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Preliminary Estimates of the Macroeconomic Costs of Cutting Federal Funding for Scientific Research

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Ignacio González, Juan Montecino, and Vasudeva Ramaswamy worked on this report.

About IMPA The Institute for Macroeconomic & Policy Analysis (IMPA), housed at the Economics Department of American University, is a nonpartisan research institute focused on macroeconomics, inequality, and economic policy. The IMPA model emphasizes the widespread prevalence of market power in goods and labor markets, heterogeneity among sectors and firms in the economy, and income and wealth inequality.
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Key Takeaways

- Budget cuts to public R&D would significantly hurt the economy in the long run, with large negative effects on GDP, investment, and government revenue.
- A 25 percent cut to public R&D spending would reduce GDP by approximately 3.8 percent in the long run. This effect is comparable to the decline in GDP during the Great Recession.
- Cutting annual public R&D spending in half would decrease GDP by approximately 7.6 percent, making the average American approximately $10,000 poorer (in today's dollars) than the value implied by the historical trend in GDP.
- Cutting public R&D would also shrink federal government revenue. A 25 percent cut in R&D would decrease revenue by approximately 4.3 percent annually, while a 50 percent cut would decrease it by 8.6 percent annually.

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Introduction

Technological progress—and the scientific discoveries that drive it—is the single most important engine of long-run economic growth and society's material well-being. Federal agencies such as the National Institutes of Health (NIH) and National Science Foundation (NSF) are critical sources of funding for basic and applied scientific research. Recently, many of these agencies have seen their research operations frozen or downsized as part of retrenchments imposed by the Department of Government Efficiency and the Trump administration's broader agenda.

This brief presents preliminary estimates of the long-run macroeconomic costs of cutting public spending on the sciences. Building on up-to-date empirical evidence on the long-run effects of government spending on research and development (R&D), we use the IMPA macroeconomic policy model to assess how cuts to the NIH and other agencies that undertake public R&D spending could impact long-run productivity growth, GDP, and other macroeconomic indicators. Since it takes many years for initial research to translate into medical advances and new technologies, the time frame of our analysis is approximately 25–30 years.

Our preliminary model-based evaluation finds that budget cuts to public R&D would significantly hurt the economy in the long run, with large negative effects on GDP and private investment. A 25 percent reduction in public R&D spending would reduce GDP by approximately 3.8 percent in the long run. This effect is comparable to the decline in GDP during the Great Recession.[1]

Cutting annual public R&D spending in half (from 0.6 percent of GDP to 0.3 percent of GDP or approximately $260 per person) would have an even larger effect on economic growth and living standards, making the average American some $10,000 poorer (in today's dollars) than projected under the historical trend in productivity growth.[2]

Finally, because cutting public R&D would shrink the economy, it would also shrink the tax base and federal government revenue. A 25 percent cut in R&D would decrease revenue by approximately 4.3 percent annually, while a 50 percent cut would decrease it by 8.6 percent annually.

How Spending on Scientific Research Impacts the Macroeconomy

The government funds research that is unlikely to receive alternative forms of financing despite having large social returns.[3] Such research may be deemed too risky an investment target by private investors, or the economic returns to the associated innovations are often diffuse or difficult for private business to appropriate. In these situations—which represent a common type of market failure—private business lacks

[1] https://www.federalreservehistory.org/essays/great-recession-of-200709

[2] The R&D spending numbers are calculated from line 62 of the Bureau of Economic Analysis's Table 5.9.5 for the year 2023 (accessed April 2, 2025). We calculate the per capita cost of the spending cuts assuming a counterfactual in which real GDP per capita grows at its average rate since 1947.

[3] Bloom et al. (2013) suggest that the social returns to public R&D are approximately 2–4 times larger than the private returns. See Jones and Summers (2022) for an overview of the debate on the social returns to innovation.

a financial incentive to invest in necessary R&D even though society and the economy as a whole grows wealthier when such research is undertaken.

Government agencies such as the NIH and the NSF help solve this market failure by funding research with positive externalities that would otherwise remain underfunded. From a macroeconomic perspective, these public investments in R&D increase the stock of knowledge in the economy and directly boost GDP in the long run by increasing aggregate productivity. Moreover, because technological progress makes private businesses and their workers more productive, it also raises real wages and the returns on private investment, which increases investment. This complementarity with private factors of production means that public R&D has an additional, indirect effect on GDP: Economists say it *crowds in* private investment.[4]

Understanding the Relationship Between Public R&D and GDP

The IMPA macroeconomic policy model assumes that firms employ a standard *production function*, according to which output (GDP) is produced with inputs of private physical capital (K) and labor (L). The amount of output produced with a given amount of inputs depends on total factor productivity (TFP), which is driven by the economy's trend of technological progress and by the stocks of public factors of production, including public investments in scientific R&D.

The long-run percent change in GDP following a change in public R&D investments can be decomposed as:

$$\%\Delta GDP = a * \%\Delta R\&D + b * \%\Delta K + c * \%\Delta L$$

The first term on the right side of the equation (in blue) represents the direct productivity impact of public R&D on GDP. The term $\boldsymbol{a}$ represents the elasticity of GDP with respect to public R&D. Our model-based assessment, shown in Table 1, assumes $\boldsymbol{a}$=0.11, a value in line with the estimates in Fieldhouse and Mertens (2024).

The other terms on the right side of the equation (in red) are the indirect effects of a change in public R&D on GDP that occur through changes in private capital investments and employment. Because public R&D is complementary to private factors of production, these indirect effects are positive, so they add to the long-run impact of a change in public R&D on GDP.

Our model-based evaluation draws on new empirical evidence on the long-run returns to government-funded R&D. Using historical data on appropriations for major federal agencies, Fieldhouse and Mertens (2024) provide causal evidence that public R&D has large effects on aggregate business productivity and other variables associated with innovation. According to their benchmark results, a one percent increase in the stock of public R&D leads to a statistically significant increase in TFP of approximately 0.2 percent after around 15 years.[5] They also show that investment in basic scientific research has high social returns, which

[4] Recent theoretical and empirical evidence supports the view that public investment in R&D crowds in private factors of production. See, for instance, Fieldhouse and Mertens (2024), Moretti et al. (2025), and Akcigit et al. (2021).

[5] Fieldhouse and Mertens (2024) estimate the total effects of the stock of public R&D on GDP; these effects include both the direct impact on productivity and the indirect spillovers through, for example, crowding-in of private investment. In addition,

range from 140 to 210 percent for nondefense spending.

Evaluating Cuts to Scientific R&D

We evaluate several policy scenarios. First, we consider uniform and permanent budget cuts to every major agency that funds nondefense scientific R&D. These include the NIH, NSF, Department of Energy (DoE), and National Aeronautics and Space Administration (NASA). We consider cuts of 25 percent, 50 percent, and 75 percent. We also consider the long-run macroeconomic impact of cutting the budgets of each of these agencies by 50 percent.

For each policy scenario, we present the long-run effect of the spending cuts relative to the outcomes under a baseline policy holding the spending level of each agency equal to its federal budget share over the 10-year window between 2010 and 2019.[6]

Table 1 shows the results of our model-based evaluation. Cutting public spending on R&D would have a large negative effect on GDP. A 25 percent cut to nondefense public R&D would reduce GDP by approximately 3.8 percent. As explained above, this reduction is due to the direct negative effect on long-run TFP, which would shrink by 2.75 percent, and the indirect response of private capital accumulation, which would fall by 4.3 percent. A 50 percent cut in nondefense public R&D spending would shrink TFP by 5.5 percent and GDP by approximately 7.6 percent. A 75 percent cut in nondefense R&D spending would have massive negative consequences: Long-run GDP would be more than 11 percent lower than the baseline with no spending cuts.

The bottom rows of Table 1 show the effects of a 50 percent cut to the budget of individual federal agencies that fund nondefense R&D. The NIH is the largest source of public R&D funding. Accordingly, halving its R&D spending would have the most significant macroeconomic effects: GDP would fall by approximately 3.7 percent, driven by decreases of 2.6 percent in TFP and 4.1 percent in the private capital stock. Halving R&D spending by NASA, the DoE, and the NSF would decrease GDP by approximately 2.2 percent, 1.1 percent, and 0.7 percent, respectively.

In addition to lowering GDP in the long run, cutting public R&D would shrink the economy's tax base and dynamically lead to lower overall federal government revenues. The last column of Table 1 shows the model-based estimate of the percentage change in annual federal revenues under each scenario relative to the baseline. A uniform cut in public R&D of 25 percent would reduce annual federal revenues by approximately 4.3 percent, while a cut of 75 percent would reduce it by nearly 13 percent.[7]

the authors provide structural estimates of the direct elasticity of GDP with respect to the stock of public R&D. As described in the box "Understanding the Relationship Between Public R&D and GDP" above, this elasticity is a critical parameter for calibrating macroeconomic models featuring public R&D spending. Several other recent empirical studies support the view that public R&D is an important driver of long-run productivity growth; see, for example, Dyèvre (2024).

[6]The budget shares are calculated from the data appendix in Fieldhouse and Mertens (2024).

[7]Given the substantial social rates of return on public R&D, it is highly plausible that public R&D is "self financing," that is, that the fiscal costs of the foregone revenues outweigh the savings from cuts to spending. Whether R&D is actually self-financing also depends on how public R&D is financed and the cost of servicing federal debt. We therefore do not take a stance on whether public R&D spending is self-financing.

	TFP	GDP	Capital	Revenue
Cutting All Nondefense R&D by:				
25%	-2.75%	-3.81%	-4.30%	-4.34%
50%	-5.50%	-7.59%	-8.55%	-8.58%
75%	-8.25%	-11.33%	-12.75%	-12.73%
Cutting R&D Budgets of Individual Agencies by 50%:				
National Institutes of Health	-2.63%	-3.65%	-4.11%	-4.15%
National Science Foundation	-0.52%	-0.72%	-0.82%	-0.83%
Department of Energy	-0.78%	-1.08%	-1.22%	-1.24%
National Aeronautics and Space Administration	-1.57%	-2.18%	-2.45%	-2.49%

Table 1: IMPA model-predicted effects of public R&D cuts on key macroeconomic indicators
(percentage change relative to outcome under baseline spending)
Notes: Estimates assume an elasticity of GDP to public nondefense R&D capital of 0.11, in line with the estimates from Fieldhouse and Mertens (2024). Baseline spending is the 10-year average nondefense R&D budgets of each agency for the period 2010–2019.

These preliminary estimates are likely lower bounds of the true macroeconomic effects of cutting public R&D spending. The results presented here do not account for additional spillover channels, such as the long-run reaction of public investment in infrastructure or complementarity between public and private R&D activities. If we were to incorporate these additional channels, we would likely observe larger estimated effects on GDP and other macroeconomic indicators. Similarly, the agency-specific estimates are likely understated because, for example, the innovations produced by NIH-funded research may reasonably increase the likelihood of innovations in other publicly funded research areas.[8]

[8] Another, more technical, reason why the aggregate effects are likely significantly larger than we estimate here is that we have assumed—as is standard in models featuring productive stocks of public capital—that the economy converges to a stable and unique steady state in the long run. It follows that permanent cuts to public R&D spending will reduce the *level* of GDP in the long run, not its growth rate, as would occur in a model featuring endogenous growth.

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