



Why Life-Sciences Innovation Is Politically “Purple”—and How Partisans Get It Wrong

BY ROBERT D. ATKINSON | FEBRUARY 2016

It is time for a renewed bipartisan consensus recognizing that both public and private sectors have their own distinct and important roles in ensuring a robust American biopharma innovation ecosystem.

The United States has long had the world’s most effective and competitive system for discovering and developing new drugs—and for more than a half century, there has been a bipartisan consensus that there are two reasons for that success: First, the federal government provides robust funding for scientific research, mostly through the National Institutes of Health (NIH). Second, the U.S. system encourages vigorous innovation in the private sector by providing strong intellectual property protections and a drug reimbursement system that together allow companies to earn sufficient revenues to reinvest in highly risky research and development.¹ But today that consensus is fraying as populists on the left and libertarians on the right question both the policy means and the end result. If the center cannot hold and the longstanding bipartisan policy framework falls apart, then the future of U.S. biomedical innovation will be in peril.

INTRODUCTION

Many on the left have long voiced concerns about drug prices, but most of them have acknowledged that the U.S. system for discovering and developing drugs has worked well and that America has benefited by constantly improving drugs and fielding a globally competitive biopharmaceutical industry (biopharma). Now that view is under attack from an ascendant camp that may be fairly described as “drug populists.” These left-wing advocates complain that biopharma companies charge too much for drugs and that government should impose price controls, weaken patent protections, and shorten the term of intellectual property protection for the clinical test data related to new biologic drugs (known as “data exclusivity”). This is part and parcel of a larger policy agenda for the federal government to assume a significantly increased role in drug development, and the biopharma industry to be significantly hemmed in. These populists embrace the view that health care is a fundamental human right, and they deeply distrust the private sector, which

leads them to argue that health care should be a government responsibility—and that government should not only provide insurance through a single payer plan, but also direct and fund development of new medicines.

Meanwhile, just as “drug populists” demonize the biopharma industry, an increasingly vocal band on the right discounts the need for government support for life-sciences research. Motivated by an antigovernment attitude and an overarching focus on fiscal discipline, these “drug libertarians” argue that the private sector can and should do most, if not all, of the work involved in driving biomedical innovation.

Both sides are wrong, however. Implementing their respective proposals to reduce revenues for U.S. biopharma firms and to slash government funding for biomedical research would significantly reduce life sciences innovation—potentially increasing, not lowering, future health care costs—and also likely lead the U.S. biopharma industry into decline. Following in the path of the U.S. auto and steel industries, it is likely the United States would lose global market share, risking tens of thousands of high-wage jobs.

As such, it is time for policymakers to renew their longstanding bipartisan consensus—recognizing that, politically, biologic innovation is colored neither conservative red nor liberal blue. It is a “purple” issue. Both the public and private sectors have their own distinct and important roles in ensuring the country has a robust biopharma innovation ecosystem. Policymakers should allocate more money, not less, for NIH. And they should push back against efforts to shrink and remake the biopharma industry—either through weakened intellectual property rules or government price controls, which represent a form of “free riding” that expects others to pay for the costs of drug development.

Following the policy advice of the drug populists on the left or drug libertarians on the right would undermine biomedical innovation. And this matters for three key reasons:

- First, reduced biomedical innovation would likely increase, not reduce, future health-care costs, including for diseases such as cancer and Alzheimer’s.
- Second, reduced biomedical innovation would slow the rate of improvement in longevity and quality of life for all Americans.
- Third, reduced innovation would put at risk one of the country’s most globally competitive industries, potentially costing tens of thousands of high-paying jobs.²

TORTURED LOGIC ON THE LEFT AND RIGHT

Rather than a pragmatic and evidence-based analysis of how to maximize the economic and social welfare from biopharma drug development, ideological advocates on both sides of the political spectrum engage in all-or-nothing analysis and Manichaeian thinking. The left wants to limit for-profit drug development as a way to shrink corporations and redistribute income to consumers. The right wants to limit government-supported life-sciences research as a way to shrink government and redistribute income to taxpayers. And while both sides sell their proposals as benefiting the average American (as consumers or taxpayers, respectively), they do not acknowledge that their designs will result in less life-sciences

innovation, which will reduce improvements in both the longevity and quality of life for this same population.

Over the last decade, progressives have focused like a laser not only on income inequality, but also on how to shrink corporations' role in the economy. In the case of the biopharma industry, progressives' goal is simple: lower the price of drugs so that low- and middle-income Americans pay less. They want to do this not by spurring more drug innovation, which promises to reduce health-care costs, but by reducing biopharma revenues. For example, the liberal Center for American Progress (CAP) has proposed a wide array of policies to reduce drug prices, including price controls and reducing the period of data exclusivity for biologic drugs to seven years.³ The Economic Policy Institute (EPI) calls for the government to “negotiate drug prices with pharmaceutical companies in order to save \$155 billion over 10 years.”⁴ The Center for Budget and Policy Priorities (CBPP) writes, “By lowering the costs that Medicaid and Medicare pay for prescription drugs, Congress could generate substantial savings to help pay for comprehensive health reform that achieves universal coverage.”⁵ Robert Reich explains that reducing patent terms to three years would lead to reduced drug prices.⁶ But CAP, EPI, CBPP, Reich and others are strangely silent on the need for continued medical innovation, nor do they consider how the industry would support research and development (R&D) with significantly less revenue. Rather their focus is solely on solving “the problem of cost growth while protecting and improving access to needed care.”⁷ In other words, their goal is cheaper medicines today not better medicines tomorrow.

To both cut drug prices and to shrink the biopharma corporate sector, drug populists advocate an interventionist agenda grounded in two key pillars: imposing drug price controls and significantly weakening intellectual property laws.

Moreover, for these and other liberal organizations, the goal is not just reduced drug prices, but also a reduced role for biopharma corporations in the economy.⁸ For them, large biopharma corporations motivated by profits cannot be trusted to discover, produce, and distribute drugs in a way that advances the public interest. Therefore, they argue that government's role should be vastly expanded, to shrink revenues going to industry and to expand funding to government. To both cut drug prices and to shrink the biopharma corporate sector, they advocate an interventionist agenda grounded in two key pillars: imposing drug price controls, coupled with significantly weaker intellectual property laws to empower the generic drug industry. Some drug populists go further and call for a radical downsizing of the for-profit drug industry, replacing it with a significantly expanded NIH and a network of nonprofit drug development labs. To be sure, the end result of this agenda would be cheaper drugs, but it would also mean fewer life-sciences jobs and less life-sciences innovation in the future.

The drug libertarians' objective is also relatively straightforward: reduce federal funding for life-sciences research, especially anything not explicitly designated for basic research. And like drug populists who seek to shrink the role of corporations, drug libertarians seek to shrink the role of government—even the role that until the 2000s was generally accepted by the right as legitimate: funding basic research. Just as the left is motivated by a distrust of “big corporations,” many on the right are animated by a deep distrust of “big government,” including “big government” support for science. For them, the issue is political; they think a great deal of federal funding of life-sciences research is wasted by bureaucracy. Most egregiously, this federal funding represents state confiscation of

individuals' hard-earned money for a collective enterprise. Therefore, they argue, we should rely much more on the private sector not only to discover and develop drugs but also to conduct the basic science that underpins drug discovery. But because the benefits to society from basic research are so large, industry will naturally underinvest in this relative to the optimal amount, and without federal funding of basic life-sciences research, the biopharma industry will innovate less.

OVERVIEW OF PREVAILING ARGUMENTS ON THE LEFT AND RIGHT

In the advocacy of their uncompromising agendas, drug populists and drug libertarians make a number of key assertions, including that the suspect entity (business or government) does not invest in the right areas, wastes money, and ultimately is unnecessary for drug discovery and development. This section examines each of these arguments.

Argument 1: Government and Industry Both Invest in the Wrong Areas

In their argument to shrink government's or industry's role in drug development, each side argues that the party they disparage—industry or government—does not fund the right research and that we would be better off having the other party do it instead.

Because the external benefits from basic research are so large, industry will naturally underinvest in this, and without federal funding of basic life-sciences research, the biopharma industry will innovate less.

Drug Populists' Position

The left argues that society should not rely on industry to drive drug development because its focus on making profits means it ignores certain diseases and treatments or focuses too much on “me too” drugs rather than truly needed medicines. Dean Baker, an economist with the Center for Economic and Policy Research, writes that one of the problems with industry-led life-sciences innovation is that the industry neglects research that is not likely to lead to patentable drugs. He gives this example: “If a researcher at a major drug company discovers evidence that a natural substance or long existing drug like aspirin could provide an effective treatment for a specific condition, they have no incentive to do further research in the area.”⁹ But this ignores the fact that these supposed “open source” medical discoveries are few and far between. Moreover, market incentives drive companies to use scarce societal resources to focus on diseases that impose the greatest and most severe health problems on the most people. And smart public policies such as the orphan drug tax credit and longer periods of data exclusivity for orphan drugs (drugs with a small market because of the relatively small number of people having a medical condition that requires the drug) can effectively align public priorities with private sector interests. (For example, when Congress wanted to encourage the development of pediatric drugs, it added six months of data exclusivity.)

Baker also argues that industry spends too much money on research in developing duplicative drugs, claiming that industry data shows that roughly two-thirds of research spending goes to developing duplicative drugs rather than to drugs that represent qualitative breakthroughs over existing drugs. This overlooks the fact that many “duplicative” drugs in fact represent improvements over already existing drugs, and that not all patients respond the same way to the same type of drug and sometimes respond better to an alternative to the first-in-class drug. Moreover, DiMasi and Faden find that, nonetheless, nearly one-third (32 percent) of all follow-on drugs have received a priority rating from the U.S. Food and Drug Administration (FDA), indicating that these drugs are

likely to provide an important improvement over the first-to-market drug.¹⁰ They find that one reason for the number of follow-on drugs is that different companies simultaneously work on finding drugs for the same disease, in essence competing to be the one that makes the first discovery. Indeed, DiMasi and Faden find that “initial clinical testing of at least one follow-on drug in a class occurred before the approval of the first-in-class drug for at least 80% of the classes in each of the periods since the late 1980s.”¹¹ Moreover, they find that Phase II trials had begun for more than 70 percent of the follow-on drugs when the first-in-class drug was approved. Moreover, for first-in-class drugs developed since the early 1990s, almost all of them (98 percent) had a follow-on drug with a patent approved before the first-in-class drug was approved. As they conclude, “Overall, these results indicate that new drug development is better characterized as a race to market among drugs in a new therapeutic class, rather than a lower risk imitation of a proven breakthrough.” Drug populists see “waste” from this competition, and presumably would limit such competition by government either performing the research itself or by limiting the kinds of research any individual company could do. The result of this would most certainly be a reduced number of drugs with real therapeutic value coming to market. Moreover, as described below, some of their proposals, such as prizes, would likely increase such competitive “duplication.”

Furthermore, the reality is that the biopharma industry is producing both breakthrough new drugs as well as drugs targeted to address rare or orphan conditions. As Moses et al. write in *The Anatomy of Medical Research: U.S. and International Comparisons*, “Rare diseases have emerged for industry as a preferential area of therapeutic development, with nearly as many compounds in trials as analgesics and antidiabetic drugs.”¹² Indeed, since 2000, the FDA has approved more than 500 new medicines. In 2014, the FDA approved 51 new medicines across a wide variety of disease areas. Of those approvals, 41 were made by the Center for Drug Evaluation and Research (CDER) at the FDA, the highest number since 1996.¹³ Among the CDER approvals in 2014, 41 percent were identified as first-in-class medicines, meaning they used a unique mechanism of action to treat a medical condition that is different from any other approved medicine. Moreover, an additional 41 percent of these medicines were approved to treat rare diseases.¹⁴

Finally, the populists’ line of reasoning fails to recognize that products approved after a first-in-class product can be beneficial to patients. Not all patients respond in the same way to a particular drug. Drugs related to depression are a good example, where there are many different options on the market, and each patient responds better to some rather than others.¹⁵ In addition, follow-on drugs can be slightly better in efficacy or method and convenience of use and administration.

Drug Libertarians’ Position

If the left argues that industry does not fund the “right” research, the right asserts that government does not fund the right research. The Cato Institute’s Michael Tanner writes, “No evidence shows that government bureaucrats have either the qualifications or the incentives to make better decisions than private individuals and organizations about what research should be funded. After all, government involvement in research inevitably injects politics into scientific questions.”¹⁶ In other words, government does not have the insight into the biopharma market and what is needed (defined as what will sell the most). But this

ignores the fact that government “bureaucrats” are for the most part not deciding what gets funded. The National Institutes of Health’s system of providing funding to university researchers is based on peer review, informed by leading scientists in the sub-disciplines involved. This is not to say, as discussed later, that the system could not be improved, for example, in encouraging funding of more high-risk projects. But to say that individual scientists get money because of political manipulation or bureaucratic pressure misrepresents the system.

Argument 2: Government and Industry Waste Money

In order to advance their ideological case for shrinking the role of industry and government, both sides impugn the efficiency of the side they want to shrink, arguing that it wastes money. Because of this waste, so go the arguments, reduced revenues—either from government funding to agencies such as NIH or market revenues to drug companies—will not hurt innovation. Cutting funding will just force government or industry to become more efficient and focused.

Parties that would vitiate, variously, the public and private sectors’ roles threaten to undermine the very foundation of this productive and healthy American life-sciences innovation ecosystem.

Drug Populists’ Position

The left argues that there is plenty of money for the biopharma industry to develop drugs, even if its revenues were significantly lowered due to price controls or reduced intellectual property protections. They rationalize this assertion with claims of waste and excess profits. For example, Dean Baker argues that the industry wastes money on marketing, noting that industry marketing costs are comparable to research expenditures, and that if the industry just reduced advertising, it could reduce drug prices.

But again, this argument is misguided. First, Frosch et al. find that direct-to-consumer advertising was \$4.9 billion in 2007 (most of it for television), or just 1.4 percent of total sales, hardly a honeypot of savings to be applied to lower drug pricing.¹⁷ Moreover, while some private-sector advertising, including in the life sciences, is zero-sum and designed to gain market share over competitors, some is about educating consumers—and in the case of biopharma, educating health-care providers, too—about choices. Moreover, the drug industry is different than say the soap or car industry where it is relatively easy for consumers to find out on their own about new products and the differences between products. Some of the marketing expenses are to educate doctors and consumers about the value and efficacy of new drugs. This is why Frosch et al. find that more than half of physicians agree that ads educate patients about health conditions and available treatments and nearly 75 percent of patient respondents agree that advertisements improve their understanding of diseases and treatments.¹⁸ Moreover, the authors point out that with average visits with a physician lasting between 16 and 21 minutes, advertisements can help impart information that busy doctors now have a harder time finding. To the extent that direct-to-consumer advertising creates problems as well as solutions, there are a number of proposals for reform that would not reduce the costs but rather improve the effectiveness of the advertisements.¹⁹

Moreover, even if advertising costs were “excessive,” cutting them would do little to improve societal welfare because most of the advertising expenditures are not a cost to consumers, but an intermediate payment to support content production (e.g., television

shows, magazine content, radio, etc.). If the industry did not spend money on advertising, other industries would spend more, or there would be less free content for consumers; either way consumer welfare would be unchanged.

In addition, drug populists argue that industry profits are excessive and that if government limited drug company revenues (either through price controls or weakened intellectual property protection), this would come not at the expense of research and development and drug discovery, but of profits. For example, Public Citizen argues that “profit margins are large enough that reducing them will still leave plenty of money for research.”²⁰ One source of “excess profits,” according to drug populists, is from the patent system, which enables companies to have monopolies (albeit temporary ones). As Baker writes, “The immediate cause of high drug prices is government granted patent monopolies, which allow drug companies to charge prices that are often 400 percent, or more, above competitive market prices.”²¹ Therefore, to get lower drug prices, drug populists advocate for radically reduced intellectual property protections for drugs.

When drug populists point with disapproval to some drugs that make a lot of money relative to the cost of development, they are ignoring all the drugs whose revenue did not cover development and production costs.

There are two responses to this argument, the first related to the profits on any particular drug, the second related to industry-wide profits. The claim that any individual drug generates very high profits cannot be viewed in isolation. All the drugs that did not make it through clinical trials to the marketplace by definition generated no profits, only losses. But even many drugs that make it to the market do not cover their costs. In a 1990 article, Grabowski and Vernon found that 70 percent of new drugs made less than their R&D costs. Entities in the third-most-profitable decile barely broke even; those in the second decile had profits (adjusted for the time value of capital) nearly twice discounted R&D costs.²² Fifty-five percent of industry revenues came from the top 10 drugs, whose average profits exceeded discounted R&D costs by a factor of 5. In an updated article released in 2010, Vernon, Golec, and DiMasi found that 80 percent of new drugs made less than their capitalized R&D costs. Entities in the second-most-profitable decile barely broke even; those in the first decile had discounted profits more than twice their discounted R&D costs.²³ Moreover, new research from Berndt et al. finds that the average lifetime returns on new medicines has dropped recently. Specifically, they find that the average present values of lifetime net economic returns of new drugs in the 2005–09 drug cohort were significantly below those for the 1995–99 and 2000–04 cohorts, with the average present values of lifetime net economic returns of the drugs in the 2005–09 cohort being very slightly negative and, on average, failing to recoup research and development and other costs.²⁴

Other studies have found that of the most successful 10 percent of approved drugs, only 1 percent of those that entered clinical trials—maybe three new drugs each year—generate half of the profits of the entire drug industry.²⁵ Likewise, the Tufts Center for the Study of Drug Discovery found a clinical-approval success rate of just 11.8 percent of drugs under development.²⁶ So when drug populists point with disapproval to some drugs that make a lot of money relative to the cost of development, they are ignoring all the drugs whose revenue did not cover development and production costs. This is similar to the venture capital industry, where three-quarters of investments do not return the investors’ money.²⁷ As industrial organization economist F.M. Scherer writes:

New drug development resembles a risky lottery that throws out rich rewards to a few big winners while the majority of entries lose money. Although these risks ... can probably be pooled to insignificance by common stock investors holding multi-company portfolios, pooling within companies may be insufficient to avoid substantial variability in individual company returns, especially for smaller companies.²⁸

This implies that capping the returns companies can make on any one drug would lead to them investing significantly less, since their expected overall value would decline.

We have only to look to Europe for this natural experiment. Many European nations impose strict price controls on drugs.²⁹ And this translates directly into lower levels of new drug development. For example, from 2000 to 2010, companies in the United States were responsible for 57 percent of new chemical entities (new drugs), with Switzerland (a nation with limited price controls) responsible for another 13 percent. In contrast, France, Germany, Japan, and the United Kingdom—nations with moderate to strict price controls—were responsible for just 29 percent of new chemical entities developed, despite having a combined GDP 78 percent the size of U.S. GDP.³⁰

Even if the drug populists acknowledge that returns vary significantly based on the specific drug in question (and that returns are negative on drugs that do not make it through clinical trials into the marketplace), they will claim that overall industry profits are too high and that policies that limit revenue would not hurt innovation, as they would come at the expense of “excess” profits.

At first glance it may appear that the advocates have somewhat of a case. Using IRS data U.S. drug industry profits from 2010 to 2012 were 14 percent, while profits for all U.S. industries were 8 percent over that period.³¹ Data from NYU Professor Aswath Damodaran show that in 2015 pharmaceutical return on equity (ROE) was 15.2 percent while biotechnology ROI was 22.3 percent, compared to overall market profits of 10.8 percent.³² However, when the more accurate measure of ROE adjusted for R&D spending is used, the delta is significantly less with adjusted pharmaceutical ROE of 11.1 percent and biotechnology ROI of 13.9 percent, compared to overall market adjusted ROE of 9.9 percent.³³

Moreover, there are a number of studies that show that these figures overstate true profits. First as Damodaran points out these ROI figures are only for survivors and do not include all the biopharma companies that went bankrupt because their discoveries did not pan out. He writes:

There is a survivorship bias, insofar as only the most successful firms in each group are represented in our samples of publicly traded firms. To illustrate, consider pharmaceutical firms. Many small biotechnology and pharmaceutical firms never make it through the FDA approval process and the capital invested in them gets wiped out when they go under. If we regulate or restrict the mature (and successful) pharmaceutical firms to generate only their cost of capital, where is the incentive to do research in the first place?³⁴

Moreover, as Scherer writes:

A more compelling objection is that accounting data on profits yield biased implications, given the special circumstances faced by the pharmaceutical industry. Under standard accounting practice, R&D and new product marketing outlays, both of which are atypically high in pharmaceuticals, are written off as current expenses. Since both, and especially R&D, affect revenues for many years to come, it would be more accurate in principle to capitalize the outlays and then depreciate them over appropriate time periods. Otherwise, the rate of return on “investment” is calculated using an asset base that improperly excludes accumulated intangible R&D and marketing capital. Accounting figures tend to *overstate* the true rate of return on investment under these conditions. Most studies attempting to correct for this accounting bias have reached the same conclusion: reported drug company returns on stockholders’ equity are overstated.³⁵

Efforts to drive down profits would yield only very small price declines, but would generate significant R&D reductions.

The former Congressional Office of Technology Assessment (OTA) came to a similar conclusion, finding that, “Over a longer span of time, economic returns to the pharmaceutical industry as [a] whole exceeded returns to corporations in other industries by about 2 to 3 percentage points per year from 1976 to 1987, after adjusting for differences in risk among industries. A risk-adjusted difference of this magnitude is sufficient to induce substantial new investment in the pharmaceutical industry.”³⁶

Even these modestly higher returns should not be cause for significant concern. As the OTA study points out, “Pharmaceutical R&D is a risky investment; therefore, high financial returns are necessary to induce companies to invest in researching new chemical entities.”³⁷ Scherer writes, “Had the returns to pharmaceutical R&D investment not been attractive, it seems implausible that drug-makers would have expanded their R&D so much more rapidly than their industrial peers.”³⁸

Moreover, in their quest for lower prices and a more socialized drug industry, drug populists hold out optimistic promises for massive price declines. Yet, as the OTA study found, “Excess returns over R&D costs would be eliminated if the annual revenue per compound was reduced by 4.3 percent over the product’s life.”³⁹ This is a similar finding to the OTA’s finding that U.S. drug firms had an average profit rate just 2 to 3 percentage points higher per year than the internal rate of return in control-group industries.⁴⁰ In other words, efforts to drive down profits would yield only very small price declines, but as noted below, would generate significant R&D reductions.

In order to defend their revenue-reduction agenda, drug populists try to portray drug-development costs as much lower than they actually are. The Tufts University Center for the Study of Drug Discovery’s report, *Cost of Developing a New Drug*, is the baseline study that many cite to understand these costs. In 2014, the Center estimated that the average cost of developing a new drug was \$2.56 billion. This includes out-of-pocket clinical costs and discovery research and preclinical development costs, as well as the cost of capital and the cost of developing drugs that did not make it into the marketplace.⁴¹ Of the \$2.56

billion, \$1.4 billion consisted of out-of-pocket costs, and the remainder was attributed to the cost of capital. This new estimate of average drug development represents an increase from the \$1.1 billion estimated in 2000 (in 2015 dollars), in part because the risk rate increased (there were more failures) plus the higher costs for clinical-phase costs.⁴²

In their campaign to show that drug development is actually quite inexpensive, drug populists offer a number of criticisms of the Tufts study. Public Citizen contends that drug development costs are nowhere near as high as industry estimates, arguing that “a more realistic estimate of R&D costs per ‘average new drug’ is considerably lower.”⁴³ It cites an OTA study showing lower drug development costs as evidence of the flaws in the Tufts’ study but does not point out that the OTA study was from 1993 when drug development costs were lower (due to higher rates of success and much lower spending on R&D) or that the OTA estimates actually were higher than the Tufts’ estimates at the time. The OTA report states, “OTA’s check revealed a substantial consistency between aggregate R&D spending estimates and the cash outlays per NCE [new chemical entity] estimated by [the] DiMasi study.”⁴⁴

Notwithstanding the drug populists’ claims that industry R&D and industry revenues are not related, the fact is that they are intimately linked.

In their attempt to argue for a lower cost than the Tufts’ study finds, some argue that it is not appropriate to include the cost of capital.⁴⁵ But, unlike many industries where investments (e.g., money spent now to achieve a return later) pay off relatively quickly, in drug development, money spent in any current year will not see returns for more than a decade, and only then if the drug is successful. So not to include the cost of capital is a bit like asking a person if they would be willing to give you \$100 now with the promise that you will give them \$100 in 10 years. No rational person would do this, because they could invest their \$100 somewhere else and get more than \$100 in 10 years. As the OTA states, “Riskier investments require higher dollar returns; otherwise, investors would put their money in safe investments like U.S. Treasury bills or bank certificates of deposit. The riskier the investment, the higher the required return. The rate of return that investors must be able to expect from money invested with a given level of risk is referred to as the investment’s ‘cost of capital’.”⁴⁶ Drug populists who accept the validity of using the cost of capital argue that the Tufts’ cost of capital figure is too high. But, again, the OTA study found higher, not lower, rates for the cost of capital for the industry than did the Tufts’ study.

Critics also assert that the study does not include the benefits of tax credits—including the R&D tax credit and the orphan drug tax credit—arguing that when these are included the costs of development are lower. But as the Tufts’ study concludes, “Tax expenditure data available from the U.S. government on the size of orphan drug tax credits, along with external estimates of aggregate biopharmaceutical R&D expenditures, indicate that U.S. orphan drug tax credits amount to a small share of U.S. aggregate R&D spending by the biopharmaceutical industry.”⁴⁷

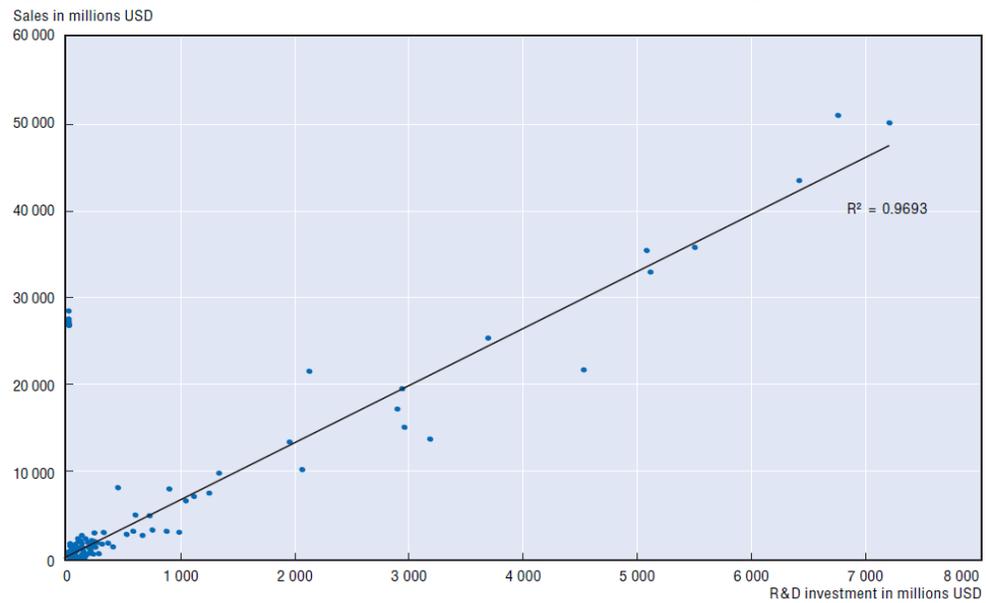
Finally, notwithstanding the drug populists’ claims that industry R&D and industry revenues are not related, the fact is that they are intimately linked. In fact, the sector is extremely research intensive, investing over 18 percent of its sales in R&D, while accounting for 21 percent of domestic R&D funded by U.S. businesses, more than any

other sector of the U.S. economy.⁴⁸ (At the same time, America's life-sciences industry—led by the biopharmaceutical sector—leads all industries in volume of research performed.)⁴⁹ Limiting industry revenues would mean less investment in R&D. In other words, capping revenues would cap drug discovery. As Scherer writes:

Governmental bodies that regulate prices and profits characteristically have a myopic bias. They are inclined toward what might be called 'Willie Sutton' regulation, emphasizing recapture of 'excess' profits on the relatively few highly profitable products without taking into account failures or limping successes experienced on the much larger number of other entries. If profits were held to 'reasonable' levels on blockbuster drugs, aggregate profits would almost surely be insufficient to sustain a high rate of technological progress. Assuming that important new drugs yield substantial consumers' surplus untapped by their developers, consumers would lose along with the drug companies. Should a tradeoff be required between modestly excessive prices and profits versus retarded technical progress, it would be better to err on the side of excessive profits.⁵⁰

A number of studies find this causal relationship. For instance, as the Organization for Economic Cooperation and Development (OECD) writes, "There exists a high degree of correlation between pharmaceutical sales revenues and R&D expenditures." Indeed, as Figure 1 illustrates, recent data from the United Kingdom's Department of Innovation, Universities, and Skills R&D Scoreboard show a very strong relationship between R&D expenditures and sales for the largest 151 pharmaceutical firms worldwide.⁵¹ Likewise, Henderson and Cockburn have identified scale effects for R&D in the pharmaceutical industry, finding that R&D expenditures are directly proportional to the amount of sales revenues available to undertake R&D investment.⁵² This is why academic research shows a statistically significant relationship between a biopharma enterprise's profits from the previous year and its R&D expenditures in the current year. Indeed, Simanjuntak and Tjandrawinata estimate that a 1 percent increase in a firm's one-year lagged profitability is accompanied by a 0.2 percent increase in the firm's R&D expenditure.⁵³ Moreover, the pharmaceutical firms with the greatest sales are also the ones with the largest R&D investments, which may in part explain why most global R&D investments are undertaken by the largest multinational firms.⁵⁴ Symeonidis notes that this is in part because large firms are better able to spread the risks of R&D uncertainty, since they can undertake several projects simultaneously.⁵⁵

Figure 1: R&D Expenditures and Sales in the Pharmaceutical Industry, 2006⁵⁶



Note: The data were prepared on the basis of annual reports and consolidated accounts received up to and including 31 July 2006. Annual reports with a year-end older than 30 months from the cut-off date or a publication date older than 24 months from cut-off date are excluded.

Source: DIUS (2007).

As OTA noted in its report *Pharmaceutical R&D Costs, Risks, and Rewards*, “The rapid increase in revenues for new drugs throughout the 1980s sent signals that more investment would be rewarded handsomely. The pharmaceutical industry responded as expected, by increasing its investment in R&D.”⁵⁷ The OTA report goes on to contend that lower prices would mean that “Research on pioneer drugs could also decline as firms realize that the returns to the winner are likely to be reduced by early price competition from me-too drugs.”⁵⁸ Likewise, the Government Accountability Office (GAO) asserts that pharmaceutical spending control policies “would decrease R&D spending.”⁵⁹ Similarly the Congressional Research Services writes, “Actual experience and cited studies suggest that companies which do not control the results of their investments—either through ownership of patent title, exclusive license, or pricing decisions—tend to be less likely to engage in related R&D.”⁶⁰ That is in part why Simanjuntak and Tjandrawinata find a statistically significant relationship between profits from the previous year and R&D expenditure in the next year.⁶¹

One reason why Europe has produced fewer biopharmaceutical innovations than the United States is because its biopharmaceutical firms have not generated as much profit (which can be reinvested in R&D) as U.S. firms. That explains why, in the 2000s, more new chemical entities were developed in the United States than in the next five nations—Switzerland, Japan, the United Kingdom, Germany, and France—combined.⁶² For example, Golec and Vernon demonstrate that, because of price regulations, “European Union [EU] pharmaceutical firms are less profitable, spend less on R&D...”⁶³ By using data from 1986 through 2004, they go on to show that the economic tradeoff for the EU, by maintaining real pharmaceutical prices constant over 19 years, was forgoing about 46 new medicine compounds and 1,680 research jobs. Golec and Vernon took this one step further by presenting a counterfactual scenario of the United States adopting EU-level price

Academic research shows a statistically significant relationship between profits from the previous year and R&D expenditure in the current year.

controls over the same time period and estimate that similar price controls would have resulted in 117 fewer new medicine compounds and 4,368 fewer research jobs.⁶⁴ Maloney and Civan use a cross sectional analysis to estimate that a 50 percent drop in U.S. drug prices could see the number of drugs in the development pipeline reduced by between 14 and 24 percent.⁶⁵

Drug Libertarians' Position

Just as the populists question the efficiency of government funding, drug libertarians question the efficacy of government investment in life-sciences research. Townhall.com, a conservative website, mocks NIH for funding research to study the effects of alcohol on monkeys, claiming the money was flushed down the drain.⁶⁶ Clearly the author is not aware that alcoholism is a serious medical problem in America and that monkeys are often the best animal to study for life-sciences experiments because they are close to humans genetically. Likewise, former Republican Senator Tom Coburn called NIH to task for funding research on the effect of massage on muscle health, implying that funding this kind of research meant that NIH did not need additional funds for life-sciences research.⁶⁷ But the muscle research in question could address whether massage is an effective medical treatment, important because medical science currently cannot assess the effects of massage at the molecular level. Michael Tanner of the Cato Institute writes, “there is no reason that government medical research shouldn’t receive the same critical scrutiny as any other program,” implying large amounts of waste.⁶⁸ Terry Jeffrey writes in Townhall.com that NIH funding is “an uncontrollable malignancy” and that Congress should cut its funding (e.g., “amputate the extremities”).⁶⁹ Just as liberals want to save money by cutting drug revenues, conservatives want to save money by cutting federal funding. As Kevin Glass writes, “NIH funding has been something conservatives have tried to target in the past as a place for the government to save money.”⁷⁰ In this framing, large funding cuts to federally supported medical research would not hurt drug innovation. To be clear, this does not mean that NIH policies could not be improved. For example, some have argued that NIH should encourage more grants to younger researchers and fund more goal-oriented research.⁷¹ But, it’s one thing to argue constructively about how to improve federal funding of life-sciences research; it’s quite another to ideologically oppose the very function.

Argument 3: Neither Government nor Industry R&D Is Needed for Drug Discovery and Development

In order to gain adherents and support their ideological goals—for the left, to roll back the biopharma industry and for the right, to roll back government funding—advocates on both sides know they need a narrative to explain how their agenda will not hurt innovation.

Drug Populists' Position

As noted above, the left argues that there is waste and excess profits and that cutting prices would only cut waste, not R&D. But even if they were to acknowledge that reduced revenues from price controls and weaker intellectual property protections would lead to lower levels of industry R&D, they argue that this can be offset by other mechanisms, particularly by an increased government role in drug development. In their quest to shrink the for-profit drug discovery and development industry, drug populists have floated a variety of proposals, including having employers pay a medical research fee, which they

would allocate to any research organization, including government; subjecting firms to compulsory licenses (where they must make patented discoveries available to other firms) but having the government pay patent holders directly to compensate them; having the government buy patents from firms through an auction; establishing government-funded corporations to develop and sell drugs; using prizes;⁷² and, finally, giving NIH the task.

For example, Baker writes, “We could expand the public funding going to NIH or other public institutions and extend their charge beyond basic research to include developing and testing drugs and medical equipment.”⁷³ Knowledge Ecology International, a leading drug populist organization, has advocated eliminating drug patents and instead having the government issue prizes for drug development. It cites proposed legislation by Senator (and presidential candidate) Bernie Sanders (D-VT) to create a Medical Innovation Prize Fund that would equal 0.55 percent of U.S. GDP, an amount greater than \$80 billion per year, with the federal government funding half and private health insurance companies the other half.

There are multiple problems with these proposals, but the most central is that—in the political and fiscal environment where Congress cannot even index the gas tax to inflation to pay for badly needed roads and bridges (even with gas prices at their lowest levels in a generation)—the chances that Congress would be willing to appropriate the funds needed for any of these proposals is close to zero. The NIH budget is approximately \$30 billion, while the U.S. biopharma industry invested over \$51 billion in R&D in 2014.⁷⁴ Even if the drug populists were correct that half of this funding is unnecessary, taxes would still have to be raised by \$33 billion or more to pay for this. As Baker writes, “The government already spends more than \$30 billion a year to finance biomedical research through the National Institutes of Health. It would probably be necessary to increase this amount by \$50-\$60 billion a year in order to replace the funding currently supported through patent monopolies.”⁷⁵ But given the unwillingness of the public or lawmakers to support higher taxes or spending, these proposals to replace private revenue with government spending would almost certainly lead to reduced overall spending (combined private and public) on biomedical innovation. Even if government took on more of the burden of drug development and prices became cheaper because more of the work was subsidized, this would only represent a shift in costs from patients and insurance companies paying for drug development through drug revenues to insurance companies and taxpayers paying for drug development through insurance premiums and taxes.

Second, even if by some miracle there were the political will to raise higher taxes for much more government-funded drug discovery, the idea that government can do this without industry is wrong. As the National Academies of Science wrote, relying on earlier data on costs, “The cost of developing a new drug has been estimated to be more than \$1 billion. Development of this scale involves multiple financing mechanisms, as well as the involvement of numerous partners throughout the process.”⁷⁶ Moreover, intensive private-sector investment in life-sciences R&D has generated tremendous results, with the Tufts Center for the Study of Drug Development finding that, among 35 drugs and drug classes, private-sector research was responsible for central advances in basic science for 7, in applied

science for 34, and in the development of drugs yielding improved clinical performance or manufacturing processes for 28.⁷⁷

A third problem with these proposals is that they imply that the government will make better allocation decisions than industry. But there is no evidence for this. In fact, as the report *Wealth, Health and International Trade in the 21st Century* points out, “it is questionable that public sector actors would be more efficient in allocating resources to research scientists and others working in pharmaceutical R&D than private sector decision-makers for whom efficiency is vital.”⁷⁸ Moreover, as the report continues, “It is also doubtful that if the possibility of private industrial profit were removed from their calculations, governments would wish to give medical developments that will in time lead to end points such as increased survival in later life the same degree of priority that is afforded to them under present arrangements.”⁷⁹ This is not to say that the government process would be inferior; it is to say that there is no evidence it would be superior. Again, we need both. Government, in part by leveraging peer review practices, does a good job identifying areas of science to pursue, while industry does a good job identifying the drugs society needs.

Government, in part by leveraging peer review practices, does a good job identifying areas of science to pursue, while industry does a good job identifying the drugs society needs.

Drug Libertarians' Position

The right starts its argument with the claim that government research funding is less effective than private spending. Libertarian author and U.K. politician Matt Ridley, in a recent *Wall Street Journal* essay entitled “The Myth of Basic Science,” argued that federal funding for research is detrimental: “Heretical as it may sound, ‘basic science’ isn’t nearly as productive of new inventions as we tend to think.”⁸⁰ Likewise, the Cato Institute’s Michael Tanner argues that empirical studies suggest that the rate of return on publicly financed research is much lower than that of research financed by the private sector, implying that it is better if the private sector performs relatively more life-sciences research. But the studies Ridley and Tanner cite to support their claim actually do not support it.⁸¹ Moreover, studies by Cockburn and Henderson find that the “rate of return to government funded biomedical research may be 30% a year, a figure that may actually be higher because calculations do not account for the broader effects of pharmaceutical innovation on health and well-being.”⁸²

And just like the left, which argues that government can develop drugs, the right argues that industry can adequately support basic science and knowledge discovery. We can cut government funding of NIH, and the biopharma industry will jump in and fill in the gap, with no reduction of life-sciences discoveries, goes their argument. This is the argument that government-funded research crowds out private-sector-funded research. For example, Ridley argues that “for more than a half century, it has been an article of faith that science would not get funded if government did not do it, and economic growth would not happen if science did not get funded by the taxpayer.” Ridley argues that “there is still no empirical demonstration of the need for public funding of research.” Tanner agrees: “there is no evidence that the private sector is incapable of financing medical research.” He goes on to say, “we should ask whether government funding of medical research is really necessary. There is no proof that the private sector is incapable of financing medical research, either for profit or as charity.”⁸³

But when one examines these claims of crowding out, one finds a much different story. Tanner claims that an OECD study found that government support of research crowds out business research funding.⁸⁴ In fact, what this study found was that direct public funding of business R&D may, in some circumstances, crowd out business R&D, not that funding of basic science at universities and federal laboratories does. Moreover, the study found that this crowding out only occurred if government funding was more than 25 percent of business funding. In the United States, it is only 12 percent.⁸⁵ Moreover, in an OECD study entitled *The Impact of Public R&D Expenditures on Business R&D*, the researchers found that “direct government funding of R&D performed by firms (either grants or procurement) has a positive effect on business financed R&D (one dollar given to firms results in 1.70 dollars of research on average).” This is evidence of “crowding in,” not crowding out.⁸⁶ Most other studies of the issue find similar results, with the effect differing from around 10 cents⁸⁷ to 30 cents additional R&D for every one dollar of government funding for university or government laboratory research.⁸⁸

The reason why public funds are so important to the life-sciences industry is because, unlike many other industries, the majority of value-added from the life-sciences industry is derived from radical innovation drawn from basic science.

If anything, there is an increased, not decreased, need for government support for life-sciences research. As an OECD study argues, “It is particularly important for government-funded research to continue to provide the early seeds of innovation. The shortening of private-sector product and R&D cycles carries the risk of under-investment in scientific research and long-term technologies with broad applications.”⁸⁹ Likewise, the National Academy of Sciences notes, “Fewer investments in basic research (by NIH) can result in fewer new drug therapy candidates, which in turn can result in fewer investments by private industry to advance promising candidates.”⁹⁰ Likewise, the Tufts Center for Drug development writes, “These scientific and development histories demonstrate the rich interconnectivity of all sectors in the drug-discovery and drug-development ecosystem.”⁹¹ This is why the Battelle Memorial Institute found that “NIH funded research produced an average of 5.9 patents per \$100 million in R&D expenditures from 2000-2013—or at a rate of one patent per every \$16.9 million in NIH funding.” The report went on to find that “NIH patents also averaged 5.14 forward citations, meaning the NIH is an integral part of the knowledge chain for \$105.9 million in downstream R&D for every \$100 million in taxpayer funded. These downstream connections represent other research organizations, in both the private and public sector, leveraging NIH discoveries into follow-on R&D spending that is equal to the original federal investment—supporting high skilled, high-wage R&D jobs.”⁹²

One reason federal support for basic and early-stage applied research is a complement to private research is that industry is able to build on the knowledge discoveries from publicly supported life-sciences research, making their own research more productive and effective. These “spillovers” provide firms with a common platform of basic knowledge, and thus induce greater levels of innovation. For the life-sciences industry, Ehrlich finds that a dollar of NIH support for research leads to an increase of private medical research of even greater levels, roughly 32 cents.⁹³ After reviewing over 60 academic articles on whether public-sector R&D crowds out private-sector investments, Cockburn and Henderson conclude, “There are a number of econometric studies that, while imperfect and undoubtedly subject to improvement and revision, between them make a quite convincing case for a high rate of return to public science in this [life-sciences] industry. It is worth noting that there are, so

far as we are aware, no systematic quantitative studies that have found a negative impact of public science.”⁹⁴ Similarly, a 2012 report by the Milken Institute found that \$1 of NIH funding boosted the size of the bioscience industry by \$1.70 and that the long-term impact may be as high as \$3.20 for every dollar spent.⁹⁵ A 2013 report by Battelle found that, looking solely at federal support for the Human Genome Project between 1988 and 2012, every dollar of federal funding helped generate an additional \$65 dollars in genetics-related private activity.⁹⁶

The reason why public funds are so important to the life-sciences industry is because, unlike many other industries, the majority of value-added from the life-sciences industry is derived from radical innovation drawn from basic science. At the advent of the modern life-sciences industry in the 1960s and 1970s, it typically took many years for federally funded research to impact the private sector. More recent revolutions in techniques in biotechnology, including “mechanism-driven” drug design, have made publicly funded basic R&D more relevant to pharmaceutical firms in the near term.⁹⁷ Indeed, the lifespan of R&D to commercialization (as defined by patents) is substantially longer in life sciences than other industries, taking on average between 12 and 14 years.⁹⁸ In this sense, publicly funded basic R&D generates more than just papers, pure knowledge, and post-graduates; public sector funds increase the productivity of the industry as a whole by facilitating an environment of readily valuable basic R&D. Public R&D within the life-sciences industry leads to the development of “infrastructure knowledge,” or skills acquisition, techniques, and research tools that increase the expected rate of return for private-sector R&D projects.⁹⁹

SHORT-SIGHTEDNESS ON THE LEFT AND THE RIGHT

There is one final issue that drug populists and drug libertarians have in common when it comes to their ideal system for drug discovery and development: They both privilege current consumption over future innovation. Generating innovation, whether in drugs or any other product or service, requires setting aside current consumption hopefully in order to achieve some future benefit. Society gains no net benefit today from R&D performed today. R&D funding diverts societal output that could instead be going to current consumption: more police protection, more televisions, more vacations. But a society that privileges current consumption over investment in the future through innovation is a society where the pace of innovation will grind to a halt. In other words, in considering access to and the price of medicines, policymakers must balance the interests of present versus future generations. Low prices today mean less biopharma innovation tomorrow. This is a critical issue because, despite the amazing biopharma breakthroughs of the last half century, we are far from discovering all that needs to be discovered, and failure to obtain the needed breakthroughs will cost society money in the future, not to mention deprive tens of millions of people of the cures they need. For example, the financial impact of Alzheimer’s disease is expected to soar to \$1 trillion per year by 2050, with much of the cost borne by the federal government, according to the Alzheimer’s Association report *Changing the Trajectory of Alzheimer’s Disease*.¹⁰⁰ Thus there is good reason to be deeply concerned with continuing to invest in finding solutions to diseases and conditions that remain unsolved by medical science. But doing so requires preserving sufficient incentives to invest in biomedical research. Otherwise, we will be left with the stock of drugs we have

today, and our children will be taking the same drugs we take today, not better ones or drugs that provide new cures.

Moreover, a healthy, innovative biopharma industry promotes a thriving generics sector. The research-based biopharmaceutical industry invests in breakthrough drugs that become the inexpensive generic drugs of tomorrow. As Scannell notes, “Nearly all the generic medicine chest was created by firms who invested in R&D to win future profits that they tried pretty hard to maximize; short-term financial gain building a long-term common good.”¹⁰¹ As Scannell points out, “I would guess that one can buy today, at rock bottom generic prices, a set of small-molecule drugs [non-biotech drugs] that has greater medical utility than the entire set available to anyone, anywhere, at any price in 1995.”¹⁰² This balanced system explains how the United States has been able to foster both the world’s leading innovative biopharma sector as well as thriving generics competition that fills over 85 percent of U.S. prescriptions. But parties that would vitiate, variously, the public and private sectors’ roles threaten to undermine the very foundation of this productive and healthy American life-sciences innovation ecosystem.

In considering access to and the price of medicines, policymakers must balance the interests of present versus future generations. Low prices today mean less biopharma innovation tomorrow.

Drug Populists’ Position

For many on the left, the focus is on improving the quality of life and economic conditions for people today, especially low-income individuals in America and most in developing nations. As such, they are more willing to sacrifice future innovation for current welfare. For them, lower drug prices, even if they come at the expense of better medicines in the future, are worth it. To be sure, how much to invest in innovation is a worthy discussion, but drug populists should acknowledge that a tradeoff exists between low drug prices for people today and better drugs tomorrow. Instead, they argue that there is no such tradeoff.

Drug Libertarians’ Position

For many on the right, it is not just that the private sector is privileged over the public sector, it is that current consumption is privileged over future investment, especially if that investment is made collectively, through government spending. For them, better to let taxpayers keep “their” money for current consumption than to let the government invest it for some potential outcome in the future.

CONCLUSION

America did not get to be the global leader in biomedical innovation by accident or because we had more sick people. We achieved that status because policymakers from both sides of the aisle architected a public-private partnership where the public sector made robust investments in scientific research and where public policies, including strong intellectual property protections and market-based drug pricing, combined to fuel private-sector investment, innovation, and jobs creation.

The policy paths advocated by the drug populists on the left and the drug libertarians on the right would, if followed, significantly damage this highly effective innovation ecosystem. Following the drug libertarians’ counsel would mean less private-sector biomedical innovation because U.S. biopharma companies would have access to less scientific information and less biomedical talent coming out of universities. Following the

drug populists' counsel would mean significantly reduced revenues for biopharma innovators, which would translate into reduced expenditures on the R&D needed to find better and more cures.

This does not mean that the U.S. system is perfect and cannot be improved. NIH funding, despite recent increases by Congress, is still significantly below levels (as a share of GDP) attained after the NIH budget doubling of the 1990s and 2000s. Indeed, following a decade of remarkable public sponsorship of medical research with growth exceeding 7 percent per year in the 1990s, NIH funding declined nearly 2 percent per year in real terms after the mid-2000s; this decrease represents a 13 percent decrease in NIH purchasing power (after inflation adjustment) since 2004.¹⁰³ There is still room for improvement on NIH research grant funding, including ensuring more higher-risk research is funded and more funding is available to younger scientists. On the private side, there is more work to be done on finding new methods and models to reduce the costs involved in drug discovery and development, including perhaps more cooperative research models focused on particular types of diseases or challenges, such as NIH's new Accelerating Medicines Partnership.¹⁰⁴ And Congress could make the tax code more supportive of high-risk R&D, including by expanding the R&D tax credit and instituting an "innovation box."¹⁰⁵ And as ITIF recently recommended, other nations should step up to the plate as well, increasing not only their funding for biomedical research but also doing more to respect intellectual property and to pay closer-to-market prices for drugs.¹⁰⁶ But these are needed improvements to the current largely successful model, not a wholesale rejection of it.

ENDNOTES

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