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RESEARCH AND DEVELOPMENT INTENSITY AND THE INFLATION REDUCTION ACT'S PRESCRIPTION DRUG PROVISIONS

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Abstract:

The Inflation Reduction Act (IRA) newly allowed the federal government to negotiate the prices Medicare pays for prescription drugs. It also put in place policies that constrain the growth of prescription drug prices while increasing the generosity of Medicare's drug benefit and increasing subsidies for low-income Medicare beneficiaries. These changes alter the economics of the prescription drug market. They make prescription drugs more affordable for Medicare beneficiaries, thereby increasing demand for many drugs, while also reducing prices for some brand-name drugs.

The IRA has sparked vigorous disagreement about how its provisions will affect innovation. Some have argued that increased affordability of life-saving drugs will boost demand for these drugs, possibly accelerating innovation. Others fear that the law's limits on prices will slow the development of new products, such as new cancer drugs or new cell and gene therapies.

We use quasi-experimental evidence to assess which of these competing characterizations of the IRA's effects is most correct. To analyze the effects of the IRA on pharmaceutical research and development (R&D) investment, we adopt the conventional view that R&D investment decisions are based on the expected cash flow generated by investment projects. The effects of the IRA then hinge on how the law affects the cash flow generated by future successful R&D projects. The IRA affects these cash flows in multiple ways, mainly by changing the revenues that firms can expect to earn by selling drugs to Medicare beneficiaries.[1]

To assess the effect of the IRA on investment decisions, we adopt a difference-in-differences approach that examines changes in investment decisions made by firms with higher and lower shares of their revenues from Medicare in 2019. Because, as we document, Medicare exposure is persistent over time, firms with higher levels of Medicare exposure were likely more exposed to the IRA, while those with less Medicare exposure were likely less exposed to the IRA. Our outcome variables are measures of R&D intensity, the ratio of R&D spending to total revenues, a widely used metric of R&D activity (Hughes, 1988). We also estimate models where the outcome variables are log R&D spending.

In both sets of models, our point estimates indicate that greater Medicare exposure is associated with larger increases in R&D activity in the post-IRA period, although these estimates are only statistically significant at conventional levels when analyzing log R&D expenditures. These results do not provide evidence supporting the contention that the IRA reduced R&D activity and, if anything, they suggest the law may have increased R&D.

[1] Below, we focus on the major provisions related to prescription drugs. We do not address various tax policies included in the IRA that might affect the economic choices of pharmaceutical manufacturers, like the new tax on stock buybacks, which could have some effect on the relative attractiveness of R&D spending.

I. Introduction

The Inflation Reduction Act (IRA) newly allowed the federal government to negotiate the prices Medicare pays for prescription drugs. It also put in place policies that constrain the growth of prescription drug prices while also increasing the generosity of Medicare's drug benefit and increasing subsidies for low-income Medicare beneficiaries. These changes alter the economics of the prescription drug market. They make prescription drugs more affordable for Medicare beneficiaries, thereby increasing demand for many drugs, while also reducing prices for some brand-name drugs.

While the basic research underlying most new prescription drugs is publicly funded via the National Institutes of Health (Cleary et al., 2018; Cleary et al., 2023), private funding plays a central role at later stages of the drug development process. In 2024, IQVIA estimated biopharmaceutical funding of research and development (R&D) to be at $102 billion (IQVIA, 2025). Research and development costs for new prescription drugs are high because the process to develop a prescription drug is long, and clinical trials are expensive. Thus, it is natural to ask how policies that alter the economics of the pharmaceutical industry will affect private firms' willingness to make these investments. Recently, Kirsten Axelsen made precisely that point, saying:

> "*We need to do a proper job of investigating how investors are reacting, and policymakers should be acknowledging the uncertainty around the potential impact on drug development before expanding the policy. The investment of billions of dollars in developing medicines—and the curative and health benefits they provide is at stake. There is too much at stake to not seek better evidence to inform future policy on biopharma regulation*." (Axelsen and Garrison, 2024)

In this paper, we seek to take a step towards understanding how R&D investment is responding to the IRA by examining the impact of the IRA on the R&D intensity of pharmaceutical companies with varying exposure to Medicare revenues. The rest of this paper is organized into four sections. The next section presents some background and summarizes the decision framework used in analyzing R&D choices. The third section outlines our empirical strategy for making estimates on the IRA's impact on R&D spending. The fourth section presents results from our empirical model. The fifth and final section offers some observations on what we believe the results mean.

II. Background and Framework

The IRA has sparked vigorous disagreement about how its provisions will affect innovation. Some patient groups have argued that increased affordability of life-saving drugs will boost demand for those drugs, accelerating innovation.[2] Other consumer groups fear that the law's limits on prices will slow the development of new products, such as new cancer drugs or new cell and gene therapies.[3]

[2] See patients for affordable drugs: https://www.patientsforaffordabledrugs.org/.
[3] See Alliance for Aging Research: https://www.agingresearch.org/; and Alliance for Aging Research (2024) amicus brief.

Indeed, even the pharmaceutical industry itself has offered somewhat different assessments in different venues. For example, PhRMA made the following declarations in its litigation against the IRA:

> "*Congress's recently enacted Inflation Reduction Act of 2022, Pub. L. 117-169 (IRA or the Act), however, upends this time-tested, market-based system for encouraging innovation. In its place, Congress established a system of price controls, seeking to reduce expenditures even at the cost of drastically slowing innovation, reducing drug availability, and worsening patient outcomes*." (PhRMA, 2023)

In contrast, pharmaceutical companies' filings with the Securities and Exchange Commission (SEC) create a different view of the R&D environment for pharmaceutical manufacturers. For instance, the CFO of AstraZeneca stated the following during the Q3 2024 earnings call:

> "*But overall, I think, it's fair to say that from a biopharma perspective, the IRA impact will be manageable. We have good programs in place to drive further volume*." (AstraZeneca, 2024)

Similarly, the Sanofi CEO in Q3 of 2024 noted modest impacts, if any, on R&D.

> "*From an IRA standpoint, our portfolio actually lends us very well to this because we have an innovative portfolio. We have an innovative pipeline coming and that's what we see as the U.S. marketplace really values innovation. And so, we don't really see any meaningful impact on our portfolio there for any reason for that matter, especially in relation to how the pricing provisions that are in place.*" (Sanofi, 2024)

Both companies announced large increases in R&D spending that coincide with these statements.

Our aim is to use quasi-experimental evidence to assess which of these competing characterizations of the altered incentives for R&D created by the IRA is most correct. To analyze the effects of the IRA on pharmaceutical R&D investment, we adopt the conventional view that R&D investment decisions are based on the expected cash flow generated by investment projects (e.g., CBO, 2021). This is also the view underlying most arguments that the IRA would reduce investment activity. The effects of the IRA then hinge on how the law affects the cash flow generated by future successful R&D projects. The IRA affects these cash flows in multiple ways, mainly by changing the revenues that firms can expect to earn by selling drugs to Medicare beneficiaries.[4]

The law has two main provisions that would reduce the prices—and, thus, revenues—that manufacturers receive for prescription drugs: the inflation rebate and the prescription drug negotiation program. The inflation rebate provision requires manufacturers to pay a rebate to the government if prices paid by Medicare increase at rates greater than the change in the consumer price index (CPI-U). While inflation rebates will reduce revenues from many existing products, they will likely have more muted effects on the revenues earned by future products—and, thus,

[4] Below, we focus on the major provisions related to prescription drugs. We do not address various tax features that might affect the economic choices of pharmaceutical manufacturers, like the new tax on stock buybacks that could have some effect on the relative attractiveness of R&D spending.

on R&D incentives—because manufacturers can raise new product launch prices above where they otherwise might have been.

The IRA's negotiation program seeks to reduce prices for certain single source drugs. The policy applies to high-sales Medicare drugs (those with over $200 million in annual sales) that are a specified number of years past FDA approval (9 years for small molecule drugs and 13 years for biologics). Unlike the inflation rebate provision, the negotiation program directly reduces the prices that future drugs can expect to receive from the Medicare program (albeit late in a drug's life cycle) and, as such, has the potential to reduce R&D investment incentives within the framework we use here. Because small molecule drugs become eligible for negotiation sooner than biologic drugs, expected future revenues may fall more for small molecule drugs, although whether this will translate into a larger effect on investment is unclear in light of the many other differences in the development process and regulatory environment for these different categories of drugs.

Other IRA provisions have the potential to increase revenues by reducing Medicare beneficiaries' out-of-pocket costs and thereby increasing demand. First, the IRA caps annual out-of-pocket drug spending at $2,000 (indexed to inflation). Second, it established zero cost-sharing for a number of vaccines. Third, it implements a monthly out-of-pocket cap for insulin products of $35. Finally, eligibility for the most generous version of the low-income subsidy for Medicare Part D was extended to higher income levels. All four of these provisions are likely to increase demand for prescription drugs under the Medicare program and, in turn, revenues (Duggan and Morton, 2010).

Because the IRA is multifaceted and has complex incentives, the net impact on net revenues and the expected payoffs to investing in new prescription drugs are empirical questions. The IRA was enacted in August of 2022 and, therefore, pharmaceutical manufacturers have had three years to consider the potential impact on their revenues and, during that time period, have considered hundreds of billions of dollars in investments in both new projects and those in the development process. Therefore, observing the investment behavior of these firms will allow for a window into how the IRA is affecting expectations about the profitability of making investments in R&D.

III. Empirical Strategy

To assess the effect of the IRA on investment decisions, we adopt a difference-in-differences approach that examines changes in investment decisions made by firms with higher and lower shares of their revenues from Medicare in 2019. The assumption underlying this approach, which we substantiate below, is that firms that derived a greater share of their revenues from Medicare in 2019 have R&D portfolios tilted toward products likely to derive a larger share of their revenues from Medicare and, thus, experienced a larger shock to their expected future revenues from the IRA than other firms.

Our outcome variables are measures of R&D intensity, the ratio of R&D spending to total revenues, a widely used metric of R&D activity (Hughes, 1988). At the firm level, innovation is seen as the product of R&D (Panteleimon and Shaw, 2024; Darfo-Oduro, 2023). In constructing our R&D intensity metric, we measure both direct firm expenditures on R&D and the sum of direct and some indirect spending through acquired and in-process R&D (AIPR&D). This category includes irregular expenses such as licensing, alliance payments, and the acquisition of

products from other firms' R&D pipeline. Most major pharmaceutical companies report AIPR&D, though at a lesser frequency than R&D.

The rest of this section describes our approach in greater detail.

Study Design

As described above, we aim to estimate the effect of the IRA on R&D intensity by comparing the behavior of firms with greater and lesser exposure to the IRA's changes. Unlike the canonical difference-in-differences model, we do not have "untreated" comparators, as nearly all pharmaceutical companies with publicly available financial data have products subject to IRA negotiations in the upcoming years.

Instead, we compare the R&D investment behavior of pharmaceutical manufacturers with differing shares of revenues derived from Medicare as of 2019. The assumption underlying this approach is that a firm's Medicare share in 2019 is positively correlated with the likely Medicare share of the drug products in a firm's R&D portfolio. If this is the case, having a higher Medicare share as of 2019 will be predictive of having a greater change in expected future revenues attributable to the IRA.

For this assumption to hold, R&D investment portfolio composition by therapeutic area must be persistent or, as some recent research has called it, "sticky" (Cohen et al., 2025). There are plausible reasons to expect this type of stickiness because of firms' investments in specialized human talent, laboratory facilities, and clinical relationships. Indeed, Cohen et al. show that blockbuster sales and lead product sales are, in fact, strongly related to early-stage investment projects (see their Table 2). These results for blockbusters are highly relevant; the IRA requires that products selected for negotiation must have Medicare sales of at least $200 million, and none of the drugs selected for the first round of negotiation (2026) had annual sales of less than $1 billion, while none of the drugs selected for the second round of negotiation (2027) had annual sales of less than $1.2 billion.[5,6] We also examined the 10-K filings for 2017 to 2024 from our sample firms. We found that firms that continuously reported projects involving diseases of older adults had 2019 Medicare exposure of 28.1% and those that did not consistently focus on diseases of aging had exposure of 18.9% (the median exposure was 20.4%). Thus, the available evidence indicates that there is substantial persistence in investments by therapeutic area.

We posit that most of the information necessary for firms to make initial investment choices in response to the legislation was present in the legislative text and the accompanying Congressional Budget Office (CBO) analysis, and those provided by other public and private

[5] Anderson Cook A., and Richard G. Frank. 2024. "Impact of Federal Negotiation on Prescription Drug Prices." *The Brookings Institution*. https://www.brookings.edu/articles/impact-of-federal-negotiation-of-prescription-drug-prices/; and Frank, Richard G., and Yihan Shi. 2025. "Cumulative net earnings of drugs selected or likely to be selected for negotiation." *The Brookings Institution*. https://www.brookings.edu/articles/cumulative-net-earnings-of-drugs-selected-or-likely-to-be-selected-for-negotiation/.

[6] We estimate the autocorrelation of Medicare revenue share over the period 2017 to 2024. That estimate is 0.89. However, given the relatively short time period and the small number of new launches per year for most of our sample, this autocorrelation may be high because firms persistently earn a large share of their revenues from the same set of currently approved drugs, not because their newly introduced drugs have a similar Medicare share to their prior drugs. Our analysis of 10-K filings and the evidence from Cohen et al is not subject to that limitation.

analyses (e.g., ASPE, Avalere). This included shifts in potential revenues resulting from the enactment of the IRA in August 2022. Consistent with this, we examine a pre-IRA period that extends from January 2017 through August 2022 and a post-IRA period that extends from September 2022 through December 2024.

We therefore estimate the following model by ordinary least squares:

$$R_{it} = \beta_0 + \beta_1 E_i + \beta_2 (IRA_t \times E_i) + d_t + \mu_i + \varepsilon_{it} \qquad (1)$$

where i indexes firms, t indexes years, R is the R&D intensity metric, E is our Medicare exposure measure, IRA is a dummy equal to 1 following IRA enactment in the 3rd quarter of 2022, d is a vector of time fixed effects, μ is a vector of pharmaceutical firm fixed effects, and ε is an error term. Unlike a canonical difference-in-difference model, we exclude the "treatment" term (E_i) outside the interaction, as it is implicitly included in the firm fixed effects.

The coefficient of interest in equation (1) is β_2, which we interpret as reflecting the causal response of investment decisions to an incremental increase in Medicare share—and, thus, IRA exposure. To aid in interpretation, we often present a scaled version of this coefficient that corresponds to the effect of moving from the 25th percentile to the 75th percentile of Medicare exposure. Identification relies on an assumption that without the IRA, firms with different Medicare drug spending exposures would not have different changes in R&D intensity post-enactment of the IRA. Our approach follows prior research on policy changes that differentially affect hospitals based on their Medicare shares of patient admissions (Acemoglu and Finkelstein, 2008).[7]

Measuring R&D Intensity

We collect financial data from quarterly financial reports, such as 10-Qs, from nearly all publicly traded research-focused pharmaceutical companies[8] subject to the IRA drug negotiation program. This sample of firms represents a significant range in market capitalization (from $732.9 billion to $17.7 billion in Q4 2024), maturity, location, and product line composition (firms in sample are listed in the Appendix).[9] Further, they represent a significant portion of the global pharmaceutical market, capturing $745 billion of the $1.8 trillion of global pharmaceutical sales in 2024 (IQVIA, 2024).

Our data includes nearly all financial measures reported by our sample, but we focus on a few key metrics from their quarterly income statements. These include global revenues/sales, research and development expenditures, and acquired in-process research and development. Finally, we weigh our regressions by firm revenues.

The primary focus of our analysis are two metrics of R&D activity—R&D intensity (R&D as a portion of revenue) and AIPR&D intensity (R&D + AIPR&D as a portion of revenue), each of which is commonly used in this literature (see for example Hall, Mairesse, and Mohnen, 2009; Darfo-Oduro, 2023). Examining R&D investment scaled by revenues, rather than absolute spending on R&D, yields a measure that is on the same scale for firms of varying sizes, which is

[7] For an extensive treatment of this type of research design, see Callaway, Goodman-Bacon, and Sant'Anna (2024).
[8] We exclude only one company from our analysis, Roche, because their regular financial reports omit several key data points that are crucial for our analysis, such as R&D expenditures.
[9] See Astellas Q4 2024 Annual Report and Eli Lilly Q4 2024 10-K.

necessary for our difference-in-differences research design. Notably, even in our relatively small sample of large companies, some firms spend many times more on R&D than their smaller counterparts (e.g., on average, Merck spends 7 times more than Astellas). Because we are ultimately interested in effects on the aggregate R&D investment, we nevertheless weigh our regressions by mean firm revenues in the pre-period so as to give an appropriately higher weight to larger firms. As a robustness check, we also examine specifications where the outcome is the natural logarithm of R&D spending (in which case the firm fixed effect implicitly controls for firm size); we weigh these regressions by mean pre-period R&D spending.

Using AIPR&D intensity in addition to R&D intensity provides two complementary views of firms' R&D decisions. AIPR&D provides a broader view than just the investments a firm makes to further their own pipeline to the market. It includes transactions such as acquiring in-process research from other firms, as well as paying licensing and partnership fees for collaborative efforts.

Measuring Medicare Exposure

Key to our identification strategy is our measure of Medicare exposure, the proportion of each firm's sales that come from Medicare. We estimate this metric using a combination of sales data (from public firm reports) and survey data on Medicare's contribution to patient payments for drugs.

First, we scraped total annual sales in both the U.S. and globally for each drug from the annual financial statements of our sample firms. This method has some important advantages over using reports on total sales of a drug in a region (e.g., from IQVIA or the Medicare Dashboard). First, we can accurately estimate how much revenue a particular firm receives from a drug in a given year *after* sending or receiving partnership shares. Many drugs, such as one of Medicare's highest expenditure medications, Eliquis, have alliance agreements to share sales amongst multiple firms that participated in the development costs of the product. The revenue share that each company receives is often difficult to estimate and can differ by sales location and year. Thus, by directly observing global and regional revenues after such transactions are made, we can more accurately estimate a particular firm's net revenues from a drug in the U.S. market.

Next, we use annual survey data from the Medical Expenditure Panel Survey (MEPS) to estimate the proportion of U.S. revenues that come from Medicare for any given drug and year. Many drugs, particularly those for rare diseases or oncology, are not perfectly identified by the MEPS. In these instances, we classify drugs using the Multum therapeutic classification systems, then estimate the Medicare contribution towards drugs in that particular therapeutic class.

Using these two sources, we can impute the revenue that each firm receives from the U.S., and by extension (using MEPS), how much of that revenue comes from Medicare. After dividing by total drug sales[10], we arrive at our annual estimate of Medicare exposure for each firm in our sample.

[10] Some firms report their regional drug sales for a selection of their drugs (e.g., Novartis reports their Top 20 drugs by sales). These drugs usually represent an overwhelming majority of the firm's sales. However, rather than using global revenues in our calculation of Medicare exposures, as reported in the firm's income statement, we use the sum of global sales for those drugs reported. Assuming the unreported drugs have a similar share of Medicare

IV. Results

Table 1 reports means and distribution for R&D related spending, R&D intensity metrics, and the Medicare drug sales share of revenues in 2019. The core R&D spending by our sample pharmaceutical manufacturers has a mean of $1.9 billion, with an interquartile range of $1.2 to $2.4 billion. Thus, as our sample selection criteria indicated, our firms represent "big pharma" firms: large research-based pharmaceutical manufacturers. Our more expansive AIPR&D outcome metric adds 7% to the mean R&D spending, implying a mean spending of just under $2.0 billion. That R&D spending translates into a mean R&D intensity of 19.7% with an interquartile range from 14.7% to 22.5%. Finally, the mean Medicare drug spending exposure in 2019 was 22.6% with an interquartile range from 16.8% to 28.4%.

Table 1: Sample Summary Statistics

	Mean	Std. dev.	25th Percentile	75th Percentile
Revenue ($m)	9,910	5,154	5,897	12,749
R&D Expenditure ($m)	1,843	1,163	1,184	2,354
R&D+AIPR&D Expenditure ($m)	1,973	1,399	1,230	2,442
R&D Intensity (%)	19.7	8.05	14.7	22.5
R&D+AIPR&D Intensity (%)	21.1	11.6	15	23.4
Medicare Exposure (%)	22.6	8.48	16.8	28.4

Source: Data scraped from pharmaceutical firms' quarterly and annual reports. Medicare Exposure is derived from authors' calculations, as described in Section III.

Table 2 reports the difference-in-differences estimates for the R&D intensity outcomes with year and company fixed effects[11]. Our point estimates indicate that a 1 percentage point increase in Medicare exposure increases the causal effect of the IRA on R&D intensity by 0.098 percentage points and on AIPR&D intensity by 0.183 percentage points. Neither estimate is statistically significant at conventional levels. [12] To provide another way of gauging the magnitude of these effects, the memorandum line in Table 2 rescales our point estimates to reflect the effect of a change from the 25th percentile to the 75th percentile of the exposure distribution. We estimate that such a change would result in a 1.1 percentage point increase in the IRA's effect on R&D intensity and a 2.1 percentage point increase in the effect on AIRP&D intensity.

revenue (i.e., closer than 0), our method is a closer approximation of Medicare exposure. Using the global revenue of all drugs would likely lead to an underestimation of Medicare exposure.

[11] We conduct a test to determine whether our difference-in-difference specification has sufficient statistical power to evaluate our hypothesis. We find that all our regressions exceed the required R-squared for an F-test using standard parameters (80% power and 0.05 alpha) for our three tested parameters: constant, IRA timing dummy, and the interaction between the IRA timing dummy and Medicare Exposure.

[12] We assess significance using a two-tailed t-test.

Table 2: R&D Intensity Difference-in-Difference

	(1) R&D Intensity	(2) AIPR&D Intensity
IRA Passed	0.332	-1.705
	(2.237)	(3.286)
IRA Passed	0.0980	0.183
× Medicare Exposure	(0.0758)	(0.111)
Constant	17.83***	19.08***
	(0.560)	(0.822)
Interquartile Treatment Effect	1.137	2.127
N	512	512
Company Fixed Effects	✓	✓
Year Fixed Effects	✓	✓

Interquartile Treatment Effect is the difference in 25th and 75th percentiles of Medicare Exposure times the IRA and Medicare Exposure interaction coefficient.
Standard errors in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

Our overarching conclusion is that our estimates provide no evidence that supports the propositions that the IRA's enactment reduced R&D intensity. If anything, our (imprecise) point estimates point to an increase in R&D intensity.

Robustness Analysis

As a check on our findings, we estimated difference-in-differences regressions where we replaced the outcome variable with log R&D spending. The estimation results are reported in Table 3. The estimates indicate that a 1 percentage point increase in Medicare exposure increases the causal effect of the IRA on R&D spending by 0.7 log points and the effect on AIPR&D spending by 0.8 log points. Unlike our baseline results, these estimates are statistically significant beyond conventional levels. These results accord with our baseline conclusion that there's no evidence that the IRA's enactment resulted in reduced R&D intensity and, if anything, some evidence that it increased it.

Table 3: Log R&D Difference-in-Difference

	(1) Log R&D Expenditures	(2) Log AIPR&D Expenditures
IRA Passed	-0.0431	-0.0824
	(0.0798)	(0.0952)
IRA Passed	0.00711***	0.00827**
× Medicare Exposure	(0.00270)	(0.00323)
Constant	7.530***	7.575***
	(0.0200)	(0.0238)
Interquartile Treatment Effect	.083	.096
N	512	512
Company Fixed Effects	✓	✓
Year Fixed Effects	✓	✓

Interquartile Treatment Effect is the difference in 25th and 75th percentiles of Medicare Exposure times the IRA and Medicare Exposure interaction coefficient.
Standard errors in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

V. Interpretation and Implications

Our results suggest that the IRA has not reduced R&D intensity or R&D spending by large pharmaceutical manufacturers. We consider two potential explanations for these findings.

One is that firms expect the features of the IRA that increase demand for prescription drugs to outweigh the features of the law that reduce prices, making the law either neutral or somewhat positive for expected revenue flows and thus R&D, on net. The possibility that the net impact on pharmaceutical revenues is neutral or even positive aligns with some comments made in recent industry earnings calls. The quote from AstraZeneca's CEO noted earlier is instructive:

> "*But overall, I think, it's fair to say that from a biopharma perspective, the IRA impact will be manageable. We have good programs in place to drive further volume*" (Q3 2024 Earnings call).

A second potential explanation is that the IRA is very selective in how it applies pricing policies. As noted above, the negotiation program only applies to drugs with Medicare sales of over $200 million per year, which may limit its effects on projects on the margin of viability. Similarly, while the inflation rebate policy reduces revenue for existing drugs, it is likely to have little effect on expected revenue for new brand drugs—and thus R&D investment—because firms can raise launch prices.

This feature of the inflation rebate program and the fact that the negotiation program only applies to drugs where the Active Pharmaceutical Ingredient has been on the market for either 9 or 13 years also increases the revenue earned by new products relative to older ones, which may

encourage firms to increase their R&D effort related to new products. This effect has some precedent in research on the effects of generic competition (Thakor and Lo, 2022). They show that when there are revenue shocks stemming from intensified competition, firms shift spending from investing in promoting existing products to R&D activities to bring in new products with exclusivity protections. The analogy in the IRA case is that rather than altering spending to "escape competition" such as through line extensions, drug manufacturers may move investments away from more price regulated products toward the less regulated drugs that come to the market through R&D.[13] This type of logic goes back to Arrow (1962), who argued that innovation is promoted by forces that disrupt the status quo; the relative revenue shocks created by the IRA may serve this function.

The industry and some researchers have made dire predictions about the impact of the IRA on pharmaceutical R&D (Ezell, Kann, and Barbosu, 2025). Many of these predictions rely on studies of policies that result in much larger price reductions than are part of the IRA (Philipson and Durie, 2021; Ho and Pakes, 2024) and therefore do not provide the most relevant evidence. Since 2022, the industry has been assessing and crafting their business strategies to respond to the altered incentives created by the IRA. In this analysis, we rely on observed changes in R&D intensity by large research-based pharmaceutical manufacturers. The analysis, therefore, aimed at providing information on the actual responses to the IRA based on the exposure to the new policy faced by each firm. The results indicate that industry responses to the IRA to date have not led to reduced R&D intensity. Therefore, the claims that one might expect large reductions in new drugs numbering in the many dozens over the next 10 years are not supported by the observed R&D activity that has taken place since the enactment of the law. That finding is consistent with reports from investment analysts and industry participants themselves. The R&D decisions of the last 2.5 years will affect the supply of new drugs over the next 2 to 12 years and thus call the dire predictions into question.

Nevertheless, we remain in the early days of the implementation of the IRA's prescription drug provisions. While the first set of negotiated prices has been announced and the estimated savings are notable but modest with respect to their effects on overall industry revenues, those prices are not yet in force. There remains much to be learned over the coming years. One area that is important to understand is how the IRA will influence the mix of new products to be developed. There is a great deal of speculation and debate on how the IRA will affect investment in small molecule products and whether it will encourage fewer line extension offerings, little to no health benefits, or whether fewer drugs that treat illnesses associated with advancing age will be developed. Strong views on most of these issues have been offered. Yet the empirical foundation for them is quite thin. Given the complexity of the legislation and the dynamics of pharmaceutical innovation, how the policy as a whole will work is an empirical question that will only be answered over time.

[13] Given this line of reasoning, one might think that would result in an incentive for more line extensions of existing drugs. The implementation of the IRA attenuates that incentive by defining a drug as the Active Pharmaceutical Ingredient regardless of strength or formulation.

Appendix

Firms in Sample, with Basic Characteristics

Company	2024 Market Cap ($b)	2024 Revenue ($b)	Medicare Exposure (%)
AbbVie	314.0	56.3	13.6
Amgen	140.1	33.4	40.1
Astellas	17.7	12.3	25.3
AstraZeneca	203.2	54.1	16.3
Bayer	19.7	50.4	7.1
Bristol Myers Squibb	114.7	48.3	31.2
Eli Lilly	732.9	45.0	21.1
GSK	69.9	40.1	22.6
Gilead	115.1	28.8	17.4
Johnson & Johnson	349.2	88.8	19.0
Merck	251.6	64.2	26.5
Novartis	214.6	51.7	15.6
Novo Nordisk	388.4	42.1	19.6
Pfizer	150.3	63.6	30.4
Regeneron	78.3	14.2	37.0
Sanofi	122.5	52.1	18.8

Source: Data scraped from pharmaceutical firms' quarterly and annual reports. Medicare Exposure is derived from authors' calculations, as described in Section III.

References

Acemoglu, Daron, and Amy Finkelstein. 2008. "Input and Technology Choices in Regulated Industries: Evidence from the Health Care Sector." *Journal of Political Economy* 116(5): 837-880. https://doi.org/10.1086/595014.

Alliance for Aging Research. 2024. *Amicus curiae brief for the Alliance for Aging Research in support of neither party* [Amicus brief], In *Novartis Pharmaceuticals Corp. v. Becerra* (No. 3:23-cv-14221-ZNQ-JBD) (D.N.J). Retrieved from https://www.agingresearch.org/wp-content/uploads/2024/03/2024.03.07-Novartis-Amicus-Curiae-Alliance-for-Aging-Research-Brief-4859-3423-1467-1.pdf.

Arrow, Kenneth. 1962. "Economic Welfare and the Allocation of Resources to Invention." In *The Rate and Direction of Inventive Activity: Economic and Social Factors*, edited by the Universities-National Bureau Committee for Economic Research and the Committee on Economic Growth of the Social Science Research Councils, 609– 26. Princeton, NJ: Princeton University Press.

Axelsen, Kirsten, and Louis Garrison. 2024. "Opinion: Slow Down on IRA Expansions, Research Possible Outcomes." *BioSpace*. https://www.biospace.com/opinion-slow-down-on-ira-expansions-research-possible-outcomes.

Banerjee, Pradip. 2022. "Nature of Financial Constraints and R&D Intensity." *Finance Research Letters* 50. https://doi.org/10.1016/j.frl.2022.103184.

Callaway, Brantly, Andrew Goodman-Bacon, and Pedro H.C. Sant'Anna. 2024. "Difference-in-Differences With a Continuous Treatment." *National Bureau of Economic Research*, Working Paper #32117. https://www.nber.org/system/files/working_papers/w32117/w32117.pdf.

Citeline. 2025. "Pharma R&D Annual Review 2025." White paper. https://www.citeline.com/en/rd25.

Cleary, Ekaterina Galkina, Jennifer M. Beierlein, Navleen Surjit Khanuja, Laura M. McNamee, and Fred D. Ledley. 2018. "Contribution of NIH Funding to New Drug Approvals 2010–2016." *Proceedings of the National Academy of Sciences of the United States of America* 115(10): 2329–34. https://doi.org/10.1073/pnas.1715368115.

Cleary, Ekaterina G., Matthew J. Jackson, Edward W. Zhou, and Fred D. Ledley. 2023. "Comparison of Research Spending on New Drug Approvals by the National Institutes of Health vs. the Pharmaceutical Industry, 2010–2019." *JAMA Health Forum* 4(4): e230012. https://doi.org/10.1001/jamahealthforum.2023.0511.

Cohen, Wesley M., Matthew John Higgins, William D. Miles, and Yoko Shibuya. 2025. "Blockbuster Products, Sequels, and the Nature of Innovation." *SSRN*. https://ssrn.com/abstract=5086278 or http://dx.doi.org/10.2139/ssrn.5086278

Congressional Budget Office (CBO). 2021. "Research and Development in the Pharmaceutical Industry." https://www.cbo.gov/publication/57126.

Darfo-Oduro, Raymond. 2023. "Revisiting the Effect of R&D Intensity on Innovation Performance: An Instrument Variable Approach." *European Conference on Innovation and Entrepreneurship* 18(1): 242-249.

Duggan, Mark, and Fiona Scott Morton. 2010. "The Effect of Medicare Part D on Pharmaceutical Prices and Utilization." *The American Review* 100(1): 590-607. http://www.jstor.org/stable/27804943.

Ezell, Stephen, Leah Kann, and Sandra Barbosu. 2025. "The Inflation Reduction Act Is Negotiating the United States Out of Drug Innovation." *Information Technology & Innovation Foundation*. https://itif.org/publications/2025/02/25/the-inflation-reduction-act-is-negotiating-the-united-states-out-of-drug-innovation/.

Hall, Bronwyn H., Jacques Mairesse, and Pierre Mohnen. 2009. "Measuring the Returns to R&D." *National Bureau of Economic Research,* Working Paper #15622. https://www.nber.org/papers/w15622.

Hall, Bronwyn H., and Josh Lerner. 2010. "The Financing of R&D and Innovation." *National Bureau of Economic Research*, Working Paper #15325. https://www.nber.org/papers/w15325.

Ho, Kate, and Ariel Pakes. 2024. "Policy Options for the Drug Pricing Conundrum." *National Bureau of Economic Research,* Working Paper #32606. https://www.nber.org/papers/w32606.

Hughes, Kirsty. 1988. "The Interpretation and Measurement of R&D intensity—A note." *Research Policy* 17(5): 301-307. https://doi.org/10.1016/0048-7333(88)90010-8.

IQVIA Institute for Human Data Science. 2024. "Global Use of Medicine: Outlook to 2028." https://www.iqvia.com/-/media/iqvia/pdfs/institute-reports/the-global-use-of-medicines-2024-outlook-to-2028/iqvia-institute-global-use-of-medicines-2024-forweb.pdf.

IQVIA Institute for Human Data Science. 2025. "Global Trends in R&D 2025: Progress in Recapturing Momentum in Biopharma Innovation." https://www.iqvia.com/-/media/iqvia/pdfs/institute-reports/global-trends-in-r-and-d-2025/iqvia-institute-rd-trends-2025-forweb.pdf.

Nasdaq. 2024. "Sanofi (SNY) Q3 2024 Earnings Call Transcript." https://www.nasdaq.com/articles/sanofi-sny-q3-2024-earnings-call-transcript.

Nasdaq via Roic AI. 2024. "AstraZeneca PLC (AZNCF) Q3 2024 Earnings Call Transcript." https://www.roic.ai/quote/AZNCF/transcripts/2024/3.

Panteleimon, Kruglov, and Charles Shaw. 2024. "Financial Performance and Innovation: Evidence From USA, 1998-2023." https://dx.doi.org/10.2139/ssrn.4753538.

Pennings, Enrico, and Luigi Sereno. 2010. "Evaluating Pharmaceutical R&D Under Technical and Economic Uncertainty." https://www.realoptions.org/papers2010/92.pdf.

Pharmaceutical Research and Manufacturers of America (PhRMA). 2023. *Complaint, National Infusion Center Association v. Becerra*. No. 1:23-cv-00707. District Court for the Western District of Texas Austin Division. https://litigationtracker.law.georgetown.edu/wp-content/uploads/2023/06/PhRMA_20230621_COMPLAINT.pdf.

Philipson, Tomas J., and Troy Durie. 2021. "The Impact of HR 5376 on Biopharmaceutical Innovation and Patient Health." *The University of Chicago*. https://cpb-us-w2.wpmucdn.com/voices.uchicago.edu/dist/d/3128/files/2021/08/Issue-Brief-Drug-Pricing-in-HR-5376-11.30.pdf.

Schlander, Michael, Karla Hernandez-Villafuerte, Chih-Yuan Cheng, Jorge Mestre-Ferrandiz, and Michael Baumann. 2021. “How Much Does It Cost to Research and Develop a New Drug? A Systematic Review and Assessment.” *PharmacoEconomics* 39(11): 1243-1269. https://doi.org/10.1007/s40273-021-01065-y.

Thakor, Richard, and Andrew W. Lo. 2022. “Competition and R&D Financing: Evidence From the Biopharmaceutical Industry.” *Journal of Financial and Quantitative Analysis* 57(5): 1885-1928. https://doi.org/10.1017/S0022109021000284.