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## Article

# The innovation dividend of defense R&D

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## Policy Debate of the Hour

# The Innovation Dividend of Defense R&D\*

## Key Messages

- Research & development (R&D) subsidies, especially defense R&D spending, raise private R&D investment (a crowd-in effect)
- Public R&D funding increases employment without driving up wages
- Supported industries see gains in productivity
- International spillovers amplify the impact across countries, underscoring the case for international coordination – particularly within the EU
- Direct subsidies outperform tax credits in boosting total R&D



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Recent geopolitical tensions have prompted a wave of defense spending increases. According to the Stockholm International Peace Research Institute (SIPRI), global military expenditure rose by 9.4 percent between 2023 and 2024 – the steepest year-on-year increase since the end of the Cold War (Liang, Tian, Lopes da Silva, Scarazzato, Karim, and Guiberteau Ricard 2025). In response to the threat of Russian aggression and sustained pressure from

US President Donald Trump, NATO members have agreed to raise their defense spending target from 2 percent to 5 percent of GDP.

Figure 1 shows military spending as a share of GDP for the world's ten largest military spenders in 2024. The United States ranks first, spending 3.4 percent of its GDP on defense, followed by China, Russia, and Germany. After decades of military downsizing, Germany has recently reversed course and is expected to reach the 2 percent target by 2025.

\* This is an executive, non-technical summary of Moretti, Steinwender, and Van Reenen (2025).

The recent surge in defense spending is likely to have significant economic consequences. At a time of stagnant growth, tightening public budgets, and growing concerns over the global competitiveness of European firms, many fear that increased defense spending will depress economic prospects even more. However, military spending may also stimulate the economy: military outlays may stimulate demand, create jobs, and – most notably – foster innovation through technological and human capital spillovers to the civilian economy.

In many OECD countries, spending on defense-related R&D represents an important form of public support for innovation. Figure 2 shows that the United States has the highest share of defense-related R&D in total government R&D spending among all OECD countries, followed by South Korea, the United Kingdom, and France. In contrast, Germany's defense share is relatively low, accounting for just 5.2 percent of total public R&D expenditures.

### Defense R&D Spending and Private Sector Innovation

The effect of defense R&D expenditures on private sector innovation and economic growth has long been the subject of debate (e. g., see surveys by Mowery 2010 and Lichtenberg 1995). Proponents highlight the commercial success

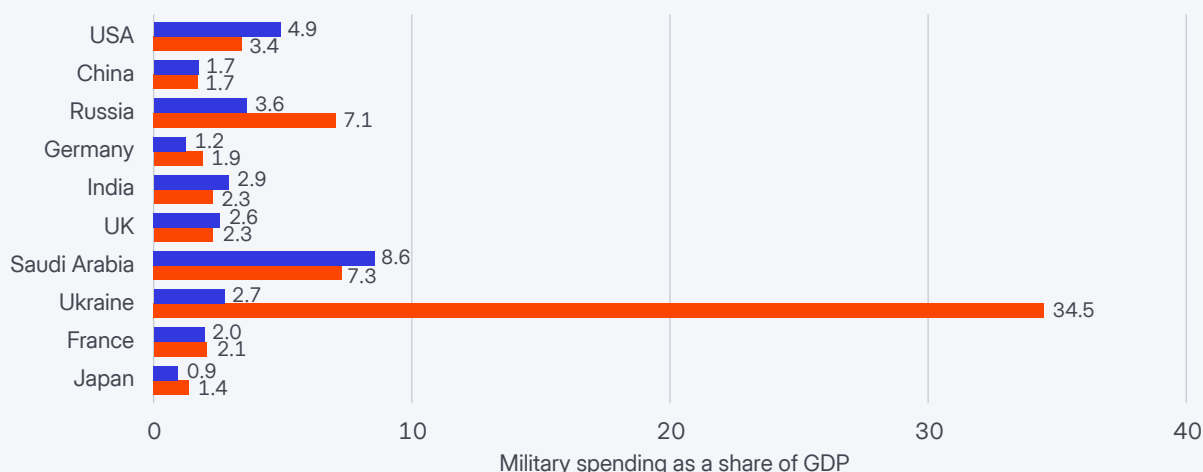
of major technological breakthroughs – including jet engines, computers, radar, nuclear power, semiconductors, GPS, and the internet – as evidence that military R&D has been a vital driver of civilian innovation (Lichtenberg 1984, 1988; Ruttan 2006; Mazzucato 2013). Some even argue that the Pentagon's role as the world's largest investor in technological innovation during the Cold War laid the foundation for the dominance of US manufacturing in the postwar period (Braddon 1999). More recently, defense R&D has been viewed as an important contributor to national economic growth through private sector spinoffs and agglomeration economies. Advocates of this perspective often cite Israel as a case where defense spending has not only strengthened military capabilities, but also fostered the emergence of a thriving high-tech sector, with numerous commercially successful startups (e. g., Senor and Singer 2009).

On the other hand, critics argue that the benefits of defense R&D are meagre, primarily because military secrecy inhibits the scope of spillovers to civilian firms. Even more fundamentally, there is a concern that defense-related R&D might displace private R&D and therefore could even have a negative impact on the total amount of innovation. Overall, there is much anecdotal evidence of some of the positive and negative effects that defense R&D might have on growth, but little systematic econometric evidence.

**Figure 1**

### Military Spending as a Share of GDP, Top 10 Military Spenders

■ 2010 ■ 2024

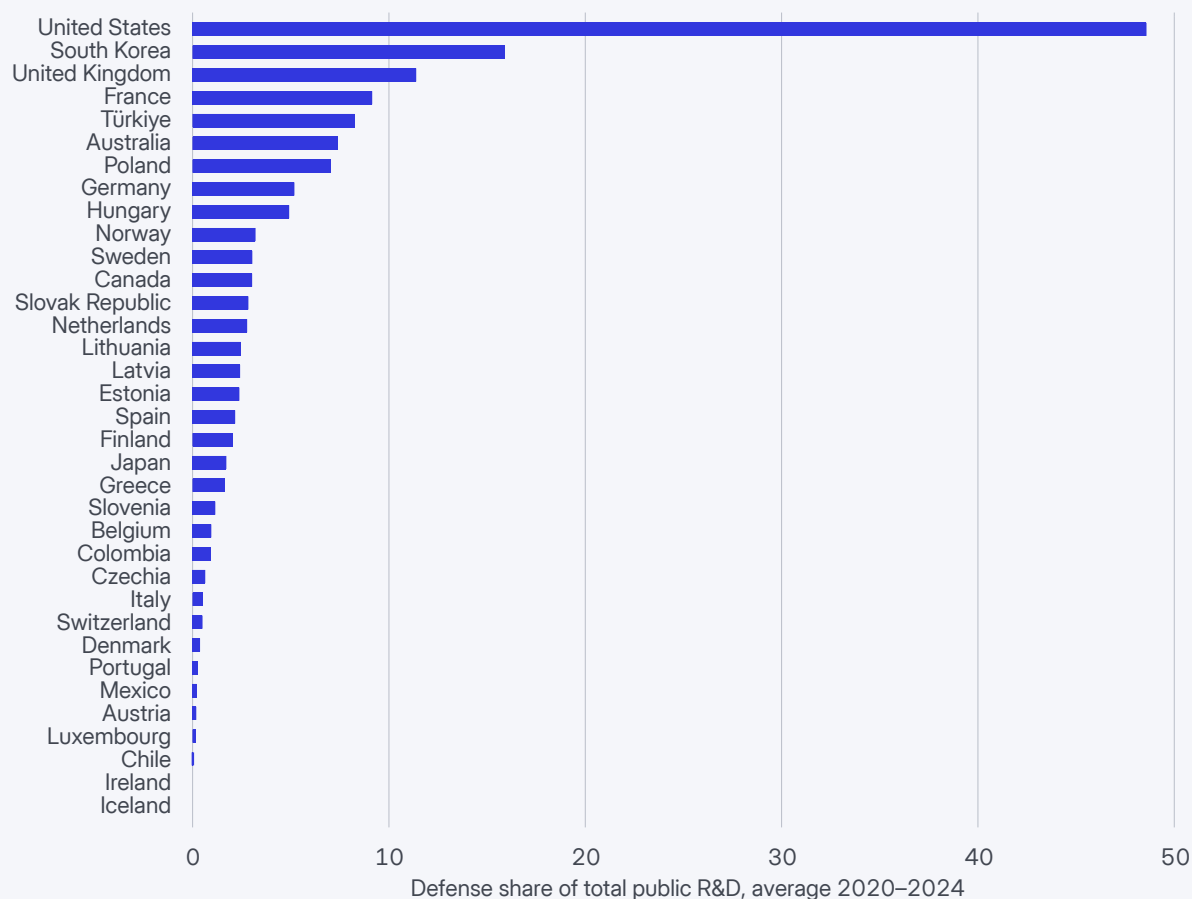


Source: SIPRI Military Expenditure Database; includes estimates for China, Russia, and Saudi Arabia.

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Figure 2

## Defense Share of Total Public R&amp;D



Source: OECD Data Explorer, Government budget allocations for R&amp;D, by socio-economic objectives.

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## Does Public R&amp;D Crowd In or Crowd Out Private R&amp;D?

In a recent paper, we study the effect of government-funded R&D – particularly defense R&D – on private R&D, i.e., R&D conducted and financed by private businesses (Moretti, Steinwender, and Van Reenen 2025). Our analysis uses a unique dataset covering public and private R&D across multiple industries in every OECD country over a 23-year period. To complement the international industry data, we draw on a panel of all R&D-performing firms in France, which includes detailed information on R&D subsidies, broken down by defense and non-defense ministries. This longitudinal data allows us to compare the same firm's behavior before and after receiving public R&D support.

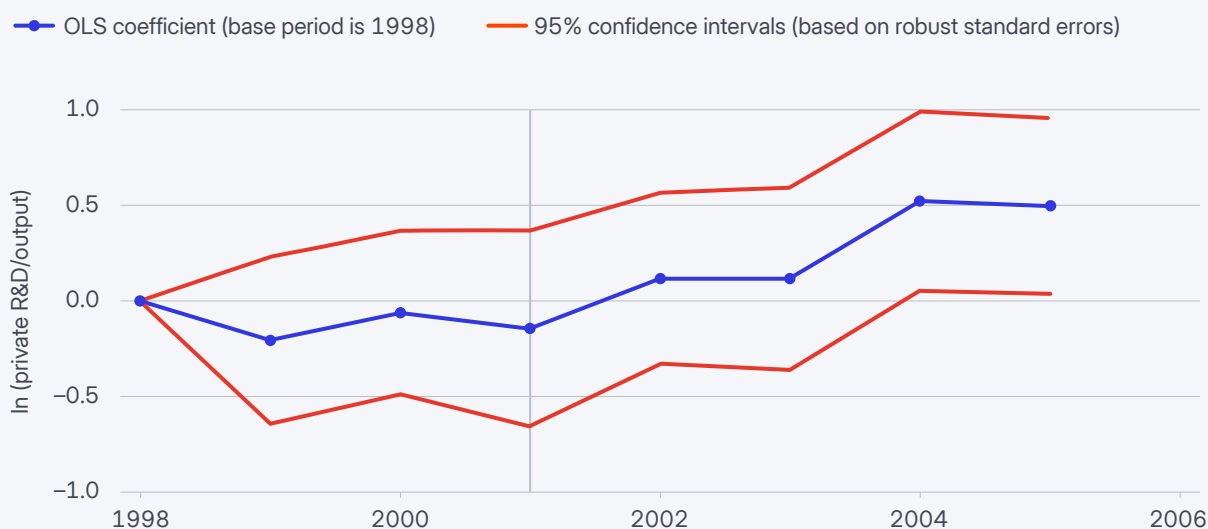
If government-funded R&D *crowds out* private R&D, the net impact could be negative. In the extreme case of full

crowding out, public support merely displaces private investment without increasing total R&D. This scenario could arise if key inputs – such as specialized scientists and engineers – are in fixed supply within a country-industry in the short run. When supply is inelastic, additional public funding may simply substitute for private effort.

Conversely, if government-funded R&D *crowds in* private R&D, the effect is positive – public support stimulates additional private investment. This can happen for several reasons. First, R&D often involves *high fixed costs*, such as setting up labs or building human capital. Public funding that covers part of these costs can make otherwise unprofitable private projects viable. For instance, infrastructure or skills developed for one project may be reused across others.

Figure 3

### Private R&D Intensity in Defense-Sensitive Sectors Relative to Other Sectors Before and After 9/11 2001 – US Data



Source: These coefficients are based on difference-in-differences regressions 1998–2005 using the data in Moretti, Steinwender, and Van Reenen (2025). “Defense sensitive sectors” are aerospace and other transport; information technology; and communication technologies (radio, TV and communications equipment). We run OLS regressions with industry dummies and time dummies and an interaction between the defense sensitive sectors and different year dummies pre and post 2001.

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Second, public R&D funding may ease financial constraints for *credit-constrained firms*. Even in well-developed capital markets, the risky and information-intensive nature of R&D can make such investments particularly vulnerable to financing frictions.

Third, government-funded R&D may generate *technology or human capital spillovers* that boost productivity in other firms within the same industry or region (e.g., Moretti 2004, 2019). While the direct effect benefits the recipient firm, indirect effects can raise R&D in nearby or competing firms. However, spillovers may also be negative if rivals free ride on supported firms’ R&D, as in the case of strategic substitutability (e.g., Bloom, Schankerman, and Van Reenen 2013).

Empirically, we find strong evidence of crowding in: a 10 percent increase in public R&D driven by changes in defense spending results in a 5–6 percent rise in privately funded R&D within the same industry. One illustrative case is the surge in US military R&D following the 9/11 terrorist attacks under the Bush administration. As shown in Figure 3, defense-sensitive industries – such as aerospace and ICT – exhibited similar trends before 2001. Afterward, however, private R&D in these sectors rose sharply in response to the increase in public defense investment.

The magnitude of this effect is economically meaningful. For example, in 2002, the US government spent about USD 3 billion on defense R&D in the aerospace industry. Our estimates suggest this triggered USD 2 billion in additional private R&D. We estimate that across all sectors, US private R&D would be about USD 85 billion lower in the absence of defense-related public R&D.

### Employment, Wages, and Productivity

We also examine how public R&D investment affects employment and wages. An increase in private R&D spending does not automatically imply more R&D activity – if the supply of R&D workers is inelastic, higher spending could simply raise wages without boosting employment or innovation (Goolsbee 1998). However, if R&D labor is mobile across industries or borders, increased funding may lead to more personnel with limited wage pressure. Effects on non-R&D workers depend on whether new technologies complement or substitute their roles: product innovations may raise labor demand, while process innovations can reduce it.

Our findings indicate that defense R&D increases employment among R&D workers and modestly raises their

wages, suggesting that the supply of R&D labor appears sufficiently elastic to meet rising demand.

The ultimate aim of innovation policy is to enhance economic performance, not just increase R&D spending. We therefore assess whether defense-induced increases in private R&D translate into higher productivity. Our estimates show a positive relationship: a 1 percentage point rise in the defense R&D-to-value-added ratio leads to an 8.3 percent increase in annual total factor productivity (TFP) growth (e.g., from 0.98 percent to 1.06 percent). While this is a meaningful effect, it accounts for only a small share of overall US growth.

### Global Spillovers from Defense R&D

Do the effects of public R&D stop at national borders? Not necessarily. On the positive side, increased government-funded R&D in one country may raise private R&D in the same industry abroad – for example, if German public R&D in chemicals encourages French firms to invest more in order to remain competitive, or if technological or human-capital spillovers cross borders. On the negative side, global spillovers could be dampened if the supply of specialized inputs (e.g., chemical engineers) is inelastic, driving up costs.

Empirically, we find evidence of positive international spillovers. For instance, higher US defense R&D in chemicals boosts not only US private R&D, but also private R&D in Germany's chemical sector – consistent with cross-border externalities in knowledge and skills. The magnitude of spillovers is larger between economically proximate countries – those with similar income levels, geographic closeness, shared technologies, foreign direct investment (FDI) ties, or R&D intensity. This underscores the nature of defense R&D as a global public good and suggests that unilateral investments can yield widespread international benefits.

### Policy Conclusion

While our findings show that government-funded R&D increases private R&D, this does not necessarily imply that defense R&D is the most efficient tool to stimulate innovation and productivity. Governments have a wide array of innovation policy instruments at their disposal (see Bloom, Van Reenen, and Williams 2019), and our analysis does not directly compare the effectiveness of defense R&D to other public interventions. Human-capital investment, for instance, is another potential driver of long-term growth. Redirecting resources away from human-capital investment toward defense may undermine economic growth,

and rising defense budgets also add to public debt – an especially pressing issue in countries like Germany, where the debt ceiling has recently been raised.

That said, our estimates suggest that direct public R&D funding – particularly defense-related – can generate more than twice as much total R&D per dollar spent as tax incentives. Although more complex to administer, well-targeted subsidies appear to be a highly effective component of innovation policy.

In an era of renewed interest in industrial policy and strategic technologies, understanding the spillovers and productivity effects of defense R&D is essential. We find that defense R&D can stimulate private innovation rather than crowd it out – particularly in R&D-intensive industries. These effects are further amplified by both domestic and international spillovers, meaning the benefits often extend well beyond the borders of the funding country.

Though defense R&D is primarily driven by geopolitical and security goals, it functions as a powerful *de facto* industrial policy. In the US, for example, defense-related R&D funding far exceeds the budgets of the National Science Foundation or the total cost of the federal R&D tax credit, often by a factor of ten (NSF 2006). This sheer scale makes defense R&D a central lever in shaping the direction and pace of innovation.

Given the political momentum behind rising defense budgets, it is reassuring that such spending yields positive economic externalities. Our finding that these benefits extend to other countries underscores the case for international coordination – particularly within the EU. From a policy perspective, individual countries may underinvest in defense R&D subsidies because they do not capture the full spillover gains. Conversely, countries that benefit from others' investments might consider compensation mechanisms. Coordinating such efforts at the European level could help ensure more efficient and equitable outcomes.

Ultimately, defense R&D should not be viewed in isolation. While not a substitute for targeted civilian innovation programs, it plays a significant role in shaping the broader innovation ecosystem – mobilizing private effort, driving technological progress, and fostering international cooperation. •

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