more precisely, *how much*—clinical testing is required. This last wrinkle goes to a further difficulty with using patents as our measure of innovativeness: the on/off inquiry of whether a patent is valid or not is too blunt an instrument when the more apt inquiry is determining the *degree* of innovativeness its covered product embodies.

For both these reasons, to better assess the extent to which secondary products involve relatively small degrees of innovativeness—and hence the pernicious

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228. *See Generic Drug Entry Prior to Patent Expiration: An FTC Study*, FED. TRADE COMM'N, at vi (July 2002), https://www.ftc.gov/sites/default/files/documents/reports/generic-drug-entry-prior-patent-expiration-ftc-study/genericdrugstudy_0.pdf [https://perma.cc/TB33-BBYR] (finding that generics win 73% "of the cases in which a court has resolved the patent dispute"); Paul M. Janicke & LiLan Ren, *Who Wins Patent Infringement Cases?*, 34 AIPLA Q.J. 1, 5 (2005) (finding that approximately 75% of cases were won by the accused infringer).

229. *See* Adam Green & D. Dewey Steadman, *Pharmaceuticals: Analyzing Litigation Success Rates*, RBC CAP. MKTS. 1 (Jan. 15, 2010), https://amlawdaily.typepad.com/pharmareport.pdf [https://perma.cc/3SFX-2EPZ] (finding that generics won 48% of cases against patent holders); Ruben Jacobo-Rubio, John L. Turner & Jonathan W. Williams, *The Distribution of Surplus in the US Pharmaceutical Industry: Evidence from Paragraph iv Patent-Litigation Decisions*, 63 J.L. & ECON. 203, 221-22 (2020) (finding generics won about 43% of paragraph-IV ANDA infringement cases at the trial-court level); *cf. 2014 Patent Litigation Study: As Case Volume Leaps, Damages Continue General Decline*, PWC 21 (July 2014), https://www.pwc.com/en_US/us/forensic-services/publications/assets/2014-patent-litigation-study.pdf [https://perma.cc/SN2Q-LPG9] ("Since 2006, ANDA litigation success rates have ranged from a low of 22% to a high of 83%. However, the sample size in the earlier years was low, possibly explaining the wide swings in success rates. Because the majority of ANDA litigations continue to end in settlement, the adjudicated case sample size remains modest.").

230. I reviewed all ANDA-based patent litigation generated by a search on Westlaw, covering the period from January 1, 2012, through December 31, 2022, in the "federal" database for the "practice area" of "patent" using the following search terms: +"pharmaceutical(s)" + "FDA" = 341.

effects of undue access and gaming costs associated with evergreening—we need to shift the focus of our analysis from the compound information good and its patent protection to the data information good and its data-exclusivity protection. Doing so allows us to zero in on two core questions. First, to what extent do new drug products approved in the United States consist of secondary rather than primary products—meaning products modifying active ingredients already on the market versus those introducing new active ingredients? Second, to what extent do such secondary products hold out significant (as opposed to modest or even trivial) advances or improvements over existing treatments? The first question allows us to distinguish between those new drug products involving a high versus modest degree of clinical testing—and accordingly meriting strong versus modest data-exclusivity protection. The second allows us to distinguish *within* the latter group—of secondary products involving modest testing—between those holding out a significant therapeutic advance, and hence meriting significant data-protection incentives, and those not.

Table 3 distills the results of a review conducted by the author of all new drug approvals by FDA from 1990 to 2023 (with the exception of the years 2005 to 2007, for which refined data is not available), as broken down, first, into "primary products" or "new molecular entities" (NMEs) and "secondary products" or "incrementally modified products" (IMPs). Each category is then further subdivided into drug products rated "priority" by the agency (representing "significant improvements in the safety or effectiveness of the treatment, diagnosis, or prevention of serious conditions compared to available therapies") and those rated "standard."[231]

231. Off. of New Drugs, U.S. Food & Drug Admin., MAPP 6020.3 Rev. 2, Review Designation Policy: Priority (P) and Standard (S) 2 (2013), https://www.fda.gov/media/72723/download [https://perma.cc/9B4C-K2DF].

TABLE 3. BREAKDOWN OF NEW DRUG APPROVALS, 1990-2004, 2008-2023[232]

	Drug Product Type		
Drug Rating	**NMEs**	**IMPs**	**Totals**
Priority	433 (49% of NMEs)	287 (14% of IMPs)	720 (25% of all approvals)
Standard	452 (51% of NMEs)	1,700 (86% of IMPs)	2,152 (75% of all approvals)
Totals	885 (31% of all new approvals)	1,987 (69% of all new approvals)	**2,872**

A focus on the second column of IMPs or secondary products reveals two crucial points (we turn to the first column of NMEs or primary products below, when discussing me-too drugs). First, of the 2,872 new drugs approved in this period, 1,987 or 69% were IMPs or secondary products. Once we realize that the relevant focus is not on patent protection for the compound information good but data exclusivity on the data information good, then we already have in hand the main tools needed for curbing excessive protection over such secondary products: patents over them should be phased out and replaced with a revised form of data-exclusivity protection. Such protection can and should make a crucial distinction unavailable within the patent system, between stronger protection for NMEs—with their more onerous clinical-testing requirements—and weaker protection for IMPs, with their lighter requirements. Indeed, the present system already draws this distinction, conferring upon NMEs 5 to 7.5 years of exclusivity and IMPs only 3 years. To be sure, these precise figures may need adjustment once data exclusivity becomes the central or sole source of protection. But the basic point remains: data exclusivity, by focusing on the right information good, provides more flexible tools for tailoring innovation incentives. And this extends to a second point: a further distinction should be drawn, *within* IMPs, between those holding out truly significant advances—here, 14% of such products—and those bearing more modest or even negligible ones (86%).

That almost 70% of the industry's output consists of secondary products, of which 86% are considered not to hold out significant advances, strongly

232. The data in this table are based on the author's review of the FDA drug-approvals database. For the original FDA databases, see *Compilation of CDER New Molecular Entity (NME) Drug and New Biologic Approvals*, U.S. FOOD & DRUG ADMIN. (Apr. 22, 2024), https://www.fda.gov/drugs/drug-approvals-and-databases/compilation-cder-new-molecular-entity-nme-drug-and-new-biologic-approvals [https://perma.cc/A27Y-6XJG]; and *NDA and BLA Calendar Year Approvals*, U.S. FOOD & DRUG ADMIN. (Mar. 15, 2024), https://www.fda.gov/drugs/nda-and-bla-approvals/nda-and-bla-calendar-year-approvals [https://perma.cc/P83X-9684].

indicates that evergreening *is* a serious problem—meaning that the incentive benefits of secondary products and patents do not justify the exorbitant access and gaming costs involved in their pursuit. And the most effective and well-tailored means for addressing this problem is simply to remove the role of patents—and their concomitant misaligned focus and invitation to gaming—and replace them with a revised form of data exclusivity that retains incentives for improvement innovations while adjusting and curtailing them appropriately.[233]

In sum, when it comes to evergreening and its potential for undue access and gaming costs, an analysis focused on the data information good lying at the center of the system allows us finally to go to the roots of the problem. It points to the underlying cause of this pharma-specific practice, enables us to better assess its extent, and directs us to more effective—farther-reaching and better-tailored—solutions. Removing patents attacks the generative source of troubling practices, while revising data exclusivity uses the institutional tools best fitted to handle the relevant concerns.

2. *Duplication Costs: Me-Too Drugs*

The same points apply when we turn to a second crucial concern: that of "me-too" drugs.[234] This concern is one familiar from the general literature on innovation races and patents: at any given level of robust patent protection, the incentives held out will, for some subset of innovations, not merely equal or just exceed the (risk-adjusted, capitalized) costs of generating the innovation, but rather exceed such costs significantly, holding out the lure of "rents" beyond

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233. The alternative would be to retain patents—and their generative sources of the problem lying in the basic misalignment between what patents focus on and what is central to innovation policy here—and to deal only with surface manifestations through partial reforms to drug patents. For discussion of these partial reforms, most of which are apt but none of which go far enough, see *infra* Section III.B.

234. *See generally* Aidan Hollis, Me-Too Drugs: Is There a Problem? (Dec. 13, 2004) (unpublished manuscript), https://www.researchgate.net/profile/Aidan-Hollis/publication/228919661_Me-too_drugs_Is_there_a_problem/links/596578234585157fcc5e3ead/Me-too-drugs-Is-there-a-problem.pdf [https://perma.cc/7KEK-FLJ4] (critiquing me-too drugs); Joseph A. DiMasi & Cherie Paquette, *The Economics of Follow-On Drug Research and Development: Trends in Entry Rates and the Timing of Development—The Authors' Reply*, 23 PHARMACOECONOMICS 1193 (2005) (defending me-too drugs against Aidan Hollis's criticisms); Jeffrey K. Aronson & A. Richard Green, *Me-Too Pharmaceutical Products: History, Definitions, Examples, and Relevance to Drug Shortages and Essential Medicines Lists*, 86 BRIT. J. CLINICAL PHARMACOLOGY 2114 (2020) (defending me-too drugs); Laura Fegraus & Murray Ross, *Sovaldi, Harvoni, and Why It's Different This Time*, HEALTH AFFS. FOREFRONT (Nov. 21, 2014), https://www.healthaffairs.org/do/10.1377/hblog20141121.042908/full [https://perma.cc/L5CH-3TKX] (critiquing me-too drugs); OFF. OF TECH. ASSESSMENT, *supra* note 84 (canvassing both sides).

normal profits.[235] Such rents will tend to draw multiple participants into the relevant innovative activity, resulting in a potentially high degree of overlapping activity, with firms duplicating each other's successes and failures.[236] This dynamic manifests in pharma as "me-too" drugs: patented, brand-name drugs clustered in the same "therapeutic class," with each variant operating through the same mechanism of action (such as selective serotonin-reuptake inhibition) to achieve the same effect or "indication" (such as treatment of depression), but using a distinct(ly patented) compound for doing so.[237]

In both general innovation theory and pharmaceutical policy, the key is to assess when such overlapping activity is beneficial — or at least not unduly pernicious — and when it is wasteful. In theory, the answer lies in drawing two distinctions. The first is between (1) "race-to-invent" activity in which many participants are seeking to be the first to reach the potential rents;[238] and (2) "invent-around" activity, in which some are seeking to "cannibalize" the existing rents of incumbents by developing their own, noninfringing but also patent-protected, variant of a good.[239] The former we may plausibly view as tending to be beneficial: "many minds" may better explore a highly uncertain possibility frontier, even with some duplicative activity.[240] The latter less so: while each new entrant *may* provide some added benefit over existing variants, there exists in such cases a basic misalignment between the social value of the new entrant (its net added benefit) and its private value (its share of total rents).[241] Second, *within* "racing" activity, a distinction should be drawn between (1) zones of highly risky or uncertain stages of research, where the benefits of many-minded exploration are greatest; and (2) later, less risky stages, where the costs of duplication loom larger.

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235. *See supra* note 59.

236. *See* Kitch, *supra* note 21, at 266-67; McFetridge & Smith, *supra* note 59, at 198; Grady & Alexander, *supra* note 59, at 317; William W. Fisher III, *Theories of Intellectual Property*, *in* NEW ESSAYS IN THE LEGAL AND POLITICAL THEORY OF PROPERTY 168, 178-84 (Stephen R. Munzer ed., 2001).

237. For further discussion of me-too drugs, see CONG. BUDGET OFF., *supra* note 214, at 19-20; and NAT'L INST. FOR HEALTH CARE MGMT. FOUND., *supra* note 96, at 17-18.

238. *Cf.* Fisher, *supra* note 236, at 180 ("First, the pot of gold represented by a patent on a pioneering, commercially valuable invention may lure an inefficiently large number of persons and organizations into the race to be the first to reach the invention in question.").

239. *See id.* ("[F]irms may try to 'invent around' technologies patented by their rivals — that is, to develop functionally equivalent but non-infringing technologies — efforts that, although rational from the standpoint of the individual firm, represent a waste of social resources.").

240. *See* Merges & Nelson, *supra* note 20, at 873-74.

241. For the implications of this point for institutional design of tailored data exclusivity, see *infra* note 260.

In light of these considerations, analysis of the distinct character of the data and compound information goods—in terms of their risk and cost profiles—as well as of the distinct tools of data-exclusivity protection, puts us in much better stead to pinpoint and address the problem of rent dissipation in pharma than would a focus on the compound information good and patents. This is for two reasons. First, once we realize that the costliest, yet lowest-risk, stage of research is clinical trials, it is clear that this is where we most wish to reduce duplicative "racing" activity. But while patents may be able to call off the race for clinical development of any one candidate drug, they are relatively hamstrung to do so *between* drugs—that is, to curb costly invent-around trials. Data exclusivity, on the other hand, is precisely oriented toward incentivizing (or not) this stage of innovative activity. Similarly, and second, FDA data exclusivity is also well suited to attend to the distinction between salutary race-to-invent and pernicious invent-around activity: those NMEs embodying priority treatments warrant stronger incentives than those rated standard.

With these distinctions in hand, a review of the pharmaceutical industry's output discloses the following diagnosis of the extent of the problem and prescriptions for addressing its ills. Just over half of all the industry's primary products or NMEs since 1990—452 out of 885, or 51%—and fully three-quarters of its products as a whole were rated standard rather than priority at the time of their FDA review.[242] While this metric is only a rough proxy of "me-too" drugs,[243] it remains a better one than any other we have—and of a problem that we have every reason of both theory and evidence to believe is a serious one not to be ignored. And the right solution is twofold. First, race-to-invent should be allowed to proceed unhampered at the compound information stage but curbed at the data information stage. Second, invent-around activity should be curbed

242. *See supra* Table 3. Again, the years 2005-2007 are excepted owing to the unavailability of refined data.

243. There are two distinct reasons why FDA ratings are only rough (yet still serviceable) proxies for the concerns raised by me-too drugs. First, the ratings are made at the time of a drug's NDA submission, and thus prior to market entry, whereas a drug's benefits may only be fully revealed after market entry, in terms of refined safety, efficacy, and convenience effects on a more heterogenous patient population than those studied in clinical trials. *See* OFF. OF NEW DRUGS, *supra* note 231, at 1 ("This distinction [between priority and standard ratings] is based upon review of NDAs, BLAs, and efficacy supplements as initially submitted."); Joseph A. DiMasi & Cherie Paquette, *The Economics of Follow-On Drug Research and Development: Trends in Entry Rates and the Timing of Development*, 22 PHARMACOECONOMICS 1, 11-12 (Supp. 2, 2004); Richard L. Kravitz, Naihua Duan & Joel Braslow, *Evidence-Based Medicine, Heterogeneity of Treatment Effects, and the Trouble with Averages*, 82 MILBANK Q. 661, 662 667 (2004). Second, even drugs similar to existing entrants may involve socially valuable innovative activity in their generation when these drugs are generated as part of a "race-to-invent" rather than "invent-around" activity. For the implications of the latter point for institutional design of tailored data exclusivity, *see infra* note 260.

at both stages, by drawing a distinction within NMEs parallel to that drawn above for IMPs: standard or me-too NMEs should not receive the same protection as truly priority or pioneering ones.

B. Reforms: Cleaning Up Versus Phasing Out Patents

The foregoing diagnosis of what explains evergreening and me-too drugs *and* of how to assess the extent of the undue access, gaming, and duplication costs that they incur comes with its own prescription. Given that the generative source of the problems lies in the misalignment between what patents focus on and the central innovation in pharmaceuticals requiring adequate incentives—the data information good—the solution lies in properly realigning the system, by phasing out drug patents and replacing them with a well-tailored system of regulatory exclusivity.

Before outlining the contours of that reform, however, it is worthwhile to point to two more modest reforms suggested by the present analysis, both going not to phasing out patents but, rather, to "cleaning up" the patent system in its handling of drugs. Regarding both Orange Book linkage and RSAs, the present analysis offers a stronger basis than currently exists in the literature for simply abolishing both. At the same time, it points to the limits of even such far-reaching improvements to drug patents, in contrast to the prevailing literature, where reform proposals tend to stay cabined within improving the patent system's performance. In other words, this Feature goes farther than existing rationales for why and how to reform drug patents, but it also shows why even the farthest such reforms do not go far enough—we need, instead, to phase patents out.

1. Cleaning Up Patents: Orange Book Delinkage and RSAs as Per Se Anticompetitive

We turn first to the system of Orange Book linkage, which provides that a generic challenge to any patents on a drug is linked to a delay in the FDA regulatory process of approving its ANDA. Consider again the question raised above: what justifies intertwining these two distinct systems—patent protection on the compound information and regulatory approval for the data information—in this way?[244] Why shouldn't the generic firm be free to pursue its regulatory-approval process independently of the patent-litigation one, so that once the data

244. *See supra* note 198 and accompanying text. As clarified there, another form of intersection does have plausible justification and is not being challenged here, namely the statutory provision empowering a generic filer of an ANDA to seek a declaratory judgment that the brand-name drug's patents are either invalid or noninfringed, so as to enable the generic to seek to avoid at-risk market entry.

exclusivity has expired on a product, it can enter the market at its own risk with respect to the patent? Why should FDA's decision-making processes be entangled with those of dispute resolution in the patent system? To ask the question would seem to answer it: there simply is no good reason. No plausible rationale exists for such unnecessary entangling of what are two entirely separate processes.

But while there is no plausible justification for linkage, there is a very plausible *explanation* for it. From a drug innovator's perspective, the more important protection is that provided on the data, not the compound, information good. What good is the (often weak) patent once the (more apt) data-exclusivity period has expired, so that a defendant is now free to replicate the crucial information good, and then take their chances vis-à-vis protection over the compound? This will massively lower the imitator's costs and result in a high degree of price competition. Consequently, it is greatly to the innovator's benefit that any challenge to its patents be linked to a delay in the approval of an ANDA based on its data. And this explanation issues its own prescription: given that innovators *are* right to intuit that the data information good is the central pivot of the system, we need to focus our attention directly on it and to better calibrate its protection to weigh incentives against access—while, at the same time, fully delinking that protection from the vagaries of patents on the compound information good, as these are simply beside the point.

Along with abolishing any Orange Book linkage, we should also rule out all RSAs. Once we understand precisely why RSAs are specific to pharmaceutical patent litigation, we also have our reason for ruling them out as a matter of antitrust law. Not merely on a case-by-case analysis of their anticompetitive features, requiring the challenger to such agreements to engage in fact-intensive, costly, and highly uncertain "rule of reason" analysis.[245] Nor even merely as "presumptively anticompetitive," such that the challenger is relieved of their initial burden of showing a case-specific anticompetitive harm unless the defendant can first offer up a plausible justification.[246] Rather, RSAs should be ruled out as per se anticompetitive—that is, categorically barred without any need for a fresh, case-specific anticompetitive theory by the challenger or any allowance for a

245. As is the current legal standard. *See* FTC v. Actavis, 570 U.S. 136, 158-59 (2013). For an account of the uncertainty currently attending this standard, see generally Mark A. Lemley & Michael A. Carrier, Rule or Reason? The Role of Balancing in Antitrust Law (July 15, 2024) (unpublished manuscript), https://ssrn.com/abstract=4896529 [https://perma.cc/7YXD-KJK4].

246. As was argued by the Federal Trade Commission (FTC) before the Court in *Actavis*. *Actavis*, 570 U.S. at 159-60; *cf.* C. Scott Hemphill, *An Aggregate Approach to Antitrust: Using New Data and Rulemaking to Preserve Drug Competition*, 109 COLUM. L. REV. 629, 668-70 (2009) (advocating for a presumption that side deals are anticompetitive).

case-specific procompetitive justification by the defendant.[247] They should be treated as simply generically anticompetitive, on par with price-fixing, output-restriction, and market-division agreements.[248] Under this standard, the *only* way a defendant can save such an agreement is by arguing that it satisfies *not* a general procompetitive justification, but one narrow exception: it is reasonably ancillary to a "productive joint venture."[249] But that is simply inapplicable to settlement agreements, the purported procompetitive virtues of which (reducing litigation costs and risks) are unrelated to a limited-purpose integration between competitors (i.e., a productive joint venture).[250]

What is the basis in antitrust law for such a categorical bar? Simply that once we understand what is really going on in RSAs—namely, that the plaintiff patentee is indeed "paying for delay" of a generic defendant, who otherwise would be a direct product competitor threatening a steep price drop—we can see RSAs for what they are: "market divisions," only here not geographically or by consumer segment but by time. RSAs are simply a way for plaintiff patentees to buy some more time without competitive entry, and such a "temporal" market division is as clear a division as any other. By contrast, in most other patent-litigation contexts, the technology at issue may not even cover a distinct product market (think of patent disputes between Samsung and Apple over components of

247. *See, e.g.*, United States v. Topco Assocs., Inc., 405 U.S. 596, 607 (1972) ("[C]ertain business relationships are per se violations of the [Sherman] Act without regard to a consideration of their reasonableness.").

248. *See* United States v. Trenton Potteries, 273 U.S. 392, 396-97 (1927) (holding that price fixing is per se illegal); Nat'l Collegiate Athletic Ass'n v. Bd. of Regents of Univ. of Okla., 468 U.S. 85, 100 (1984) (stating that output restrictions are typically per se anticompetitive); Palmer v. BRG of Ga., Inc., 498 U.S. 46, 49-50 (1990) (holding that market divisions are per se anticompetitive).

249. *See* Broad. Music, Inc. v. Columbia Broad. Sys., 441 U.S. 1, 19 (1979) (declining to find an agreement in which prices were fixed to be a per se violation of the Sherman Act, on the grounds that the price fixing was part of a "[j]oint venture[] . . . where the agreement on price is necessary to market the product at all"); Arizona v. Maricopa Cnty. Med. Soc'y, 457 U.S. 332, 355-56 (1982) (holding that, unlike in *Broadcast Music, Inc.*, the per se rule governed a price-fixing agreement, because the impugned arrangement here was not a "necessary consequence" of realizing the productive aims of the defendants' collaboration); EINER ELHAUGE, UNITED STATES ANTITRUST LAW AND ECONOMICS 56-57, 71-75, 84-85, 88-89 (4th ed. 2022) (setting out the "productive joint venture" rationale as the best explanation for existing Supreme Court precedents for when an exception to per se treatment of a horizontal agreement is or is not allowed).

250. And where such agreements contain features that reach beyond litigation savings and into aspects of productive collaborations—as many may, especially in a post-*Actavis* world, as discussed later—nevertheless they should not qualify for the exemption from per se condemnation because the delay in generic entry, be it procured by cash or some other in-kind benefit, will remain a market division unrelated to the productive collaborative aspects of any such agreement. *See infra* note 253.

smartphones),[251] and even if it does, rarely will the defendants threaten the price drop of a purely imitative ("generic") competitor in pharma. This is why plaintiffs in these cases do not have the same incentive to offer "pay for delay" reverse settlements. Recognizing the sui generis character of pharma-specific RSAs—the effect, again, of the regulatory treatment of the data information good[252]—provides the basis, then, for a categorical bar that closes the various loopholes patentees and generics continue to use in avoiding antitrust invalidation.[253]

As thoroughgoing as these reforms may seem, they are not thoroughgoing enough because they do not go to the underlying, generative, root cause of the problem. While Orange Book linkage and the legality of RSAs provide extra *opportunities* to pursue evergreening gaming practices, removing them would still leave untouched the underlying *motive*—namely, the extra fuel given to holders of drug patents to protect themselves from the especially fierce drop in price associated with the loss of the patent and entry of *generic* competition. This competition enjoys much lower costs owing to regulatory piggybacking on the innovator's data information good. To tackle the problem at its root requires attending to the specific innovation-policy needs of that information good. And

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251. For further discussion of this point, see *infra* note 276.

252. *See supra* text accompanying notes 213-217, 222.

253. Thus, while the Court in *Actavis* declined to hold RSAs as per se or even presumptively anticompetitive but instead subject to the rule of reason, many commentators have urged that the Court's guidance on how to structure the inquiry, and especially its emphasis that large and unexplained cash payments would render an agreement highly suspect, should be used by lower courts to provide more stringent scrutiny of such agreements. *See* Edlin et al., *supra* note 219, at 20-21; Michael A. Carrier, *Payment After* Actavis, 100 IOWA L. REV. 7, 47-49 (2014); Robin Feldman, *Ending Patent Exceptionalism and Structuring the Rule of Reason: The Supreme Court Opens the Door for Both*, 15 MINN. J.L. SCI. & TECH. 61, 72-76 (2014); *cf.* Elhauge & Kruger, *supra* note 218, at 297-311, 328 (setting out, in advance of *Actavis*, a structured rule-of-reason analysis focusing on the size of cash payments in relation to projected litigation savings). And some, citing FTC analysis showing that the incidence of agreements centering on cash payments significantly decreased post-*Actavis*, have thought that troubling "[p]ay-for-delay settlements may now be uncommon." HICKEY & WARD, *supra* note 219, at 58. But as others have pointed out, that agreements may no longer center on cash payments but rather confer various other "in-kind" benefits—ranging from the plaintiff patentee withholding entry by its authorized generic during the defendant generic's 180-day exclusivity period; to agreeing to license other, unrelated products of the defendant; to giving the defendant licensing perks in foreign markets; to settling unrelated claims in suits over less lucrative drugs—does not mean that such agreements are not troubling, only that the "payments" for delay may now take the form of various "side-deal" perks. *See* FELDMAN & FRONDORF, *supra* note 200, at 49-65. What the present analysis indicates is that all such side deals—whatever their independent procompetitive virtues—simply fail to justify a delay of entry, as that delay is a market division and as such is per se barred, absent a showing that it is reasonably necessary to effectuate a productive collaboration. None of the side deals or "productive collaborations" disclosed in the case law as discussed by Robin Feldman and Evan Frondorf bear any such relation to the delay of entry. *See id.*

that requires ignoring the distraction of patents and their gaming in terms of linkages, litigation, settlements, etc., all of which center on the wrong (compound) information good.

To seek to redress the problems of evergreening by improving the patent system is simply to play a game of whack-a-mole: once one symptom of the underlying cause is addressed—say listing of multiple patents to get multiple automatic stays[254]—whack!—another symptom comes to the fore, say filing of frivolous patents on metabolite byproducts.[255] Whack! At which point taking center stage may be nonfrivolous but still modest or even trivial patents on secondary formulations[256]—whack!—or perhaps those on secondary products.[257] Whack! Next, exacerbating the gaming of patent acquisition, we get the gaming of patent enforcement, via RSAs involving large cash payments to delay entry[258]—whack!—which may then give way to RSAs masking the payments for delay with various in-kind side deals, ranging from withholding competition by subsidiaries to licensing unrelated products of the defendant to conferring perks in foreign markets to dropping unrelated claims over less lucrative drugs.[259] Whack! Whack! Whack! Whack!

No matter how many of these symptoms are addressed, still others will continue to crop up unless and until we tackle the underlying source of the ills: namely, that patents in pharma work differently than elsewhere because innovation in pharma works differently, owing to the centrality of its second, data information good and this good's regulatory treatment. It is the gap between the regulatorily mandated high costs of innovation and regulatorily permitted low costs of imitation that opens up the price gap between patentees and generic competition that fuels the gaming of patents in pharmaceuticals. Thus, any reforms to how drug patents work—even those as far-reaching as abolishing the linkage of patent enforcement with the regulatory process and categorically barring RSAs—will, by remaining internal to the patent system, still be vulnerable to further gaming efforts within it. The only way out of this quagmire is to phase out patents and their distractions and focus directly on the issues of innovation policy posed by the central information good in pharma, the generation of clinical data.

In other words, we need to weigh the access benefits of generic entry against the possible costs of such entry in dampening incentives, for the generation of

254. *See supra* text accompanying note 199.

255. *See supra* note 207.

256. *See supra* note 207.

257. *See supra* note 207.

258. *See supra* text accompanying note 219.

259. *See supra* note 253.

the *data information good*. And this requires properly tailoring such incentives in the first place, providing stronger ones where they are needed, and curbing them where they are not. The only effective way of doing so is to attend directly to the features of the information good giving rise to the incentive concern: clinical data. And the right tool for the job is to tailor the protection that directly attaches to that good: data exclusivity.

2. *Phasing Out Patents with Revised Regulatory Exclusivity*

The central aspects of the reform being proposed here have already been specified above. The first is to replace drug patent protection with a revised system of "regulatory exclusivity" that is able to attend to the distinctive features of the central innovation in the system, data information. Next, to address the undue access and gaming costs associated with evergreening-type practices, we need to tailor that system's protection by providing priority IMPs with stronger data exclusivity and standard IMPs with weaker, unlike the case at present where all IMPs get three years. Finally, to address the undue duplication wastes associated with me-too drugs, we also need to distinguish between priority NMEs that get stronger data exclusivity[260] and standard NMEs that get weaker, unlike the case at present where all get between 5 and 7.5 years.

We now turn to three crucial refinements of the proposal. First, by what procedure should we "replace" or "phase out" patent protection for drugs? The preferable mechanism is to have firms "waive" their patents in order to receive data exclusivity upon getting NDA approval for their drug product and being ready for market entry. At that point, drug developers will be confronted with a choice: patents or data exclusivity? Unlike the present system where both are available, innovators will have to choose their preferred form of protection. The premise of the present proposal, supported by the foregoing analysis, is that innovators will realize that a properly tailored form of direct protection over the data information good is preferable to the indirect, and thus hazardous and often "weak," protection afforded by patents. This choice will be made easier when patents are stripped, as they still need to be, of the gaming opportunities afforded by Orange Book linkage and RSAs. In addition, the unavailability otherwise of tailored data

260. An important refinement here is that the stronger form of data exclusivity should not be limited only to "priority" treatments if it turns out upon examination that FDA rates even second or third entrants into a therapeutic class as no longer bearing "significant" therapeutic potential and hence meriting a "standard" rating. Since second or third entrants—indeed, any number of entrants within a certain time period of the first (likely about two years)—are likely "close finishers" in a "race to invent" rather than more distant "invent-around" cannibalizers, they are engaged in valuable innovative activity for which incentives need to be retained. Consequently, the right calibration here would be that "priority-plus" entrants get stronger NME data exclusivity, where "priority-plus" includes close finishers.

exclusivity will be an important stick to go along with the carrot of offering such tightened protection.

But why not simply legislatively abolish patent protection for drugs? Two reasons counsel against this route. First, and less substantively, it would likely run afoul of the United States's obligations under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), Article 27(1) of which prohibits "discrimination" against specific "field[s] of technology."[261] Second, in any case, patent protection—both in general and even specifically for drugs—likely provides a valuable institutional "safety valve": a check against any alternative innovation policy, by providing innovators with a choice. So long as such protection is not unduly strong or flawed—as, it should be emphasized, it clearly is at present—a modest form of protection for "inventors at the margin" likely makes good sense,[262] even for pharma.

A second question: if drug patents are not abolished but replaced by waiver, does this not mean we must retain them into the indefinite future, and so are not really "phasing" them out? In particular, why require firms to still go through the motions—and all the costs—of obtaining a patent only to waive it prior to commercial exploitation? Can we not simply have data exclusivity available to innovators *in lieu of* patents? Yes. There is no reason why a firm obtaining NDA approval on a drug should cease to become eligible for the data-exclusivity protection merely because, rather than obtain and waive, they simply chose not to file for a patent in the first place.

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261. Agreement on Trade-Related Aspects of Intellectual Property Rights art. 27, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299 (providing that "patents shall be available for any inventions, whether products or processes, in all fields of technology" and that "patents shall be available and patent rights enjoyable without discrimination as to . . . the field of technology"). While subsections (2) and (3) of Article 27 carve out some exceptions to this requirement, none of these apply here. *Id.* Article 27(2) allows an exemption from patent protection for those inventions "the commercial exploitation of which" may be necessary to curb in order "to protect *ordre public* or morality." *Id.* This does not apply, since under the proposed regime, drugs (and the inventions they embody) would continue to be commercially sold. Article 27(3) allows carve-outs for "diagnostic, therapeutic and surgical methods for the treatment of humans or animals." *Id.* Application of this to drugs would require stretching the notion of "therapeutic . . . methods" past the point of breaking: drugs are not "methods" within the technical meaning of that term in this context, which applies to "process" claims pertaining to methods of doing something, that is, "functional" claims, rather than the process claims at issue in drugs—those going to methods-of-making or methods-of-using a product. *See id.* And, even if we wished to include some or all of the latter within its ambit, it would remain that the majority of relevant patents here are "product" and not process ones.

262. *See generally* sources cited *supra* note 45 (arguing that patents should protect those at the margins).

But to enable firms to forgo patent protection requires an important further refinement in the system of "regulatory exclusivity": after the NDA stage at the end of clinical trials, we should add a form of "testing exclusivity" at the IND stage at their start. Why? First, this would assure innovators engaging in costly clinical-trial development that a later entrant with the same or a highly similar product will not beat them to the punch—this being, in effect, the main valuable "coordinating" function that patents presently perform.[263] Second, and relatedly, from a social point of view, duplicative clinical trials would be highly wasteful. Thus, to phase out patents fully, we need to replace their coordinating function with FDA-granted testing exclusivity.

This raises a third issue. As the foregoing refinement makes clear, "regulatory exclusivity" here means more than merely "data exclusivity": it is "data exclusivity" plus "testing exclusivity." But this raises another question: should it perhaps also be *less* than "data exclusivity"? Presently, when FDA data exclusivity expires, other firms are able to rely on the originator data for purposes of ANDA submissions to FDA, but they cannot actually "see" or *use* the originator data in any other way.[264] That is, even after "data exclusivity" has expired, the firm still retains full "data secrecy."[265] Is that sensible? No. The benefits of data transparency are massive—both for improving cumulative innovation by allowing others to

263. *See supra* Section II.B.2.

264. *See* Eisenberg, *The Role of the FDA*, *supra* note 8, at 380-81 (detailing that this is the current position taken by innovator firms and FDA, while also indicating why "the statutory language invoked in support of this position is ambiguous").

265. This parallels a concern in patent law: firms are often able to enjoy both a patent *and* secrecy, in parallel, over the same information good, such that (1) once the patent form of proprietary protection ends, (2) they still retain a distinct second, if thinner, layer of protection. *See* Lisa Larrimore Ouellette, *Do Patents Disclose Useful Information?*, 25 HARV. J.L. & TECH. 545, 546-58 (2012). The parallel question here is whether there should be both (1) data exclusivity; and (2) then residual "data secrecy," such that the data always remains "proprietary." And the answer being proposed here is: "no." The firms' clinical data is a highly socially valuable information good, with its generation regulatorily mandated and its replication regulatorily prohibited and then after a time regulatorily permitted. To these points we should add another: after the right amount of time, both data exclusivity *and* data secrecy should expire. There is no reason to allow the firm to continue to "own" such an intensively regulated, socially valuable information good. The parallel debate over whether the patent system should be altered to require more forceful "disclosures"—so that, in effect, secrecy evaporates upon the patent filing—is hotly contested. *See* Colleen V. Chien, *Contextualizing Patent Disclosure*, 69 VAND. L. REV. 1849, 1854-66 (2016) (reviewing the history of the doctrine of disclosure and the debate on its actual and desirable contours). The position being taken in this Feature with respect to "data secrecy" is analogous to the one adopted by Lisa Larrimore Ouellette in the case of secrecy and patents: while "disclosure" is unlikely to be a persuasive "*justification*" for conferring patents, once a patent system is up and running, disclosure remains a persuasive (if secondary) *function* for the system to pursue. *See* Ouellette, *supra*, at 554-61, 587-601. In our context here, that means that in return for data exclusivity, firms should be required to give up data secrecy. Firms wishing to retain data secrecy should be denied data exclusivity.

build on a firm's clinical results and learn from its successes and failures[266] and for improving the quality of clinical testing in the first place, by opening up the firm's results for more effective peer review as a form of "quality control" in a context where conflicts of interest afflicting (firm-sponsored) researchers are rife.[267] The present proposal, then, joins the chorus of scholars calling for greater clinical "data transparency."[268]

A final point: the attentive reader may have noticed that one aspect of the reform proposal not elaborated here is what the actual duration and scope of the requisite data-exclusivity periods should be — be it for priority or standard drug products, and for NMEs or IMPs — once patent protection is phased out. The present analysis has simply used the existing system as the baseline to illustrate *the kind* of tailoring or finer-grained calibrations that are called for by an analysis of the causes and extent of evergreening and me-too drugs and their access, gaming, and duplication costs. A fuller analysis to determine the precise duration and scope of data-exclusivity periods is beyond the present scope, although the approach deployed here is, I believe, the right method for answering that question. This is briefly discussed next, in the final Part.

IV. FUTURE DIRECTIONS

This Part briefly canvasses three further questions for pharmaceutical innovation policy that are raised by the present analysis but lie beyond its scope. The first was just flagged: how to go about determining the precise scope and duration of the data-exclusivity periods that will serve as the sole incentive mechanism for drug innovation once patents are phased out. A second is whether we should be concerned that data exclusivity, like patent rights, remains an exclusionary incentive mechanism and, as such, still erects barriers to access over the information goods it incentivizes. This question, in turn, may be broken into two further ones. First, should we not supplement these "supply side" reforms to improving pharmaceutical innovation policy's *incentives* with "demand side" reforms, which might further improve such policy's *access* performance? In

266. *See* Eisenberg, *The Role of the FDA*, *supra* note 8, at 382-84; Morgan, *supra* note 125, at 116.

267. *See* Tracy R. Lewis, Jerome H. Reichman & Anthony D. So, *The Case for Public Funding and Public Oversight of Clinical Trials*, 4 ECONOMISTS' VOICE, no. 1, 2007, at 1, 1; *see also* Morgan, *supra* note 125, at 116 (calling an end to pharmaceutical data secrecy "socially beneficial").

268. Eisenberg, *The Role of the FDA*, *supra* note 8, at 381-84; Lewis et al., *supra* note 267, at 1; Morgan, *supra* note 125, at 116; Trudo Lemmens & Candice Telfer, *Access to Information and the Right to Health: The Human Rights Case for Clinical Trials Transparency*, 31 AM. J.L. & MED. 62, 67 (2012); Christopher J. Morten & Amy Kapczynski, *The Big Data Regulator, Rebooted: Why and How the FDA Can and Should Disclose Confidential Data on Prescription Drugs and Vaccines*, 109 CALIF. L. REV. 493, 500 (2021).

particular, might not some reforms to pharmaceutical *pricing*—even with patents replaced by data exclusivity—be merited, as an "access" supplement to the improved "incentive" side of data exclusivity? Finally, what about nonexclusionary incentives, or alternative innovation policies such as public funding or prizes? Should an expanded role for one or more variants of these be contemplated?

A. Setting the Scope and Duration of Regulatory Exclusivity

We take up first the question of how to set the right level of data-exclusivity protection. The analytic approach taken to that issue here eschews two common alternatives in the literature on exclusionary incentives, in favor of a third. One prominent approach is to try and set "optimal" levels of protection by seeking to determine the overall level of exclusionary rights at which the added incentive "bang" is no longer worth the added access and duplication "bucks." But if there is one conclusion to be drawn from the theoretical, empirical, and historical literature on patent theory and innovation economics, it is that to try to determine the optimal balance between the incentive, access, and rent-dissipation parameters is a heroic, most likely hopeless, undertaking.[269]

In the wake of its demise, a common alternative to "optimal" incentives has been "average" incentives: namely, to try to determine what level of incentives would sustain the average innovation in a given sector, in light of present gaps between average innovation and imitation costs. This was the approach used in the legislative debate around the right level of data exclusivity to accord biologics to accompany the statutory creation of their abbreviated pathway—that is, the biologics version of the Hatch-Waxman Act, the 2009 Biologics Price Competition and Innovation Act.[270] Innovator-industry-sponsored economists proposed an average of twelve to fourteen years of data exclusivity, to track the effective duration they claimed chemical drugs enjoyed on average from patents; generic-industry-sponsored economists urged the same five years of data exclusivity formally granted to chemical NMEs; and the FTC was unable to decide between

269. For two leading demonstrations of the inordinate theoretical and empirical complexities involved, not to mention the problem that a solution today may not be valid tomorrow in light of dynamically changing conditions, see Kaplow, *supra* note 59, at 1888, which concludes that a properly fulsome analysis of the relevant tradeoffs reveals that "any careful attempt to resolve" the issues "will be far more complex than has been previously realized"; and Fisher, *Reconstructing Fair Use*, *supra* note 53, at 1795, which concludes that a thorough analysis of the relevant tradeoffs should contribute to "an appreciation of just how encompassing and complex a serious effort to maximize allocative efficiency must be."

270. Biologics Price Competition and Innovation Act of 2009, Pub. L. No. 111-148, §§ 7001-7003, 124 Stat. 119, 804-21.

them.[271] The legislation that passed was closer to the innovator industry's advocates than those of generics: a twelve-year period that is extendable by six months with pediatric testing.[272] The trouble with both estimates, quite apart from any empirical flaws, is simply that any "average" approach is hostage to a deep status-quo bias: the average innovation currently generated in a sector is generated under *existing* innovation-policy rules. To take that existing average as a yardstick is to assume that existing rules are more or less optimal. But, as we have seen with evergreening and me-too drugs, we have good reason to believe that the existing rules are far from optimal. To seek simply to mimic their performance is to harbor an indefensibly (or at least undefended) complacent position with respect to how well (or badly) the present system is already working.

Rather than seek to fashion either first-best "optimal" rules or status-quo "average" ones, a better third approach, also present in the literature but less well developed, is to *start from where we are and seek to improve*. Two key subvariants here are as follows. First, we might try to "do no harm": that is, we determine what level of overall incentives the system is currently providing and then, without either lowering or raising that aggregate level, simply seek to tweak or fine-tune how to supply it, conferring the same level of incentives with a lower set of access costs. We seek, that is, to improve upon the present system's "incentive/loss ratio."[273] Hopefully, the drawback of this approach is clear: while certainly an improvement upon the "average" approach, it too harbors an indefensibly status-quo bias, simply assuming that the overall level of incentives being

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271. *See* Henry Grabowski, *Follow-On Biologics: Data Exclusivity and the Balance Between Innovation and Competition*, 7 NATURE REVS. DRUG DISCOVERY 479, 479 (2008); Laurence J. Kotlikoff, *Stimulating Innovation in the Biologics Industry: A Balanced Approach to Marketing Exclusivity*, TEVA PHARM. USA 3-4 (Sept. 2008), https://people.bu.edu/kotlikof/New%20Kotlikoff%20Web%20Page/Kotlikoff_Innovation_in_Biologics21.pdf [https://perma.cc/D7BD-7ZB6]; Henry Grabowski, Genia Long & Richard Mortimer, *Data Exclusivity Periods for Biologics: Updating Prior Analyses and Responding to Critiques* 2 (Duke Univ. Dep't of Econ., Working Paper No. 2008-10, 2008), https://www.ftc.gov/sites/default/files/documents/public_comments/emerging-health-care-competition-and-consumer-issues-537778-00045/537778-00045.pdf [https://perma.cc/E22T-5LGJ]; *Emerging Health Care Issues: Follow-On Biologic Drug Competition*, FED. TRADE COMM'N, at vi-vii (June 2009), https://www.ftc.gov/sites/default/files/documents/reports/emerging-health-care-issues-follow-biologic-drug-competition-federal-trade-commission-report/p083901biologicsreport.pdf [https://perma.cc/3Y8W-V3RY].

272. 42 U.S.C. §§ 262(k)(7)(A)-(B), (m)(2)-(3) (2018); *see supra* notes 170-173 and accompanying text.

273. For this approach in the patent context, see Kaplow, *supra* note 59, at 1816-45. For this approach in the copyright context, see Fisher, *Reconstructing Fair Use*, *supra* note 53, at 1700-44.

provided cannot be improved upon or, at least, should not be tampered with.[274] A better alternative, then, to "do no harm" is, rather, to try to "do better." How? By identifying especially salient drawbacks of the present system and then trying to improve upon those. As is hopefully clear, this is the approach taken by the present analysis: the undue access, gaming, and duplication costs of the current system are highly salient, and measures to assess their extent and redress their sources readily available. We should continue to work along these lines to calibrate the apt overall scope and duration of a new system of regulatory exclusivity that is to replace the present forms of misaligned protection.

B. Improving Drug Pricing

Should a system of exclusionary incentives for pharmaceuticals on the supply side—whether it be via patents or an improved system of data exclusivity—be supplemented by reforms to pharmaceutical pricing on the demand side? Likely, yes. And this is for two very distinct, even if similarly important, reasons. A first is simply "access." With any system of exclusionary incentives, the resulting innovations will come with a price premium—over and above the marginal costs of producing and distributing the embodied unit of the innovation—that will have the effects of pricing some persons out and causing price hikes for others. There is no way around it: that is simply how exclusionary incentives over information goods work.[275] And suppressing for the moment the third issue of whether we should therefore pursue an expanded role for nonexclusionary innovation policies, is there a way we can do better with exclusionary ones by reforms to pricing on the demand side, to improve access?

In answering that question, it is good to attend to a second, perhaps equally important, concern, one going not only to access but also to distortionary pressures on the consumption of drugs. These stem from the interaction between

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274. To be sure, both of the main developers of this approach offer plausible, if different, reasons for advocating it. Louis Kaplow's argument is tethered to administrability concerns with alternatives. Kaplow, *supra* note 59, at 1833-34. Terry Fisher's argument, on the other hand, supplements this sort of economic analysis with pursuit of a "richer sense" of normative concerns than is typical of economists—specifically, pursuit of those adjustments that are counseled by a vision of a "just and attractive society" in general and, in particular, aim to increase both the diverse stock of expressive works generated under copyright and the opportunities for active, meaningful engagement with such works as opposed to simply passive consumption of them. Fisher, *Reconstructing Fair Use*, *supra* note 53, at 1664, 1697, 1744-46, 1768. The present point is to urge that we should try to "do better" even when our concerns remain cabined within standard economic ones, and even when attending to administrability considerations.

275. *See* Bracha & Syed, *supra* note 50, at 1852-54 (establishing the point that to confer IP rights to provide incentives without incurring a price markup is "as conceivable as a perpetual motion machine").

demand-side infirmities in health care and supply-side incentives based on exclusionary rights. In the healthcare sector, urgent needs are served and often paid for by insurance. Health care is also informationally asymmetrical—producers and doctors often know far more about innovations than users or patients do. To incentivize the generation of healthcare goods with marginal-price markups is, thus, to inject a high dose of potential demand distortion into an already-noisy system. The holder of an exclusionary right has a time-limited motive to massively increase sales, while demand-side "price signals" are often highly malleable to such efforts, be they of aggressive promotion or, simply, hiked prices.[276]

276. This point brings together two insights, one from the legal literature on how patents work for drugs, the other from the economic literature on advertising and related promotional activities. In the legal literature, it has often been observed that while a one-to-one mapping between patents and a product may be rare (consider the case of a car or smartphone, embodying many distinct technological inputs, which may each enjoy their own patent protection, often held by different firms), drugs are an instance where patents do tend to map onto discrete products (even if a given drug product may enjoy protection from multiple overlapping patents). *See* Robert P. Merges, *Intellectual Property Rights and the New Institutional Economics*, 53 VAND. L. REV. 1857, 1859 (2000) ("Often . . . there is no simple 'one-to-one' mapping of products and property rights."); Eisenberg, *Patents, Product Exclusivity, and Information Dissemination*, *supra* note 8, at 479 ("Patents on drugs seem to operate the way legal scholars and economists imagine patents are supposed to work, by giving their owners monopoly power in product markets. This is not so in every industry . . . ."); Burk & Lemley, *supra* note 42, at 1590 ("The effective scope of patents . . . varies tremendously by industry. This variance results from the relationship between a patent and a product. In some industries, such as chemistry and pharmaceuticals, a single patent normally covers a single product. . . . Such a correspondence is the exception rather than the rule, however."); Burk & Lemley, *supra* note 42, at 1617 ("As a general rule, the scope of patents in the pharmaceutical industry tends to be coextensive with the products actually sold. Patents do not merely cover small components that must be integrated into a marketable product."); Mark A. Lemley, Lisa Larrimore Ouellette & Rachel E. Sachs, *The Medicare Innovation Subsidy*, 95 N.Y.U. L. REV. 75, 77 n.8 (2020) ("In practice, patents rarely map neatly onto monopoly markets. . . . But they are more likely to do so in pharmaceuticals than elsewhere." (internal citations omitted)). Consequently, the pricing power conferred by drug patents pertains to a direct markup on a consumer product. To this point we may add another, drawn from the economic literature on promotional activities, where the "Dorfman-Steiner" theorem holds that promotional expenditures are a function of two factors: (1) the elasticity of demand to such expenditures, meaning the extent to which such expenditures increase the volume of sales; and (2) the supramarginal price markup enjoyed by the firm on each sale. *See* Robert Dorfman & Peter O. Steiner, *Optimal Advertising and Optimal Quality*, 44 AM. ECON. REV. 826, 826, 833-34 (1954). Integrating the two points, we see that whenever patents map onto an end-consumer product, the supramarginal pricing power they confer translates directly into a time-limited hyperincentive to engage in promotion to pump up the volume of sales. Further, in the case of drugs, not only is the second of the two Dorfman-Steiner factors especially in play, but so is the first: owing to the various infirmities in the "market" for health care mentioned above—that is, insurance-induced price insensitivities, information asymmetries, and principal-agent problems—the demand for drugs is rendered especially elastic or malleable by promotional efforts.

For health goods such as drugs, then, to use exclusionary incentives requires supplementing them with some form of social valuation of their worth, over and above market price signals. It requires, that is, some form of *embedded pricing*: prices embedded within some social judgment of the value or variable value range of the good, with (price) ceilings and (subsidy) floors both to hold in check expansionary pressures on the one side and to address access concerns on the other.

C. Expanding the Role of Nonexclusionary Innovation Policies?

We turn now to the suppressed third question: might we not also wish to pursue, alongside exclusionary incentives such as an improved form of tailored data exclusivity, an expanded role for alternative, nonexclusionary innovation policies? The present analysis's contributions to that question are modest but not negligible. First, the relation between high risks and a strong public role in the biopharmaceutical pipeline suggests that there is merit to experimenting with an expanded role further down the pipeline, to its low-risk, high-cost end—to consider, in other words, an expanded public role in preclinical testing and the carrying out of clinical trials.[277]

Second—and finally—one further point disclosed by the present analysis is that not only is the case for some policy intervention in pharmaceuticals a regulatory artifact, but *the central innovation in pharmaceuticals is itself a regulatory artifact*. That is, while the data information good's creation is *incentivized* by a mix of patents and data exclusivity, the actual *creation* itself is not the result of market demand (upon which the patents or data exclusivity operate) but, rather, regulatory demand (or command). In other words, it is the result of *regulating*

277. To do so would be to follow through on two key insights disclosed in the recent literature on the "developmental" or "innovative" state. First, contrary to common perception, many important innovations in high-tech sectors of the economy can be traced to activity undertaken in a dynamic "public sector" of publicly funded research by government, university, and private contractors. Second, while much of this public support has taken the form of "socialized risks, privatized profits"—whereby the riskier parts of innovation are carried out in the public sector, after which the fruits are passed on to private firms for profitable commercial development—that division of labor is neither necessary nor always socially desirable. *See* Fred Block, *Swimming Against the Current: The Rise of a Hidden Developmental State in the United States*, 36 Pol. & Soc'y 169, 171-82 (2008) (discussing the significant role of the state in developing U.S. technology); Mariana Mazzucato, *The Innovative State*, Foreign Affs. (Dec. 15, 2014), https://www.foreignaffairs.com/articles/americas/2014-12-15/innovative-state [https://perma.cc/7KNS-GMWG]; Mariana Mazzucato, The Entrepreneurial State: Debunking Public vs. Private Sector Myths 1-2 (rev. ed. 2015) (discussing the significant role of states in sustaining technological dynamism).

innovation rather than incentivizing it.[278] And the specific form this regulatory demand takes repays close attention: unlike much regulation today, it is not merely a response to a market failure to be efficient, nor does its institutional form attempt to mimic the market (the way that, say, pollution taxes or cap-and-trade do[279]). No, the way this regulation—that is, the requirement that drugs show their clinically validated safety and efficacy before being marketable—works is neither by substituting for, nor by mimicking, but rather by *embedding* the market: constraining market incentives within a matrix of public judgments of the social value of the affected interests, judgments not reducible to standard ones of efficiency or distribution.[280] This institutional form differs sharply from the prevailing options in the innovation-policy toolbox, in ways holding promise for postneoliberal innovation policy.[281]

CONCLUSION

Wisely shaping innovation policy for pharmaceuticals requires registering that at its core, pharmaceutical innovation consists of two distinct information goods: new knowledge of candidate drugs and new knowledge of their safety and efficacy for use in humans, as validated by clinical trials. These distinct compound and data information goods differ sharply in their *technological* and *economic* features, as well as in their *social desirability*, as these pertain to innovation-policy analysis. Only by attending to the distinction between these goods and their relevant features can we properly understand how patents and data exclusivity do, can, and should work in this sector.

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278. *See* Ian Ayres & Amy Kapczynski, *Innovation Sticks: The Limited Case for Penalizing Failures to Innovate*, 82 U. CHI. L. REV. 1781, 1782-83 (2016); Fisher, *supra* note 42, at 252-56.

279. *See, e.g.*, Adam B. Jaffe, Richard G. Newell & Robert N. Stavins, *A Tale of Two Market Failures: Technology and Environmental Policy*, 54 ECOLOGICAL ECON. 164, 165 (2005) (setting out the basis for environmental policies such as taxes or cap-and-trade in terms of correcting the market failure of externalities).

280. The normative and institutional components of this argument—namely, that (1) the concerns being addressed by imposing safety and efficacy requirements on drugs before they are marketable are not best understood in terms of either efficiency or distribution as these are conceived in welfare economics, and that (2) the institutional form by which these concerns are being pursued is distinct from the standard options in the regulatory-policy literature, of either market-replacing ("regulatory command") or market-mimicking ("incentive-based regulation") tools—are the topics of a work in progress. Talha Syed, Embedding Innovation: From Incentive-Based Regulation to Regulation-Based Incentives (2018) (unpublished manuscript) (on file with author).

281. For neoliberalism as an ideology of market fundamentalism that helps sustain increasing economic inequality, see Talha Syed, Legal Realism and CLS from an LPE Perspective 18-19 (Oct. 13, 2023) (unpublished manuscript), https://ssrn.com/abstract=4601701 [https://perma.cc/8CEE-PDA5].

Doing so allows us to see, first, that the driver of the industry's economics, and the appropriate focal point of its innovation-policy rules, is not the compound but the data information good. The latter is what presents a special case for an innovation-policy intervention in this area. Further, the form that such innovation policy takes cannot be patents. Patents neither provide effective protection for the data information good at present, nor can they be reformed to offer such protection. Patents *do not* directly protect the data information good because the distinctive technological features of this good — its low-risk-yet-high-cost profile — make it ill-suited for existing patent doctrines. And patents *cannot* effectively protect this good because assessments of its desirability and validity are ones that patent institutions are simply ill-equipped to make. Most fundamentally, patents *should not* be used as our innovation policy of choice in this area, because a superior policy instrument — regulatory exclusivity — is available, one that can be better tailored to tackle effectively the undue access, gaming, and duplication costs riddling the present system.

These costs — associated with evergreening practices and me-too drugs — have attracted a large critical literature, but neither their underlying causes nor their precise extent has been properly diagnosed before. Doing so requires shifting our analysis to the central innovation in the system. And that, in turn, results in prescriptions that reorient reform from patents toward regulatory exclusivity.