Institute for Macroeconomic & Policy Analysis

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

*Ignacio González, Juan Montecino, and Vasudeva Ramaswamy**

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What this report is about

- **Technological progress**: key engine of long-run economic growth
- However, private agents often lack incentives to invest sufficiently in it because
  - The return may be **too risky**
  - The return may be **too distant**
  - The return may be **too diffuse**

"Market Failure"

- Government funding in research resolves this market failure
  - Firms, individuals, and society at large benefits

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. This report quantifies these negative effects

What we find

- A 25% cut to public R&D spending **reduces GDP by ≈3.8%** in the long run
  - Comparable to the decline in GDP during the Great Recession of 2007
- A 50% cut to public R&D spending **reduces GDP by ≈7.6%**
  - I.e., from 0.6% to 0.3% percent of GDP → $260 per person
  - Makes the average American approx. $10,000 poorer (in today's dollars)
- Cutting public R&D would also shrink federal government revenue
  - **A smaller economy → lower taxes collected**
  - A 25% cut in R&D would decrease revenue by approximately 4.3% annually

The Details

Why is public R&D funding good?

- Private investment in R&D is suboptimal because
  - Social return ≠ private financial return
  - Insufficient risk appetite / risk taking ability
  - Need for collaboration vs. competition
- **Examples**: Networking – ARPANET (DARPA, 1960s-80s); Navigation – GPS constellation (DoD, 1970s-90s; still taxpayer-funded); Genomics – Human Genome Project (NIH & DOE, 1990-2003)
- Technological progress makes private businesses and workers more productive
  - Raises real wages and the returns on private investment (i.e., increases investment)
  - Complementarity with private sector → **public R&D "crowds in" private investment**

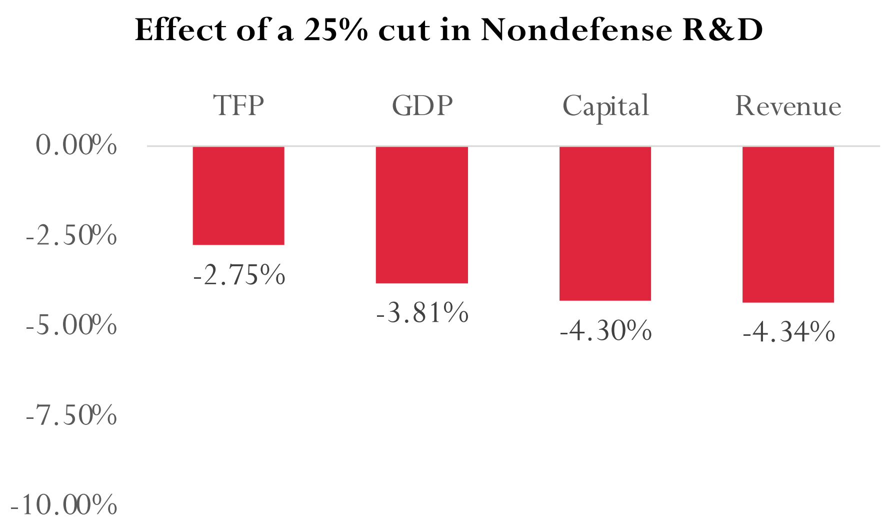
Empirical underpinnings

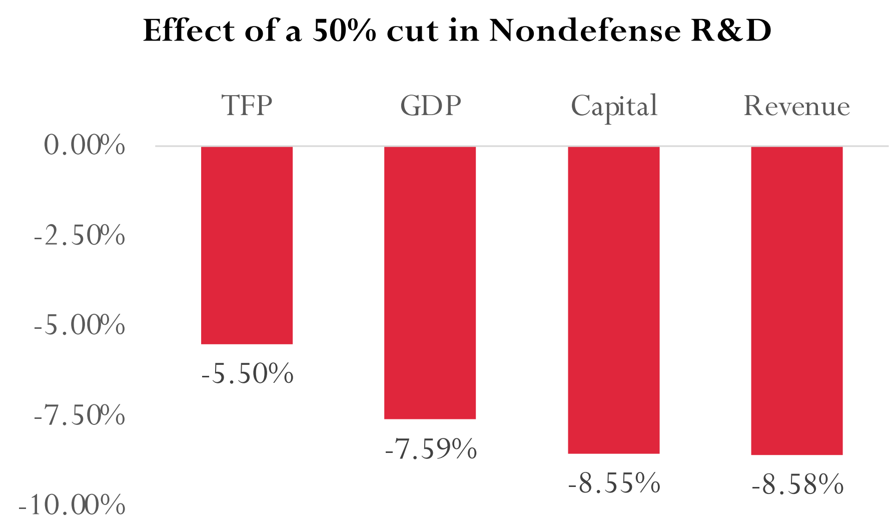
Study	Key Findings
Fieldhouse and Mertens (Federal Reserve Bank of Dallas, 2024)	▪ An increase in nondefense R&D appropriations leads to increases in innovative activity and higher business-sector productivity ▪ 1% increase in the stock of public R&D leads approx. 0.2% increase in TFP after 15 years ▪ Implied returns on R&D spending of 140% - 210% over the postwar period
Jones and Summers (NBER, 2020)	▪ $1 on R&D spending produces benefits of between $4.9 to $13.3 ▪ Social benefits that are many multiples of the investment, even when accounting for imitation, business stealing, and intertemporal spillovers etc.
Moretti, Steinwender, and Van Reenen (RES 2025)	▪ Strong evidence for "crowding in" instead of "crowding out" ▪ A 10% increase in government-financed R&D generates a 5% to 6% additional increase in privately funded R&D
Dyèvre (LSE Working Paper, 2024)	▪ A 1% decline in public R&D causes a 0.17% decline in productivity growth ▪ Public R&D spillovers have a 3x impact vs. private R&D spillovers for firm productivity ▪ The decline in public R&D explains around a third of the decline in TFP growth in the US from 1950 to 2017

Modeling the effects of public R&D spending

- Calibrated general-equilibrium model replicates the current U.S. economy
- Use the model to test how lower federal R&D spending alters economic dynamics
  - What happens if only public R&D spending changes and nothing else changes?
  - Full feedback effects captured across all sectors (general-equilibrium analysis)
- **Scenario Set 1:** Permanent, across-the-board R&D cuts of 25 %, 50 %, and 75 % to NIH, NSF, DOE, and NASA.
- **Scenario Set 2:** 50 % cut to each agency individually to isolate agency-specific impact
- Results reported as long-run deviations from a baseline that maintains each agency's 2010-2019 average budget share

Effects of cutting overall nondefense R&D

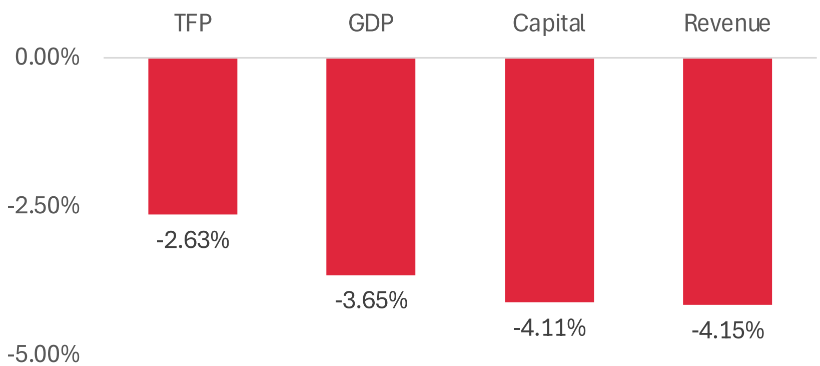




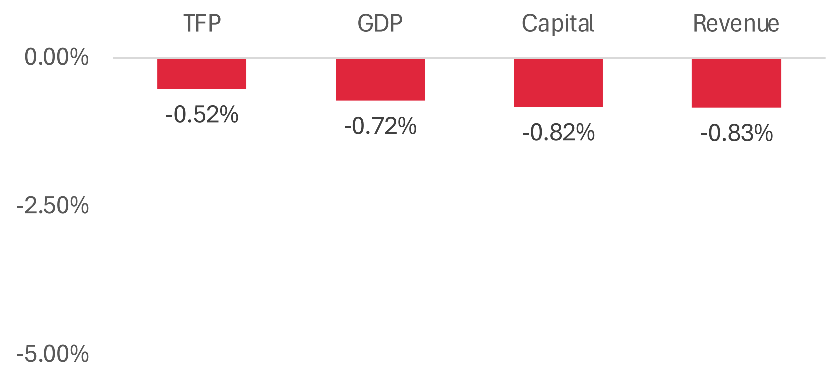
Percentage change relative to outcome under baseline spending

Effects of a 50% cut to budget, by agency

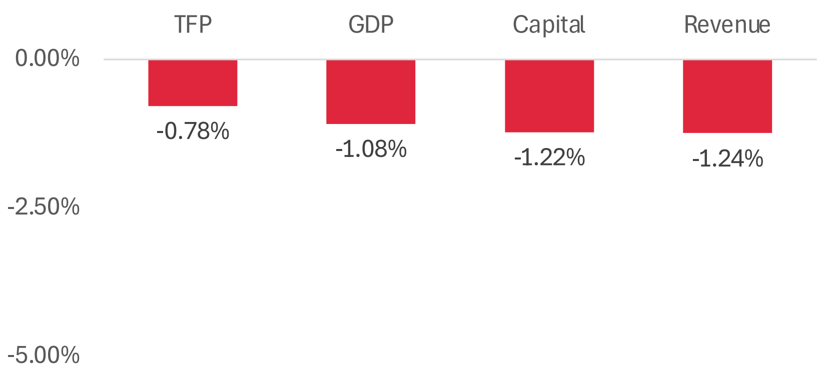
National Institute of Health



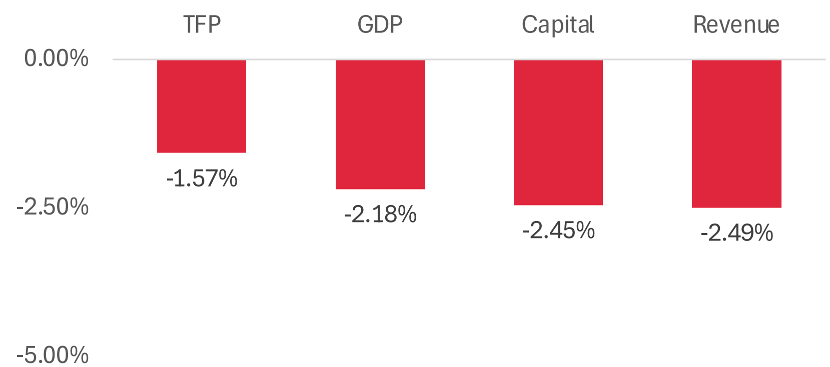
National Science Foundation



Department of Energy



NASA



Results in Context

- Reported impacts are conservative estimates of the true cost of R&D cuts
- Model omits key spillovers
  - e.g., follow-on infrastructure investment and public-private R&D complementarities – so actual GDP losses would be larger
- Agency-specific figures understate reality
  - Breakthroughs funded by one agency (e.g., NIH) catalyze innovation in others.

Bottom-line: 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.

Questions?

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.