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# Policy options for the drug pricing conundrum

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**Current proposals aimed at reducing U.S. pharmaceutical prices would have immediate benefits (particularly for low-income and elderly populations), but could dramatically reduce firms' investment in potentially highly welfare-improving Research and Development (R&D). The United States subsidizes the worldwide pharmaceutical market: U.S. drug prices are more than 250% of those in other Organization for Economic Co-operation and Development (OECD) countries. If each drug had a single international price across the highest-income OECD countries and total pharmaceutical firm profits were held fixed: U.S. prices would fall by half; every other country's prices would increase (by 28 to over 300%); and R&D incentives would be maintained. We propose a potential lever for the U.S. government to influence worldwide drug pricing: access to the Medicare market.**

pharmaceutical prices | worldwide drug pricing | policies

## Significance

Proposed U.S. policies to reduce pharmaceutical prices, though particularly beneficial for low-income and elderly populations, could reduce firms' investment in R&D. Social benefit cost ratios from pharmaceutical R&D are high, and the likely effect of the policies on profit margins are large. Higher U.S. prices subsidize the worldwide pharmaceutical market; if each drug had a single international price across high-income countries, and pharmaceutical profits were held fixed, U.S. prices would fall by half and every other country's prices would increase (by 28 to over 300%). We outline a policy that would generate a more equitable distribution of benefits and costs across high-income countries.

Pharmaceutical prices in the United States are high. If we consider data for all prescription drugs, average U.S. prices are more than 250% of those in 32 comparison OECD countries combined (1).* Accordingly, policy options have been proposed and partially implemented to reduce the burden of pharmaceutical prices on the U.S. population, particularly on seniors and low-income consumers (2, 3).

Though these policies will help U.S. consumers in the short run, they are likely to have harmful long-run effects. There is general agreement that much of the decrease in morbidity and mortality in the U.S. population over the last decade is the result of new pharmaceuticals. In this paper, we quantify these benefits and compare them to the social costs of producing the drugs (over 80% of which are funded by private firms, according to OECD data).† The results suggest that it would be socially beneficial to increase pharmaceutical research, and as long as the vast majority of the funds for research are supplied by firms, an increase in pharmaceutical research likely requires increased private incentives to do that research.

We then consider the likely implications of recent U.S. pricing policies, if expanded to cover all drugs, for firm profits. Using data from sixteen of the largest pharmaceutical companies worldwide by market capitalization, we calculate that if fully implemented these policies would lead to about a 20% reduction in worldwide pharmaceutical profit margins. Assuming firms expect the policies to continue, their expected future profits will also fall and, with them, their incentives to invest in R&D.

If one has the contractarian view that certain basic goods, including a minimal amount of health care that requires less costly access to pharmaceuticals, are a right of consumers who abide by society's rules,‡ and also wants to keep pharmaceutical R&D incentives at current levels, then there needs to be a change in the institutions governing the pharmaceutical market. The margins of Pharmaceutical Benefit Managers, for-profit firms that act as middlemen negotiating formularies and discounts for commercial plans (including in Medicare Part D), are under investigation by the Federal Trade Commission (5). A change in their structure is one source of possible savings. Others have noted that changes in the length of drugs' effective patent life would provide additional incentives for R&D§ but they would also prolong the period without generic competition and the higher prices this induces.

*Mulcahy et al. (1) conduct a bilateral comparison between the United States and each comparison OECD country. For each one, they calculate an other-country volume-weighted price equal to the sum of the product of the U.S. volume weights and the other country's prices, and divide it by the U.S. volume-weighted U.S. price. They also calculate an all-other-countries volume-weighted price using US volumes and all other countries' prices, and use it with the same denominator to find a price index for all countries combined. We note that since the U.S. data account for rebates and the other countries' data do not, the true price ratio is higher than those quoted above.

†Source: the OECD Business Enterprise R&D Expenditure by Industry data at https://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDU.

‡For more detail on the contractarian argument, see ref. 4.

§See, for example, a Bloomberg Opinion Editorial from July 19, 2024, available at https://news.bloomberglaw.com/health-law-and-business/want-cheaper-prescriptions-let-the-bargaining-begin-editorial. The European Parliament's Pharmaceutical Proposal of 2024, discussed below, is also relevant.

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We want to draw attention to another issue that, though often mentioned, is seldom quantified with this tradeoff in mind: the international dimension of the pharmaceutical market. Pharmaceuticals, like climate change, are sold in an international market. Once a new drug is developed, all countries can benefit from it. Yet unlike the attempts to mitigate the impacts of climate change, there are no international agreements on either pharmaceutical pricing, or publicly funded pharmaceutical research. We argue that the burden of pharmaceutical R&D should be shared more equally across high-income countries.

As a simple benchmark, we explore how different countries' prices would change if pharmaceutical firms charged a single international price for each drug to high-income countries, and total pharmaceutical revenues were held fixed. The results illustrate just how high US drug prices are relative to prices in other high-income countries. Moreover, the pharmaceutical package adopted by the European Parliament in April 2024, if it is adopted by the European Council, is likely to accentuate the already large differences between the U.S. and European prices reported below.

Finally, we propose a (partial) solution to the problem. The U.S. government has a lever to affect international drug company pricing policy: access to the Medicare markets. The Centers for Medicare and Medicaid (CMS) already stipulates that, if a manufacturer chooses to opt out of the Medicare Drug Price Negotiation Program set out in the Inflation Reduction Act (2022), CMS can choose to remove its drugs from Medicare (or alternatively, demand a high excise tax on its Medicare sales) (2). One or both of these policies could also be tied to increases in other-country prices.

We investigate this further in the final section of the paper, by comparing Medicare revenues to rest-of-the-world or European revenues for the fifteen firms producing most of the fifty largest drugs by expenditure in the Medicare program. The revenues from Medicare are large, often exceeding the entirety of non-U.S. revenues for these firms, and almost always exceeding the revenue from European countries. So the threat to bar a firm from Medicare if its European prices do not increase would provide the firms with significant leverage in their negotiations with European institutions.

## Benefits and Costs of R&D

**Benefits.** Buxbaum et al. (6) report that between 1990 and 2015 life expectancy increased by 1.32 y per decade. They attribute about 35% of this, or 0.46 y, to pharmaceuticals. There were 48.9 million live births in the United States between 2005 and 2015. If we value a life year at $100,000 (which may be an underestimate; see ref. 7), this generates 2.25 trillion dollars in value. This ignores the improvement in life expectancy of immigrants. Net migration over this period averaged 1.03 million immigrants per annum. If we value the contribution to their welfare at one tenth of the decadal savings for every year they were in the United States, this adds another 0.57 trillion dollars of welfare benefits. Additionally, the contribution of pharmaceuticals to the reduction in morbidity of just the Medicare population, when valuing a healthy year of life at $50,000, is 0.25 trillion per decade (see ref. 8). So overall, the benefits have been over $3 trillion per decade.

Of course, there is a difference between the average and the marginal welfare benefits of pharmaceutical research, and we have not directly measured the relationship between company-funded pharmaceutical research and the development of new drugs. There are several reasons for this. In addition to the standard difficulties in production function estimation (9), there are at least two additional issues that make it difficult to empirically establish the relationship between research expenditures and the production of new pharmaceuticals. First, the outcomes of different research programs designed to mitigate a particular disease are correlated due to the common element of the underlying scientific knowledge in the area. So the disturbances in this R&D-to-new-drug relationship do not average out in the cross-section and are commonly impacted by the increments in scientific knowledge in the time dimension. Second, the relationship between the inputs and the outputs in the pharmaceutical production function involves two distributed lags, one which reflects the production process itself and the other which is a result of the requirements to get Food and Drug Administration (FDA) approval for the drug. Both of these vary from outcome to outcome.[¶]

**Expenditures.** U.S. companies spent 747 billion dollars on pharmaceutical research between 2011 and 2021.[#] US pharmaceutical firms funded about 87% of these expenditures, 7% were funded by companies whose parents were foreign, 3% were funded by other U.S. companies, and the rest were funded by a mix of governments hospitals and universities.

The federal government is also involved in funding pharmaceutical research both directly, through NIH, and indirectly through tax and subsidy policies. Here, we consider only the NIH expenditures, and we come back to the implications of tax/subsidy policies below. Funding from the NIH "contributed to 354 of 356 drugs approved from 2010 to 2019 with expenditure totaling $187 billion..." (10).[‖] So government institutions (principally the NIH) are involved in some way in the development of most new pharmaceuticals, but they spend much less than pharmaceutical firms on drug development.

**Benefit to Expenditure Ratios.** Even if we allocate all the government research that "contributed to" new drugs to the R&D of drug development, the U.S. population's welfare benefit-to-expenditure ratio from pharmaceutical company research has recently been extremely high, 4 or more. These simple calculations are subject to a number of caveats, some of which we return to below. Still, the numbers suggest that it would be socially beneficial to increase pharmaceutical research, not decrease it.

## Pricing Policies, Incentives, and Profits

Two policy changes that aim to reduce U.S. drug prices have been initiated at a small scale and are being considered for broader application.

The Inflation Reduction Act of 2022 is allowing bargaining between the CMS and drug companies to determine the price

[¶] We could also ask, if firms did change pharmaceutical R&D spending, which types of drugs would be most effective. We should expect the change to depend on which categories of drugs have the largest expected change in profitability. We come back to this in the conclusion when considering alternative policy proposals.

[#] Source: the OECD Business Enterprise R&D Expenditure by Industry data at https://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDU. We focus on the industry defined as "Manufacture of basic pharmaceutical products and pharmaceutical preparations" and the currency measure "2015 constant prices and PPP" so that expenditure in other countries' local currencies (see later in this paper) are converted to US dollars under PPP and years other than 2015 are adjusted for inflation.

[‖] The following quote describes how this study was performed (10). "This study extended these methods by developing an accounting for NIH spending that was comparable with reported investments by the industry. Using a dataset of drugs approved from 2010 to 2019 (before the COVID-19 pandemic), this analysis estimated the NIH investment in these drugs, including the cost of published basic and applied research associated with these products, cost of phased clinical trials of failed product candidates, and opportunity cost, using discount rates recommended for government spending."

**Table 1. Large pharmaceutical firm profits, revenues, and R&D spending**

| Firm | Country | Global rank in market cap in 2023 | Total net-of-discounts global revenue on pharmaceuticals ($ million) | Total net-of-discounts US revenue on pharmaceuticals ($ million) | Share of global revenues that comes from U.S., % | R&D spend on pharmaceuticals ($ million) | Net profit ($ million) | Net margin from US, % |
|---|---|---|---|---|---|---|---|---|
| Eli Lilly | US | 1 | $28,541 | $18,190 | 63.7 | $7,191 | $6,245 | 21.9 |
| Novo Nordisk | Denmark | 2 | $25,057 | $11,987 | 47.8 | $3,405 | $7,862 | 31.4 |
| Janssen | US | 3 | $52,563 | $28,604 | 54.4 | $11,622 | $17,941 | 34.1 |
| Merck | US | 4 | $52,005 | $24,989 | 48.1 | $7,700 | $14,519 | 27.9 |
| AbbVie | US | 5 | $58,054 | $45,713 | 78.7 | $6,510 | $11,836 | 20.4 |
| Roche | Switzerland | 6 | $47,742 | $21,078 | 44.2 | $14,736 | $14,182 | 29.7 |
| AstraZeneca | United Kingdom | 7 | $44,351 | $17,920 | 40.4 | $9,762 | $3,293 | 7.4 |
| Novartis | Switzerland | 8 | $50,545 | $17,653 | 34.9 | $9,996 | $6,955 | 13.8 |
| Pfizer | US | 9 | $100,300 | $42,126 | 42.0 | $11,428 | $31,372 | 31.3 |
| Amgen | US | 10 | $24,801 | $17,743 | 71.5 | $4,434 | $6,552 | 26.4 |
| Sanofi | France | 11 | $32,222 | $14,379 | 44.6 | $5,320 | $16,372 | 50.8 |
| BMS | US | 12 | $46,159 | $31,850 | 69.0 | $9,509 | $6,327 | 13.7 |
| Gilead | US | 13 | $27,281 | $18,884 | 69.2 | $4,977 | $4,592 | 16.8 |
| Vertex | US | 14 | $8,931 | $5,699 | 63.8 | $2,540 | $3,322 | 37.2 |
| Regeneron | US | 16 | $12,173 | $6,825 | 56.1 | $3,593 | $4,338 | 35.6 |
| GSK | United Kingdom | 18 | $36,271 | $17,987 | 49.6 | $6,788 | $19,322 | 53.3 |

Notes: We include the top 18 firms by global rank in market capitalization in 2023 other than CVS Health (which is integrated with a large pharmacy chain, a health insurer, and a Pharmacy Benefit Manager) and Zoetis (an animal health company). Source of all data is firm annual reports 2022. For Janssen, we include only pharmaceuticals. For Merck, we consider only the human health segment (animal health is excluded). Net margin is net profit/total net-of-discounts global revenue.

Medicare pays for some prescription drugs.[**] Currently, the new rules apply to only ten products with about $48 billion in sales. However, President Biden's state of the union address (12) included the following statement

> *"Now it's time to go further and give Medicare the power to negotiate lower prices for 500 drugs over the next decade."*

Medicare's share of U.S. sales of pharmaceutical products grew to 30% by 2017. (Source: Kaiser Family Foundation, "10 Essential Facts about Medicare and Prescription Drug Spending," January 29, 2019.)

The Congressional Budget Office has estimated a detailed model of the drug research and approval process (13). They predict, and we agree, that the pricing changes inherent in the Inflation Reduction Act of 2022 are unlikely to lead to a substantial reduction in research spending. This is due to the small number of drugs included in the new pricing policy; the fact that the new pricing scheme kicks in only after the drug has been on the market for almost a decade; and the fact that price changes apply only to Medicare. However, the consequences of extending these changes to what is essentially all pharmaceuticals are another matter.

The second change involves allowing importation of pharmaceuticals from Canada. Florida has been approved by the FDA to do so [initially only for 14 drugs and only for people serviced by state agencies (3)]. Seven other states have applied for similar permissions. Assuming drug manufacturers do not respond by stopping their relatively low-priced Canadian sales, which they surely would if this was extended to all 42 states, this initiative could have widespread effects on their revenues. Together the eight states account for about 20% of U.S. pharmaceutical sales, and U.S. sales are over fifty percent of global pharmaceutical sales. More precisely U.S. sales are on average 55% of sales for the sixteen large pharmaceutical companies listed in Table 1 and used in our calculations below, and 62.5% of the sales in the thirty-three OECD countries listed in the RAND (2024) study we come back to below (1).

To get some idea of what the impact of the broader changes would be on company profitability we need a guess at what "bargained prices" would be. If bargaining with Medicare was instituted at a larger scale, the final result would have to be endorsed by a government-sanctioned institution (probably CMS), as is true in most other countries including Canada. The proximity of Canada to the United States facilitates importation, and cultural similarities make Canada a natural reference point for bargained outcomes. So we use Canadian prices to evaluate the implications of both CMS bargaining with the pharmaceutical companies and pharmaceutical product importation from Canada. Canadian prices are the second-highest prices among developed countries (the United States is highest; see below). So moving to Canadian prices would generate a smaller loss in profits than moving to the prices of any other developed country.

Our calculations indicate that, assuming demand was totally inelastic and there were no other mitigating developments, applying the bargained prices to all Medicare demand and allowing for importing drugs from Canada for the eight states currently negotiating with the FDA would cause about a 16% fall in pharmaceutical revenue.[††]

Before turning to the implications of the 16% fall in revenues on pharmaceutical company profits, two caveats are in order. First, demand does respond to price, although the elasticities

[**] The new pricing process has a price ceiling for the new negotiated price which is not higher than 40 to 75% of the drug's nonfederal average manufacturer price (non-FAMP). The percentage is 75% for small-molecule drugs and vaccines 9 to 12 y beyond approval, and lower for older drugs. Details of the process are provided in a CMS Memorandum from March 2023 (11).

[††] We use the data in ref. 1, figure 3.6 which specifies that US prescription drug prices, accounting for rebates, were 276% of Canadian prices for retail-dispensed brand-name drugs in 2022. Given this, extending CMS bargaining to all Medicare drugs might reduce total pharmaceutical revenues by 30% (the share of pharma revenues from Medicare) $\times$ (1/2.76) = 10.9%. Importing drugs from Canada, if these drugs could be used by the relevant states' entire non-Medicare population, might further reduce pharma revenues by ((100% − 30%) $\times$ 20%) $\times$ (1/2.76) = 5.1%.

reported in empirical work on pharmaceutical demand are small.[‡‡] More importantly, related studies emphasize that any lowering of prices is likely to have beneficial health effects. For example, in a large-scale study of diabetes, cardiovascular, and hypertension patients, Van Alsten and Harris (15) find that cost is the most common reason for medication nonadherence, with more than two-thirds of patients skipping or delaying medication. Further, cost-related noncompliance was associated with 8% to 18% higher disease-specific mortality rates. So were we to adjust our estimates of the revenue reduction to account for the price-induced increase in demand, we should adjust the welfare benefits for the gains from increased compliance, and the result may well increase the benefit-to-cost ratio. That is, because reducing prices increases consumer surplus, it raises the welfare gains from pharmaceutical innovation. This increases the social benefit to social cost ratio which underlies our argument for more, not less, pharmaceutical research.

Perhaps a bigger caveat is that the reduced prices of pharmaceutical products in the United States might induce a change in pharmaceutical prices in other countries, and this could change the impact of the proposed policies on pharmaceutical firm revenues overall. The market for pharmaceutical products is international and other countries, particularly other developed countries, might be induced to change their prices once they realized how the proposed policies would affect the health of their populations in the future. We come back to the issue of the structure of the international pharmaceutical market below, but currently we do not know of any institution in another country that ties their pharmaceutical pricing policies to the incentives to perform pharmaceutical research. Moreover, as we discuss below, there are good reasons to expect pharmaceutical prices in other high-income countries to fall relative to U.S. prices in the near future, not rise.

**Company Profits.** We have gathered data from the Securities and Exchange Commission (SEC) reports on 15 of the largest pharmaceutical firms (by capitalization).[§§] The reports provide net profits and net margins. Net profit is computed as pharmaceutical global revenue after rebates minus operating expenses, taxes, interests, and other expenses. Net margins are defined as net profits divided by global revenue after rebates. The data are reported in Table 1.

The weighted average of the global net margins of these firms, weighted by shares of net profit, is 32%. We calculate that a 16% reduction in U.S. revenues would lead to about a 9% reduction in global revenues. If there was no change in costs, net margins would fall from 32% to 25%. That is, the proposed policies could cause an almost 20% decrease in net profits.[¶¶] Potential future profits from innovation, which are the key for investment, are likely to fall similarly.

[‡‡]For example, Gatwood et al. (14) use MarketScan data in a panel data analysis with individual fixed effects to estimate the response to cost-sharing incentives for eight categories of medication. They obtain elasticities between −0.015 and −0.157 for seven of the eight categories and no elasticity at all for antiplatelet agents. The −0.157 was for smoking deterrents, and the next highest was −0.087 for Proton Pump Inhibitors. This paper also contains an extensive review of the literature on price effects.

[§§]These 15 firms account for over a third of total world pharmaceutical R&D. We use 10K reports from the SEC for 2022. For example, the report for Pfizer is at https://s28.q4cdn.com/781576035/files/doc_financials/2022/ar/PFE-2022-Form-10\protect\kern+.1667em\relaxK-FINAL-(without-Exhibits).pdf. Our analysis includes the top 17 firms by global market capitalization except CVS Health, which is integrated with a pharmacy chain, a health insurer, and a pharmacy benefits manager, and Zoena which is an animal health firm.

[¶¶]If net margin is 32% on average, and is defined as net profit divided by global revenue, then cost is currently 68% of revenue. U.S. revenues make up an average of 55% of global revenues for these firms. So the proposed policies would reduce global revenues to approximately (0.55*0.85 + 0.45) = 0.92 of their previous value. Hence, new margins would be approximately (0.92 − 0.68)/0.92 = 0.26, a reduction of (0.32 − 0.26)/0.32, i.e. 19%.

## The International Dimension of the Market

Our calculations indicate that currently the United States provides a substantial implicit subsidy to the worldwide pharmaceutical market. Some of this is due to the size of the U.S. market. We will focus on quantifying the impact of international differences in prices conditional on differences in market size. Before going to those calculations, we briefly consider public funds.

**Public Funds for Pharmaceutical Research.** A recent OECD report on publicly funded health-related research in OECD countries (16) finds that government expenditures were 0.21% of gross domestic product (GDP) in the United States; 0.07% of GDP in Europe (that is, in the 21 EU member states that are part of the OECD); and 0.04% of GDP in the other OECD member countries.

We provide these numbers only to show that if we included differences in direct government support of pharmaceutical research, the inequities in the international distribution of the costs of pharmaceuticals would likely only grow. The numbers on "health related" research relate to a broader category than pharmaceutical research, and were we to do a careful study of this issue we would also need to include the role of tax and subsidy differences across countries. This would include both the subsidies given to privately funded R&D and the impact of tax avoidance policies favoring U.S. companies that offshore profits and production. As discussed in ref. 17, the implications of the tax avoidance policies would likely dominate, also reinforcing the international inequities seen in the differences in pricing regimes across countries.

**Prices.** Much of the international inequity in funding private incentives to do pharmaceutical research is due to international differences in pharmaceutical prices. A recent RAND report (1) calculates that, using U.S. revenue shares of pharmaceutical products as weights, the indices of U.S. prices for retail-dispensed branded drugs in 2022 were 276% of Canadian prices; 434% of UK prices, and 381% of a share weighted average of 33 developed countries. These indices understate the gap between US prices and other countries' prices because they adjust US prices to account for manufacturer rebates but do not adjust prices in other countries for any rebates or other discounts there. These differences have been growing over the last two decades [see the study of Danzon (18) and the literature she cites on international price differences].

**The Impact of Internationalizing Pharma Prices.** We consider the impact of internationalizing the branded drug prices for only those 21 countries with at least $50,000 in per capita GDP. That is, we ask if i) there is an international price for each branded drug that each of these countries abide by (We note that, if there was no government involvement in setting prices, prices in different countries would never differ by more than transport costs), and ii) we assume total branded drug revenue is the same as current total branded revenue (so incentives to perform R&D would be unchanged),

> *What would be the weighted average markup or markdown in each country's prices, where the weights are country-specific revenue shares?*

Details of our data and analysis, and a table of results, are provided in the Appendix.

Fig. 1 provides the results in terms of markup (or markdown) over current prices for the twenty other countries included in

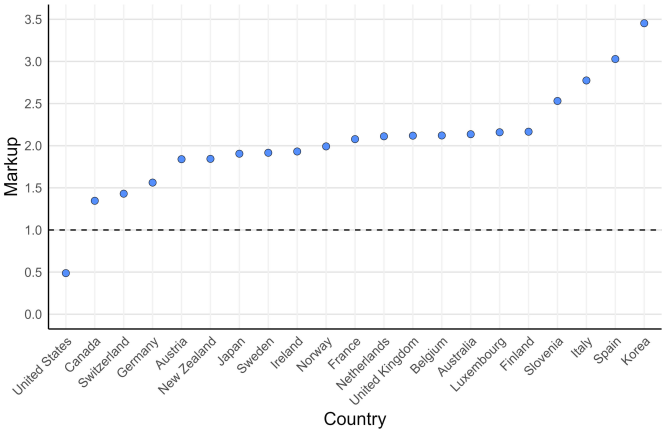


**Fig. 1.** Markups required for internationalized pricing.

this analysis. As expected, every country except the United States has a price increase. The United States would pay only 46 cents for every dollar we now spend, whereas the lowest price increase among the other countries would be Canada, with a branded index of 1.28, indicating that its prices would be 128% of its current prices. The indices for the larger European economies include; 1.48 for Germany, 1.97 for France, 2.00 for the United Kingdom, 2.63 for Italy, and 2.87 for Spain; while the Korean index is over 325%. We conclude that the use of international pharmaceutical prices would cut U.S. prices in half but would cause sharp increases in other countries' prices (of 28% to over 300%).

There would be both obstacles and benefits to proceeding with a single international price for each drug. Benefits would include not having to worry about either the costs of quasi-governmental committees setting and monitoring prices in different countries, or "parallel trade" in pharmaceuticals among the countries that agreed to the single price policy. There are numerous obstacles, including the fact that many countries might have to find alternative ways of providing their citizens the minimal level of health care that they require. We would also need to formulate international prices, hopefully in a way that led to optimal R&D incentives. Still, any movement in the direction of equating prices would likely lead to less political pressure for the current U.S. policy options and mitigate their negative impacts on pharmaceutical R&D.

**The European Parliament's Pharmaceutical Proposal.** Are high-income countries likely to increase their pharmaceutical prices? An indication of likely trends is given by the European Parliament's Pharmaceutical Proposal. The package, adopted by the European Parliament in April 2024, needs to be approved by the Council before it is enforced. The two parts of the package that are particularly relevant for the current discussion (19) are i) creation of a single market for medicines for all countries across the EU and ii) exclusivity policies which are designed to increase R&D incentives.

The creation of a single market is intended to include concentrating pharmaceutical purchases for all of Europe in a single purchasing agent.[##] This would have administrative, pricing, and R&D incentive effects. Administratively, it would eliminate both free riding in setting prices (see ref. 21, for a discussion) and parallel trade among members of the European Union. It may also decrease the cost of negotiating prices with manufacturers because this would only have to be done once for all member states. The impact on R&D incentives depends on how it would affect pharmaceutical prices.

The single purchaser would likely have higher bargaining leverage in negotiations with the pharmaceutical companies than any single member state. As a result, a bargaining model would predict that the change would further lower European prices, accentuating current international inequities. Of course, it could also facilitate a negotiation of prices between the United States and European nations (since there would be a single European agency to deal with). However this would require the European pricing agent to agree to increase prices in order to foster R&D activity, and we do not know of a quasi-governmental pricing institution who has done this in the past.

The European Parliament's proposal also extends exclusivity on pharmaceutical products (22). They i) set a minimum period of 7.5 y of protection after approval (designed for drugs for which there is a long interval between approval and use), ii) guarantee two years of market exclusivity (even if a biosimilar drug appears), and iii) grant other extensions in specific cases. These include: if the drug meets an "unmet" medical need, if much of the R&D is done in Europe, and if approval is granted for a second indication.

Notice, however, that there is no reference to pharmaceutical prices. Without a lessening of the international price disparities the political pressure on the U.S. government to decrease pharmaceutical prices is unlikely to abate, with potentially serious consequences for pharmaceutical innovation.

**Can We Induce Higher Pharmaceutical Prices in Other High-Income Countries?** Pharmaceutical prices in other high-income countries are set in agreements between governmental (or quasi-governmental) institutions and the pharmaceutical firms, in a manner similar to how the U.S. prices for the drugs specified in the Inflation Reduction Act (IRA) are to be determined. Economic theory argues that the outcome of such negotiations depends on the comparison between each participant's profits were they to reach an agreement or not. The more a participant has to lose, the smaller the share of the gains from trade they capture. Recognizing this fact, the IRA threatens firms who do not abide by the prices that are approved by the government with discontinuing Medicare purchases from the firm.

How would use of a similar threat to Europe impact the bargaining position of the pharmaceutical firms in their dealings with the European authorities? To get some idea of the leverage that would be gained by threatening to withhold Medicare sales to pharmaceutical firms if they did not obtain higher prices from their European customers, we compared Medicare revenues to European revenues for those of our fifteen firms for which the requisite data was available. Currently pricing rules differ across European countries. Of course, the ratio of Medicare to country-specific revenue would be much larger than Medicare to total European revenue, so the leverage of pharmaceutical firms in negotiation with countries would be larger than with the Union as a whole.

The results summarized in Fig. 2 indicate that the large quantities sold in the Medicare market when combined with U.S. prices would cause a remarkable effect on the profitability of different price agreements between the pharmaceutical companies negotiations and the European authorities. Fig. 2 summarizes our results looking only at the drugs that are among the top fifty in Medicare Part D purchases. Appendix 2 provides the

[##]The new purchasing authority is defined in the legislation as follows. "The Health Emergency Preparedness and Response Authority (hereafter 'HERA' or 'the Authority') is hereby established as a separate structure under the legal personality of the European Centre for Disease Prevention and Control. The Authority shall be responsible for creating, coordinating, and implementing of the long-term European portfolio of biomedical research and development agenda for medical countermeasures against current and emerging public health threats as well as the production, procurement, stockpiling, and distribution capacity of medical countermeasures and other priority medical products in the EU. (...) (Article 175a new)" (20).

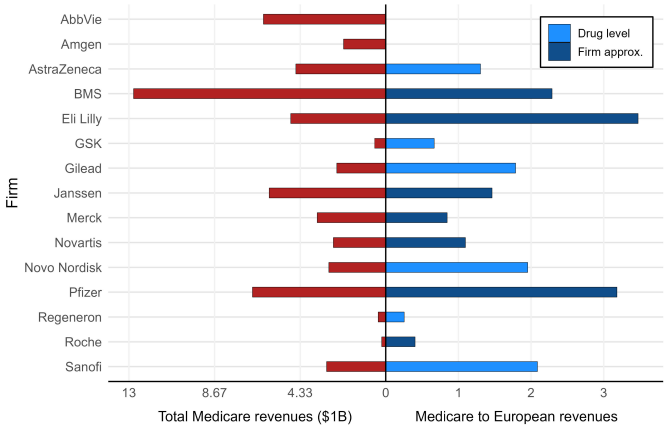


**Fig. 2.** Ratio of Medicare Part D to E.U. revenues for firms producing top 50 Medicare Part D drugs.

details on how we constructed these data as well as a similar figure for the drugs procured by either Part D or Part B. The left half of the figure provides the 2022 net revenue (revenue minus rebates) from each of these firms from sales of these drugs to Medicare enrollees in billions of dollars. The right-hand side provides the ratio of Medicare sales to sales to all members of the European Union. The ratios in light blue are for the companies that report European sales of the fifty drugs in their SEC reports. The dark blue figures are for firms that only report the fraction of their total sales that are to European Union members, in which case we take that fraction and multiply it by total sales of the firm to E.U. members. AbbVie and Amgen do not report the numbers needed to do either calculation.

Only three of the twelve firms for which we can make a calculation have higher European sales than Medicare sales (Roche, Regeneron, and Glaxosmithkline) and, perhaps not surprisingly, they are the three firms with the smallest shares of Medicare sales. Merck also has higher European sales but that is because it has one high-selling drug, Gardasil (an Human papillomavirus infection vaccine) which is only meant for those age 9 to 45, and if we drop it, that is if we apply the threat only to those drugs sold to Medicare, its ratio becomes 1.89. We then asked the following questions.

> *If we were to increase European prices for the ten companies in which Medicare revenue is higher than European revenue to a level which equates Medicare and European revenues from the drugs they sell to Medicare: (i) How much would the European price of those drugs rise? and (ii) were we to use the increase in revenue that the price rise generates to decrease the total (public plus private) U.S. expenditure on those drugs but hold the worldwide revenue of each firm (and hence its R&D incentives) constant, what would be the impact on U.S. prices for those drugs?*

The price changes ranged from 10% for Novartis to 240% for Eli Lily, with an average increase across firms of just over 100%. The fall in U.S. prices for those drugs would vary between 3% for drugs sold by Novartis to 30% for drugs sold by Merck, with an average across firms of 18%. Details are provided in Appendix 2.

These are very rough calculations of the likely impact of the threat of withholding Medicare sales on the negotiations between the firms and the European authorities. On the one hand, they assume that the European governments could push prices down to their "threat value," and so capture 100% of the surplus that trade would generate with 0% going to the firms. An alternative which might be viewed as more equitable, though perhaps is equally unlikely, would be to assume that pharmaceutical prices were equalized across countries. As shown above, this would lead to much higher European, and much lower U.S., prices. On the other hand, our calculated threat value may be a poor approximation to the true threat value generated by withholding access to Medicare sales. If the threat were to stop firm A from supplying drugs to Europe, over time firms not among our fifteen large firms might step in with substitute drugs, or new firms might appear to produce them. What is clear, however, is that Medicare sales are a large enough proportion of the total sales of these firms that withholding access to Medicare would have a large impact on these firms' profits. Our bargaining models predict that this would have a significant impact on the prices the firms negotiate with European governments.

## Conclusion

The suggestion of withholding access to Medicare could be implemented on a drug by drug basis, in which case we would expect the pharmaceutical companies' leverage to be larger for more innovative drugs, as the European countries would be least willing to lose them. Moreover threatening Medicare sales is not the only way to connect U.S. pharmaceutical prices with those in other developed countries. One suggestion from one of our colleagues is to charge a tax on the price differential between drugs sold in the foreign country and the United States. That too is an idea worth consideration. Our point is simply that, rather than solely cutting U.S. prices, we should also consider how best to influence pharmaceutical companies' negotiations with other countries, as this might allow us to decrease our health care costs without sacrificing pharmaceutical R&D investment.

**Data, Materials, and Software Availability.** Previously published data were used for this work (They are all in the paper).

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