

U.S. University R&D Funding Falls Further Behind OECD Peers

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The United States continues its relative fall in university research and development funding. To become the leader among OECD nations in government funding for university research as a share of GDP, investment would have to increase by \$90 billion per year.

KEY TAKEAWAYS

- University research is key to long-run economic growth and to furthering American and global innovation.
- According to the latest OECD data, the United States ranked 24th out of 36 nations for government funding of university research and development as a share of GDP. Nine nations invested more than double this rate.
- Federal funding for university R&D fell by 0.06 percentage points between 2011 and 2018, compared to an average drop of only 0.01 percentage point in other OECD nations.
- Meanwhile, the United States ranked 15th out of 36 nations in 2018 when it came to business funding of university R&D as a share of GDP, up from 27th place in 2011.

INTRODUCTION

In 2013, ITIF found that America was no longer the lead nation in terms of funding university research—nowhere near it, in fact—despite having world-leading research universities that have been key to driving American technological supremacy since World War II.¹ According to the latest data available at that time, the United States ranked 24th out of 39 nations in government funding of university research as a share of gross domestic product (GDP). Since then, according to data provided by the Organization for Economic Cooperation and Development (OECD), the United States remained in 24th place out of 36 nations, with the nine governments investing more than double the U.S. level. In addition, in terms of change, U.S. funding as a share of GDP fell by 0.06 percentage points. The only nations in the sample with larger declines were Lithuania, Estonia, Singapore and Ireland.

The United States would need to invest an additional \$17 billion per year to get to 15th place in government funding of university research; \$31 billion per year to get to 10th place; \$51 billion to get to 5th place; or \$90 billion to match Norway in 1st place.

Indeed, many nations are increasing investments in university research precisely because they understand the critical role research universities play in generating innovation-based economic growth, both through the training of scientists and engineers and the generation and transfer of knowledge.

If the United States is to regain some edge in the race for global innovation advantage, it will need to reverse these trends and significantly increase university research funding, while at the same time providing stronger incentives for businesses to invest in university research, including a more generous R&D tax credit. Fortunately, the Biden administration and Congress have proposed remedying this, in part through the President's infrastructure plan and the Congressional Endless Frontier Act. But proposals don't necessarily mean authorization and authorizations don't necessarily mean appropriations. Appropriating significant funds, including for university research, will show the rest of the world that the United States is serious about once again being the innovation leader.

THE IMPORTANCE OF UNIVERSITY RESEARCH

In developed, knowledge-based economies, innovation powers long-run economic growth. For example, a study published by the U.K. National Endowment for Science, Technology and the Arts found that two-thirds of U.K. private-sector productivity growth between 2000 and 2007 was a result of innovation.² In a cross-country study, Klenow and Rodríguez-Clare found that more than 90 percent of the variation in the growth of income per worker was a result of innovations that changed how capital was used.³ Likewise, Hall and Jones studied 127 nations and found that how capital was used was 4.6 times more important in driving economic growth than how much capital a nation had.⁴

Innovation is also positively correlated to job growth in the mid to long term.⁵ Innovation leads to job growth in three fundamental ways. First, it gives a nation's firms a first-mover advantage in new products and services, expanding exports and creating expansionary employment effects. In the United States, for example, growth in exports leads to twice as many jobs as an equivalent expansion of sales domestically.⁶ Second, innovation's expansionary effects lead to a virtuous

cycle of expanding employment. In the early to mid-1990s, increasing usage of information technology drove broad-based economic growth, creating hundreds of thousands of new jobs, which, in turn, led to additional job growth in supporting industries. Finally, when innovation leads to higher productivity, it also leads to increased wages and lower prices, both of which expand domestic economic activity and create jobs.⁷

Universities have taken on an even greater role in the American innovation system as many corporations have shut down or repurposed central research laboratories that used to conduct R&D.

Research performed outside the private sector is essential to the U.S. innovation system. Even with robust corporate R&D investment, the private sector alone does not invest at the levels society needs, in large part because firms do not capture all the benefits of innovation. Numerous studies suggest the rate of return society receives from corporate R&D and innovation activities is at least twice the estimated returns companies themselves receive.⁸ For example, Tewksbury, Crandall, and Crane examined the rate of return of 20 prominent innovations and found a median private rate of 27 percent. However, the median social rate of return was a whopping 99 percent—almost four times higher.⁹ Nordhaus estimated that inventors capture just 4 percent of the total social gains from their innovations; the rest spill over to other companies and society as a whole.¹⁰ This differential between private and social returns means the optimal level of R&D investment for society—that which achieves the highest rate of economic growth—cannot be met by the private sector alone. Thus, without public investment, the rates of economic growth, job creation, and living-standard improvement are all lower than their potential. The university system plays a key role in filling the gap between the current levels of private R&D and that which is optimal for economic growth.

Overall, university research has large, beneficial impacts on U.S. economic growth. Mansfield found, in terms of its impact on product and process development in U.S. firms, the social rate of return from investment in academic research is at least 40 percent.¹¹ A study by the Science Coalition found that “companies spun out of research universities have a far greater success rate than other companies.”¹² And a study by the Ratio Institute of Stockholm found that public university research spin-off companies have more patent applications and radical product innovations than similar non-spin-off firms—the study’s authors find that these superior results can be explained by both research cooperation between the companies and universities, and colocation factors.¹³ Indeed, university research has given the United States breakthrough companies such as Google, Medtronic, and iRobot.¹⁴

Despite the importance of this new, more synergistic relationship between research universities and innovation-based enterprises in the United States, some argue that government support for R&D does not really matter, and companies will pick up any slack from cuts in federal R&D. But, as previously noted, the exact opposite appears to be true, as U.S. companies have shifted funding away from basic and applied research. Moreover, publicly funded research is a complement to and not a substitute for private-sector research. A study by the RAND Corporation found that, in general, 1 additional dollar of public contract research added to the stock of government R&D induces an additional 27 cents in private R&D investment.¹⁵ A Carnegie Mellon University study found that “public research is critical to industrial R&D in a small number of industries and importantly affects industrial R&D across much of the manufacturing sector.”¹⁶

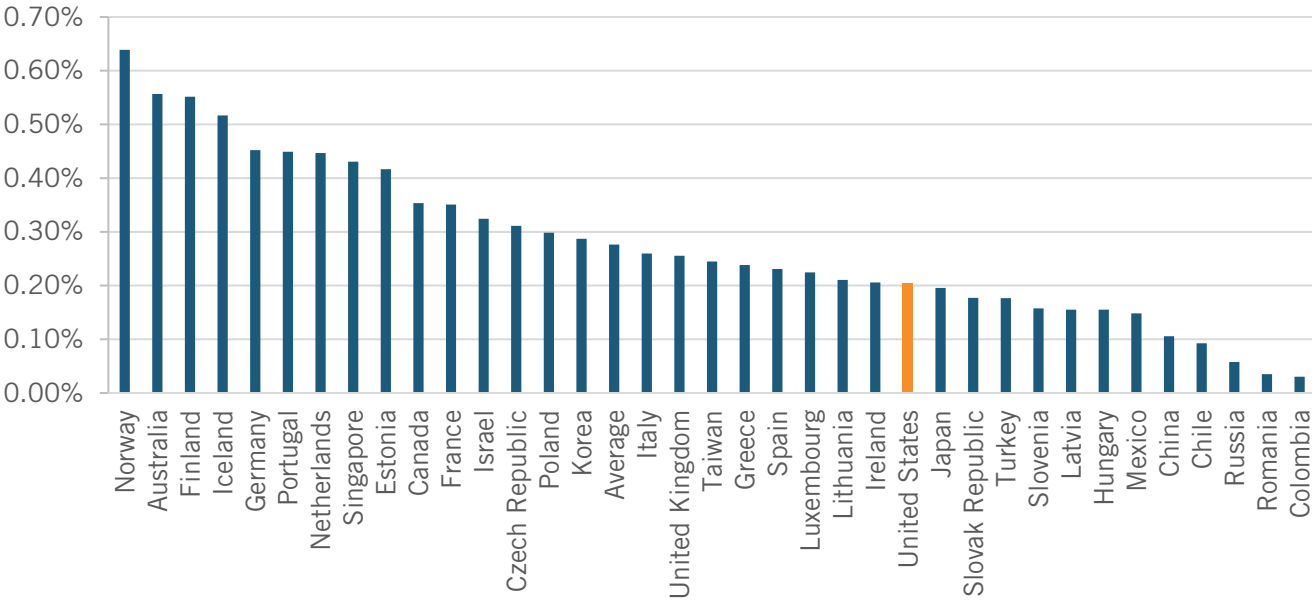
The development and expansion of major U.S. research universities, including the public land grant universities and other state universities, has played a key role in driving U.S. global innovation leadership. Indeed, it has become almost a matter of faith in economic and innovation policy circles to point to U.S. research universities as the secret weapon in the U.S. economic competitiveness arsenal. However, as the next section demonstrates, this widely held view reflects the past rather than the present.

The shift to shorter-term, less-fundamental R&D risks shrinking the knowledge pool from which firms draw the ideas and information necessary to conduct later-stage R&D and bring innovations to market.

BENCHMARKING U.S. GOVERNMENT FUNDING

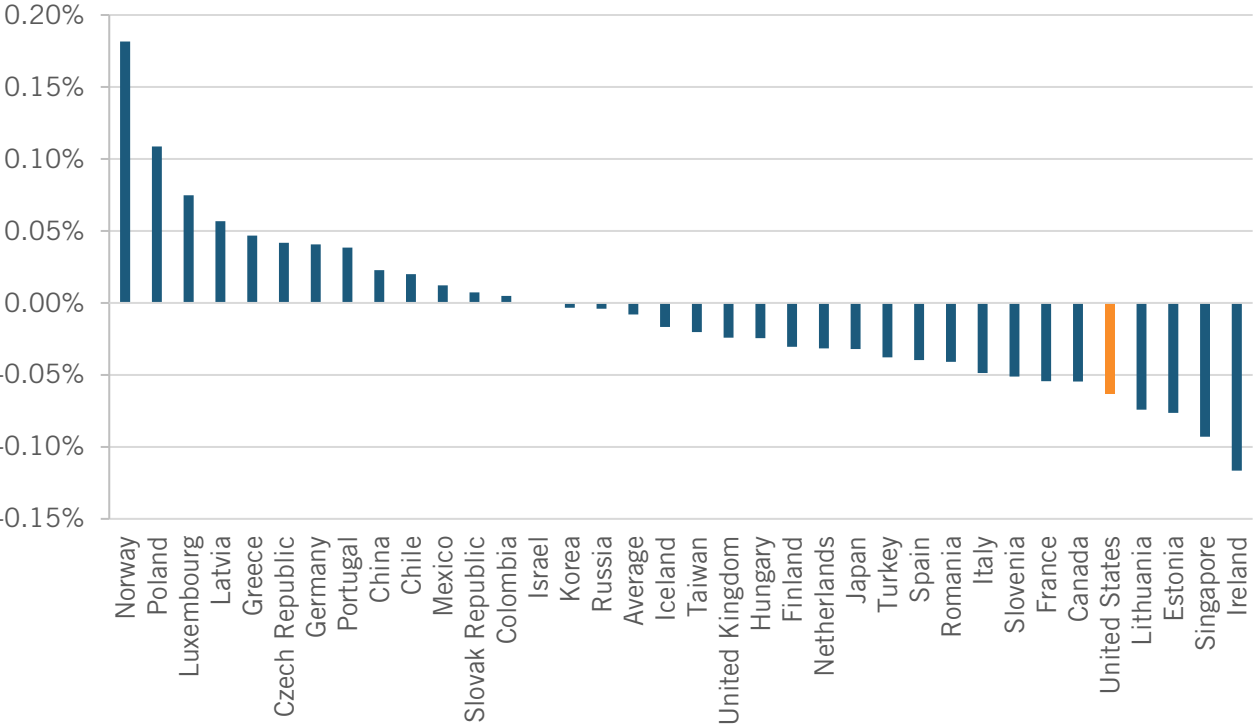
We examined 2018 OECD data on university R&D spending by sector of performance and funding source, as this was the latest year in which the United States was comparable with other OECD countries. As of 2018, governments in the United States (state and federal) collectively invested 0.20 percent of GDP on university research, ranking 24th out of 36 nations.¹⁷ For example, figure 1 shows the Norwegian government invests over 3.1 times as much (0.64 percent) on funding university research as the United States, with Australia just behind (0.56 percent). Germany (0.45 percent), France (0.35 percent), and the United Kingdom (0.26 percent) all out-invest the United States. U.S. governments fund at levels closer to East Asian countries: Although South Korea (0.29 percent) and Taiwan (0.24 percent) out-invest the United States, the United States slightly out-invests Japan (0.20 percent) and invests at almost double the rate of China (0.11 percent), although Chinese funding is increasing. The exception to lower East Asian investment levels is Singapore, which invests 0.43 percent of GDP. In all, nine countries fund at more than 200 percent of U.S. levels, while 13 fund at more than 150 percent.

Figure 1: Government funding for university R&D as a share of GDP, 2018¹⁸



Between 2011 and 2018, U.S. government funding as a share of GDP fell by nearly a quarter (0.06 percentage points), causing Spain, Israel, Poland, and Luxembourg to pass the United States. Only 16 nations increased their funding levels over this period, with an average decline of 0.01 percent of GDP. The U.S. decline is much steeper however, ranking 31st, with only Ireland, Lithuania, Estonia and Singapore seeing larger reductions in funding. The Norwegian and Polish governments increased university R&D funding by 0.18 and 0.11 percent of GDP over this period, and elevating them to first and second in the 2018 rankings, respectively. (See figure 2.)

Figure 2: Percentage-point change in government funding for university R&D as a share of GDP, 2011–2018¹⁹



BENCHMARKING U.S. BUSINESS FUNDING OF UNIVERSITY RESEARCH

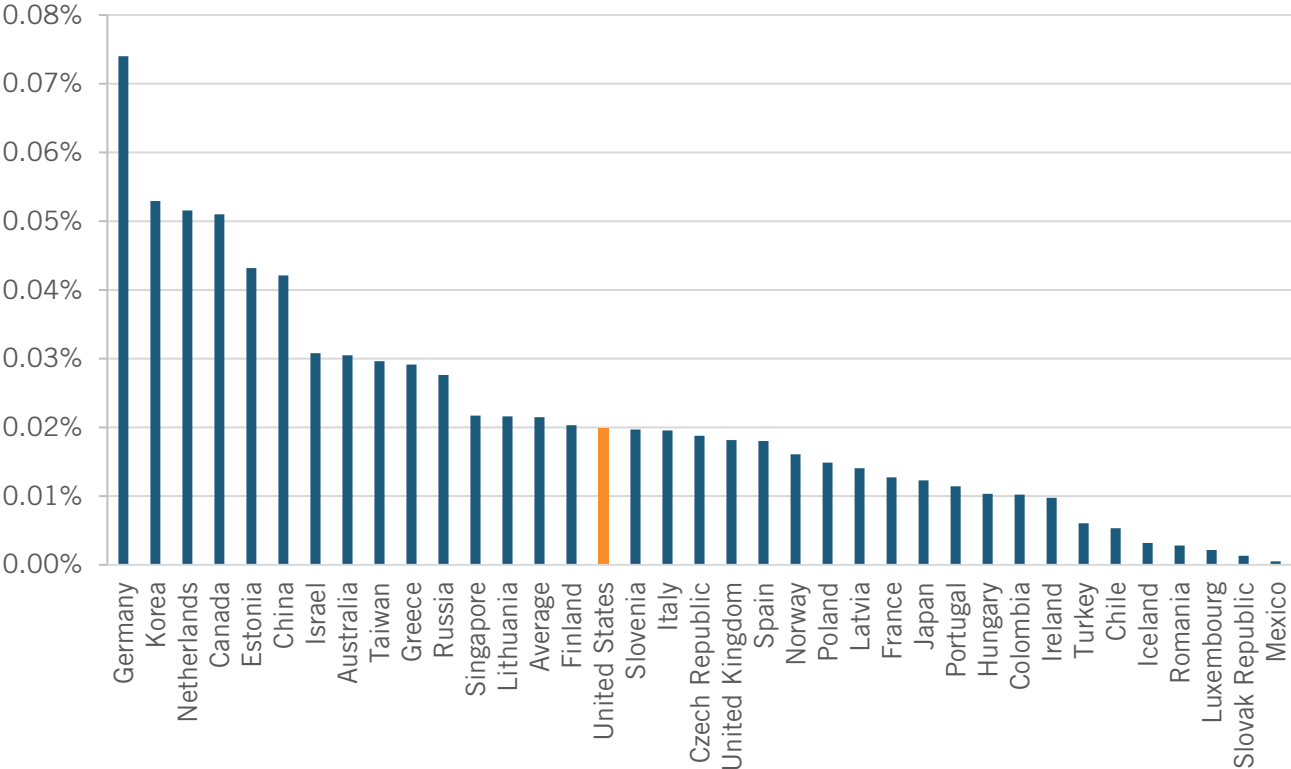
Some will argue that even if the government does not fund university research at the same levels as other nations, our private sector will compensate for this gap. After all, they say, we are the nation that passed the Bayh-Dole Act to spur commercialization of university research, and we have more entrepreneurial faculty at our universities. However, there are two key problems with this rationale. First, even in the United States, government funding of university research exceeds business funding by an order of magnitude.²⁰ And second, even with these “policy innovations,” the United States trails behind many other nations when it comes to business support of university research.

While businesses in the United States invested the equivalent of 0.02 percent of GDP on R&D at universities, businesses in Germany invested 0.074 percent—more than 3.5 times as much.

In 2018, the United States ranked 15th out of 36 countries in its level of business funding for university R&D as a share of GDP. While businesses in the United States invested the equivalent

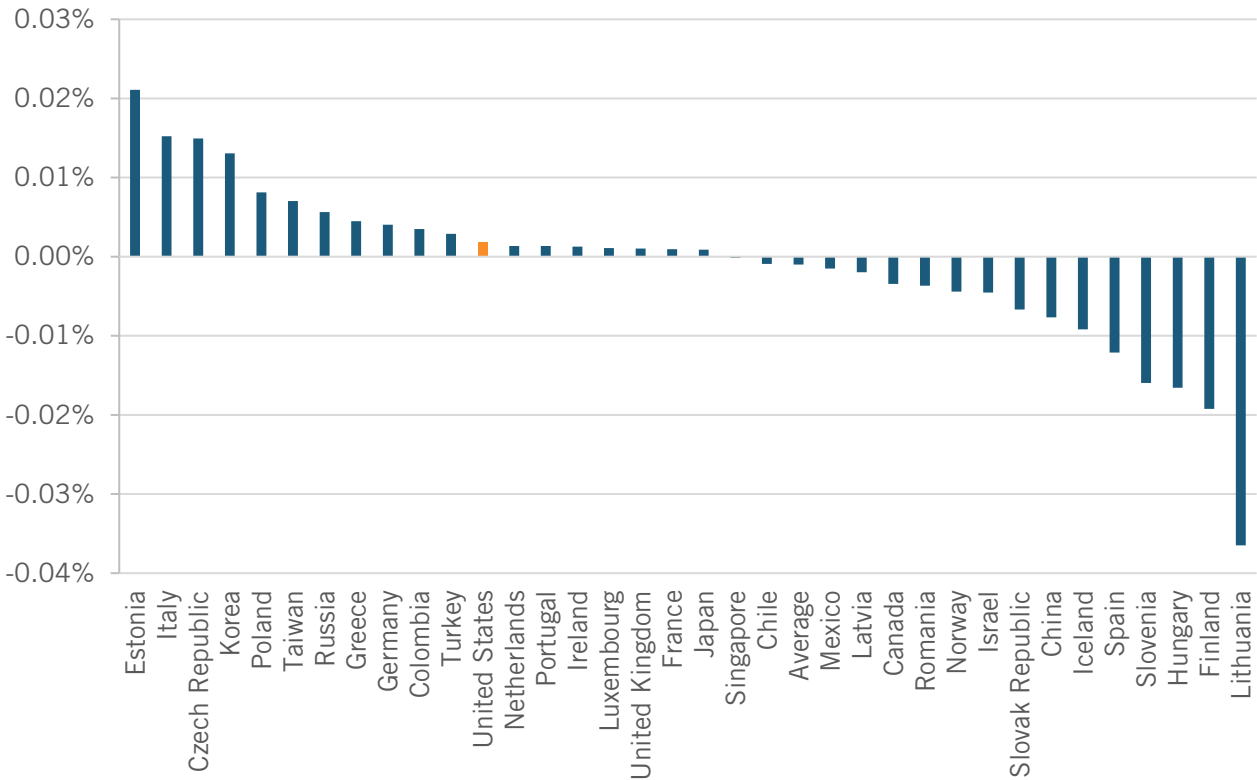
of 0.02 percent of GDP on R&D at universities, businesses in South Korea, for example, invested 0.05 percent, more than twice times as much—and Germany ranks first ahead of South Korea, where companies invest more than 3.5 times as much as the United States. East Asian countries, including China, South Korea, Singapore, and Taiwan, all outrank the United States with the sole exception of Japan, with 6th-ranked China receiving 0.04 percent of GDP from businesses, and 9th-ranked Taiwan receiving 0.03 percent, each more than 150 percent the level of funding in the United States. (See figure 3.)

Figure 3: Business funding for university R&D as a share of GDP, 2018²¹



Since 2011, business funding of U.S. university R&D has grown by 0.002 percentage points of GDP, higher than growth across 23 countries—enough for the United States to rank 12th. Estonia ranks first with a 0.022 percentage-point increase in business funding as a share of GDP, nearly 12 times U.S. growth. (See figure 4.) Interestingly, China ranks 29th in growth relative to GDP falling 0.008 percentage points as a share of GDP.

Figure 4: Percentage-point change in business funding for university R&D as a share of GDP, 2011–2018²²



CONCLUSION

Given the importance of university research to the U.S. innovation system, and the primary role innovation plays in economic growth, competitiveness, and job creation, the data presented reinforces the emerging consensus that the United States can no longer rest on its laurels and assume its universities will continue to lead the world only because they once did. The reason they led was no accident. It had nothing to do with the country’s geography, culture, or even size. Instead, it had everything to do with the fact that after World War II, the United States, before any other nation, dramatically increased federal (and state) support for higher education generally, and higher education research specifically. Indeed, public-sector R&D investment in the United States as a share of GDP in the early 1960s was greater than public- and private-sector R&D of all nations combined.²³ Fortunately, both the Biden administration and Congress are focusing on this key challenge.

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About ITIF

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ENDNOTES

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