Defence Policy and Innovation

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LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

UKRI Economic and Social Research Council

poid Programme on Innovation and Diffusion

Caveat Emptor

- In July 2024, I became Chair of the Council of Economic Advisers then Senior Adviser on growth to UK Chancellor Rachel Reeves

- I am no longer in government and speak solely in a personal capacity

Outline

- Raising Defence Spending
- Impact of Defence R&D
- How to get more innovation from defence R&D
- Policy

Outline

- **Raising Defence Spending**
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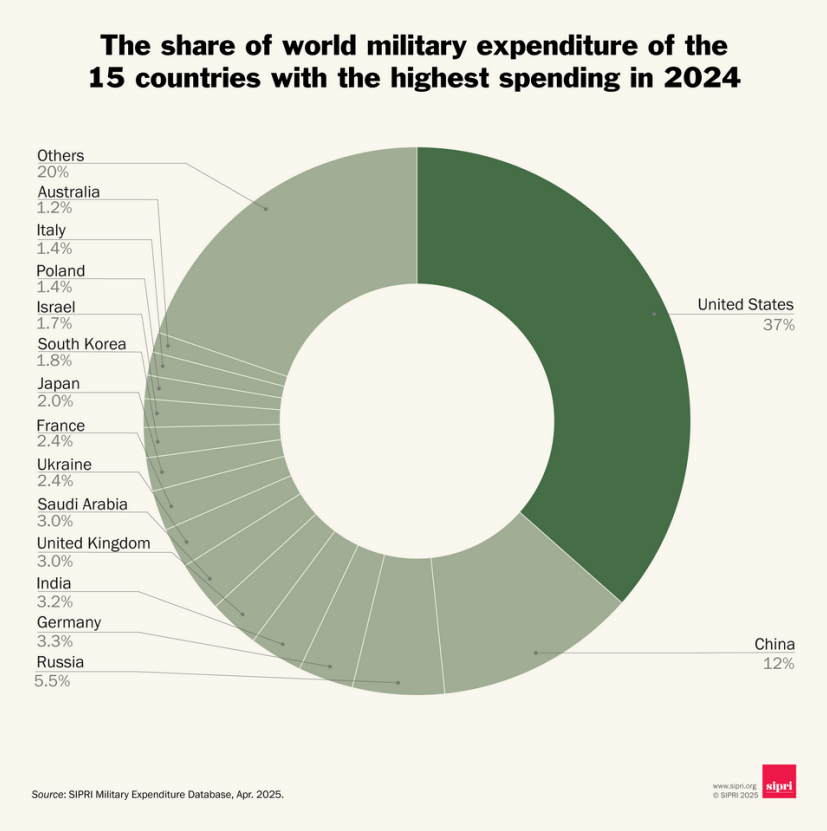
The need to raise defence spending

- Era of geopolitical instability
  - Russia's invasion of Ukraine & threats to Europe
  - Increased conflict in Middle East
  - US distancing itself from NATO & European defence



Military expenditure (% of GDP) - United Kingdom

SIPRI Military Expenditure Database, Stockholm International Peace Research Institute (SIPRI), uri: sipri.org/databases

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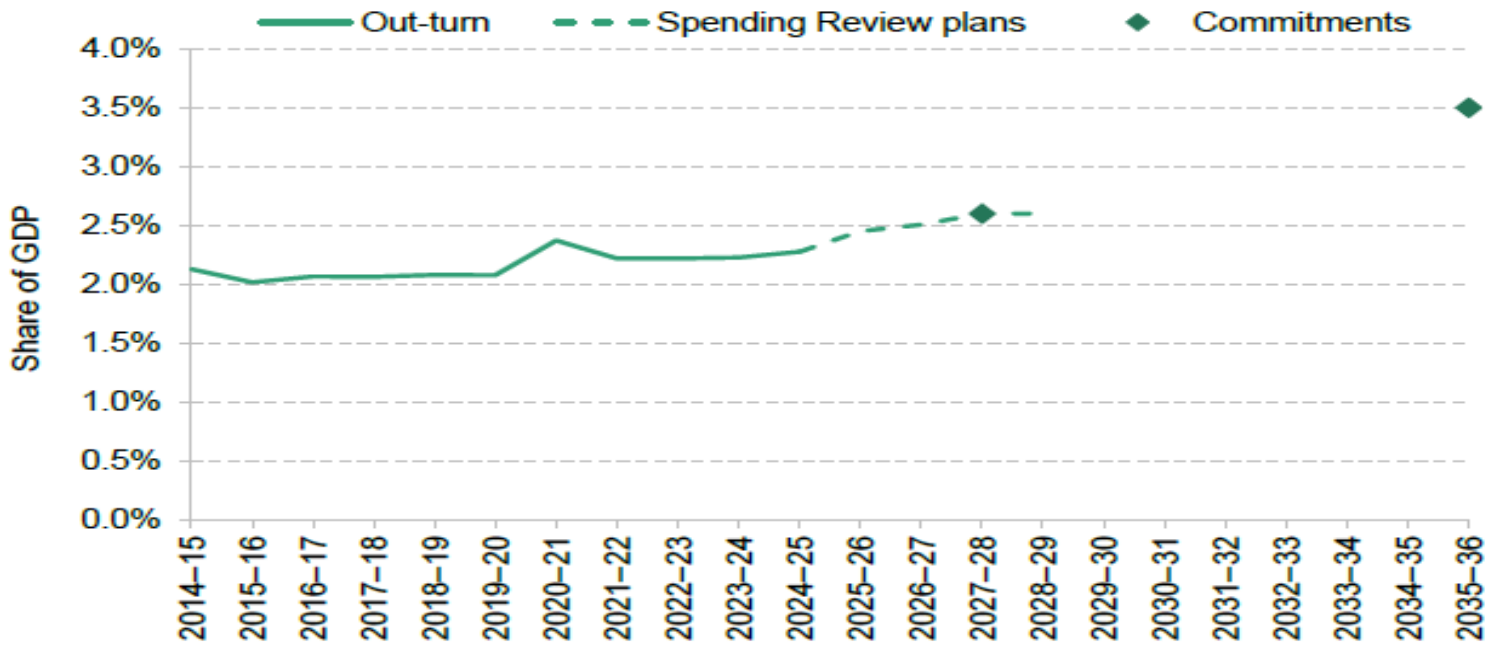
- UK military spending as a proportion of GDP fell from **7% in 1960** to **2% in 2019**
- Peace Dividend since late 1980s

Selected Countries and Economies

UK Defence Spending as a share of GDP

Figure 7.10. Defence spending out-turn and plans



Note: The 'Spending Review plans' line shows Ministry of Defence and Single Intelligence Account Total Departmental Expenditure Limits (TDEL), adjusted so that plans in 2027–28 match the 2.6% commitment. We assume that the gap between MoD and SIA TDEL and NATO-qualifying defence spending in 2027–28 remains consistent over the Spending Review period.

Source: Authors' calculations using: HM Treasury, Spring Statement 2025 and Spending Review 2025; NATO, Defence Expenditures of NATO Countries; OBR databank, August 2025; and June 2025 government announcement.

How to fund increased defence spending?

- Sits alongside many other spending challenges
  - Health; Age-related welfare (Pensions, Social Care, etc.); Energy/Environment; infrastructure
- Voters reluctant to raise taxes or cut spending elsewhere
- Government debt is already high and increasingly costly
  - Changing fiscal rules or re-branding borrowing (“war bonds”) for defence doesn’t solve fundamental problem of need to raise tax & cut some non-defence spending
- No easy solutions (“tax rich more”; “cut government waste”; “change migration”, etc.)

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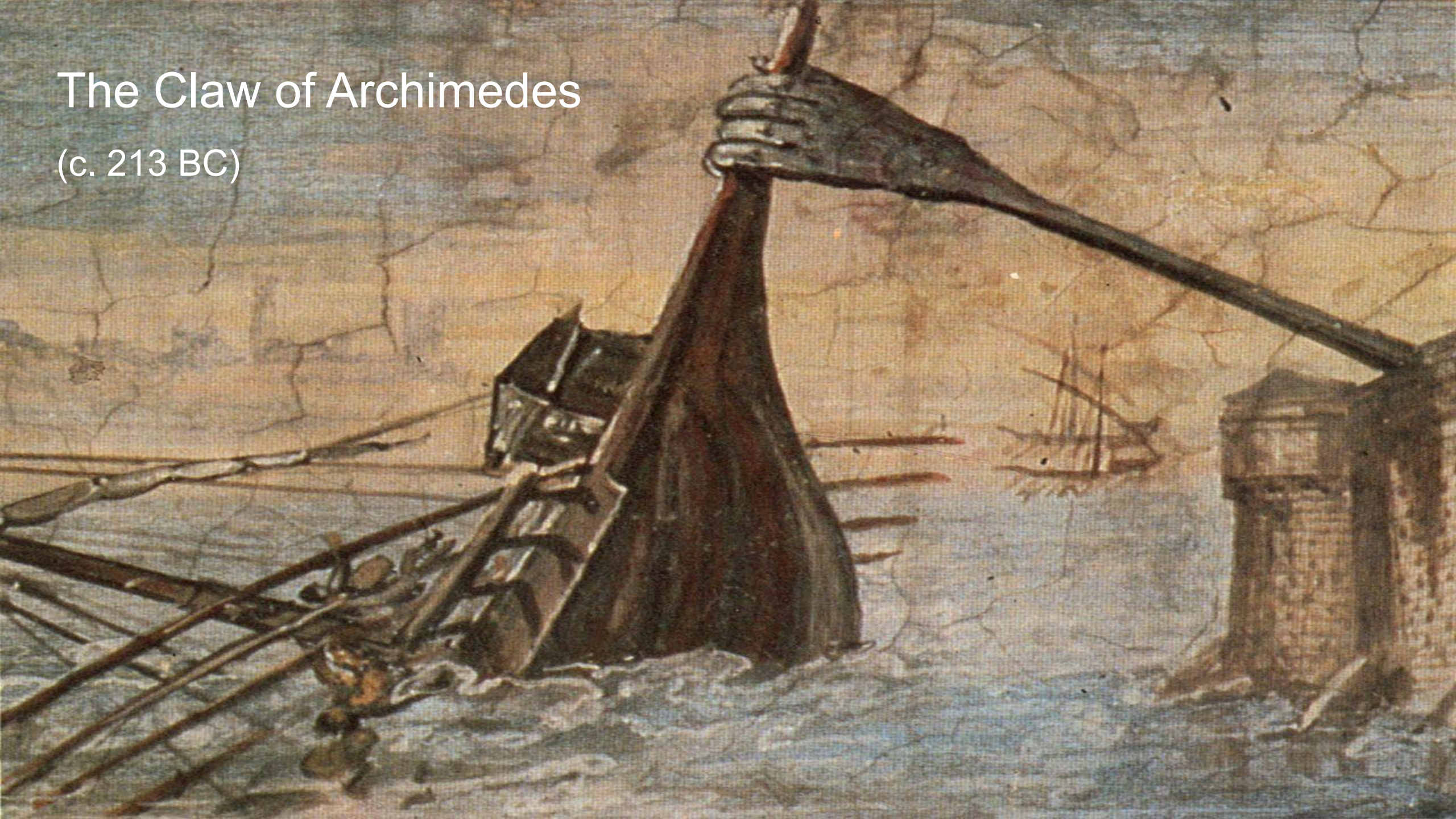
Key Question

- How can we make the increase in defence spending more pro-growth?

- Supply side crucial: using defence spend to spur innovation
  - R&D the most supply-side growth friendly part of defence budget, so will focus here.


The Claw of Archimedes
(c. 213 BC)

History

- Huge number of spin-offs from military technology
- **Dual-use** aspect of frontier defense technology: large spillovers to private sector (e.g. GPS, cryptography, nuclear power, jet engines, Internet,..)
- But can we move from story-telling to hard evidence?

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Abstract

Introduction

January 03 2025

The Intellectual Spoils of War? Defense R&D, Productivity, and International Spillovers

Enrico Moretti, Claudia Steinwender, John Van Reenen

Author and Article Information

The Review of Economics and Statistics (2025) 107 (1): 14–27.

https://doi.org/10.1162/rest_a_01293 **Article history**

Abstract

We examine the impact of government funding for R&D – and defense-related R&D in particular – on privately conducted R&D and its ultimate effect on productivity growth. We estimate longitudinal models that relate privately funded R&D to lagged government-funded R&D using industry-country level data from OECD countries and firm level data from France. To deal with the potentially endogenous allocation of government R&D funds, we use changes in predicted defense R&D as an instrumental variable. In many OECD countries, expenditures for defense-related R&D represent by far the most important form of public subsidies for innovation. In both datasets, we uncover evidence of

Government (defence) R&D

- Data
  - Industry-country-year OECD panel (26 countries over 23 years)
  - French firm panel data (12,539 firms 1980-2015).

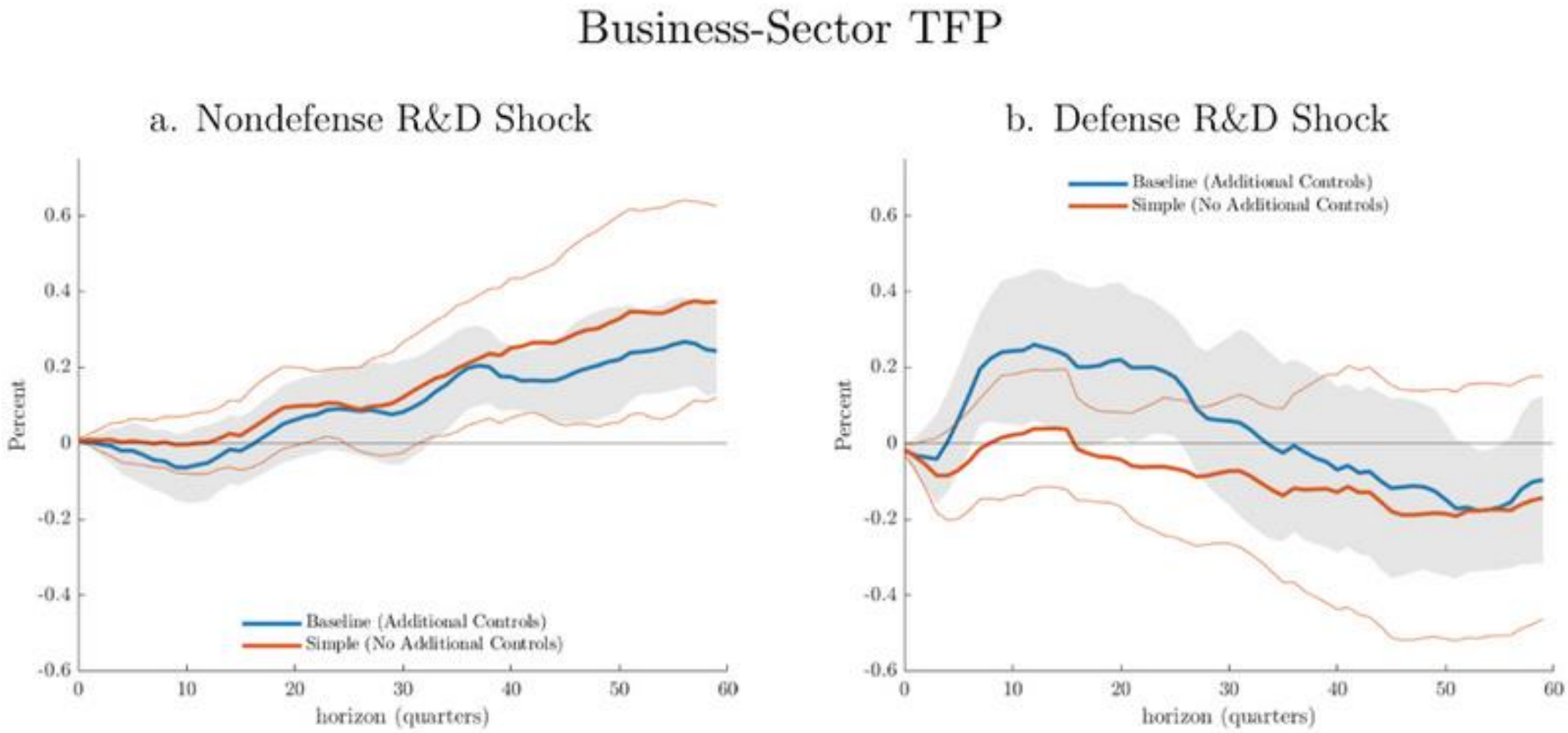
- Focus on impact of defence R&D directly (and as IV for govt. R&D)
  - Strong evidence for crowd-in of private R&D
  - Positive impacts on domestic (and international) productivity growth

Alternative question:

- Is it better to spend the marginal R&D dollar on defence or non-defence R&D?
  - *Ex ante* ambiguous. More secrecy implies less spillovers. But mission focus can drive bigger/faster results.

- Some evidence that non-defence R&D delivers bigger productivity benefits than defence R&D,
  - Fieldhouse & Mertens (2023); Gavanni et al., (2026); Frontier Economics (2024)
  - these use macro variation and complements the more micro firm and industry work discussed above.

Macro: Public Defence R&D has stronger impact only in SR



Source: Fieldhouse and Mertens (2023)

Lesson

- ‘Is it better to spend the marginal R&D dollar on defence or non-defence R&D?’ is the wrong question!

- Issue is that defence budget is going to rise and question on how to best spend it…
  - Make increase as ‘R&D-rich’ as possible

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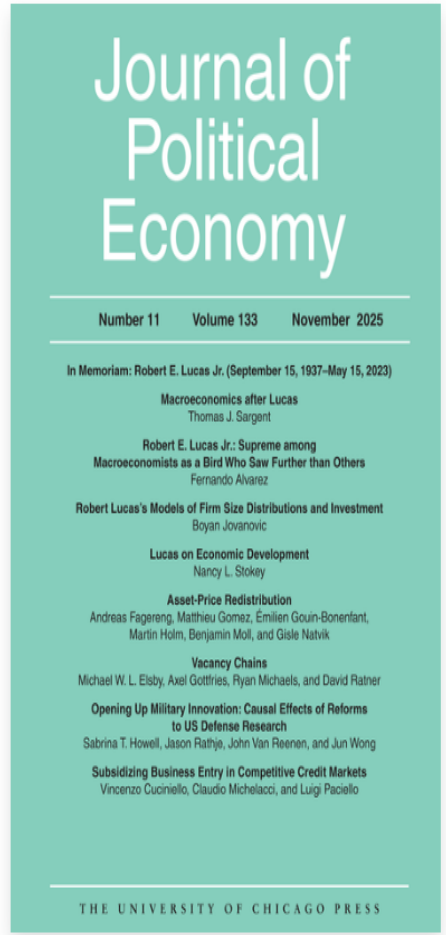
Opening Up Military Innovation: Causal Effects of Reforms to US Defense Research

Sabrina T. Howell, Jason Rathje, John Van Reenen, and Jun Wong

Abstract

For governments procuring innovation, one choice is whether to specify desired products (a conventional approach) or allow firms to suggest ideas (an open approach). Using a US Air Force R&D grant program where open and conventional competitions were held simultaneously, we find that open awards increase both commercial innovation and technology adoption by the military. In contrast, conventional awards have no positive effects on new technology but do create more program lock-in. We present evidence that openness matters over and above inducing differential selection, for example, of less well-established firms. These results suggest benefits from open approaches to innovation procurement.



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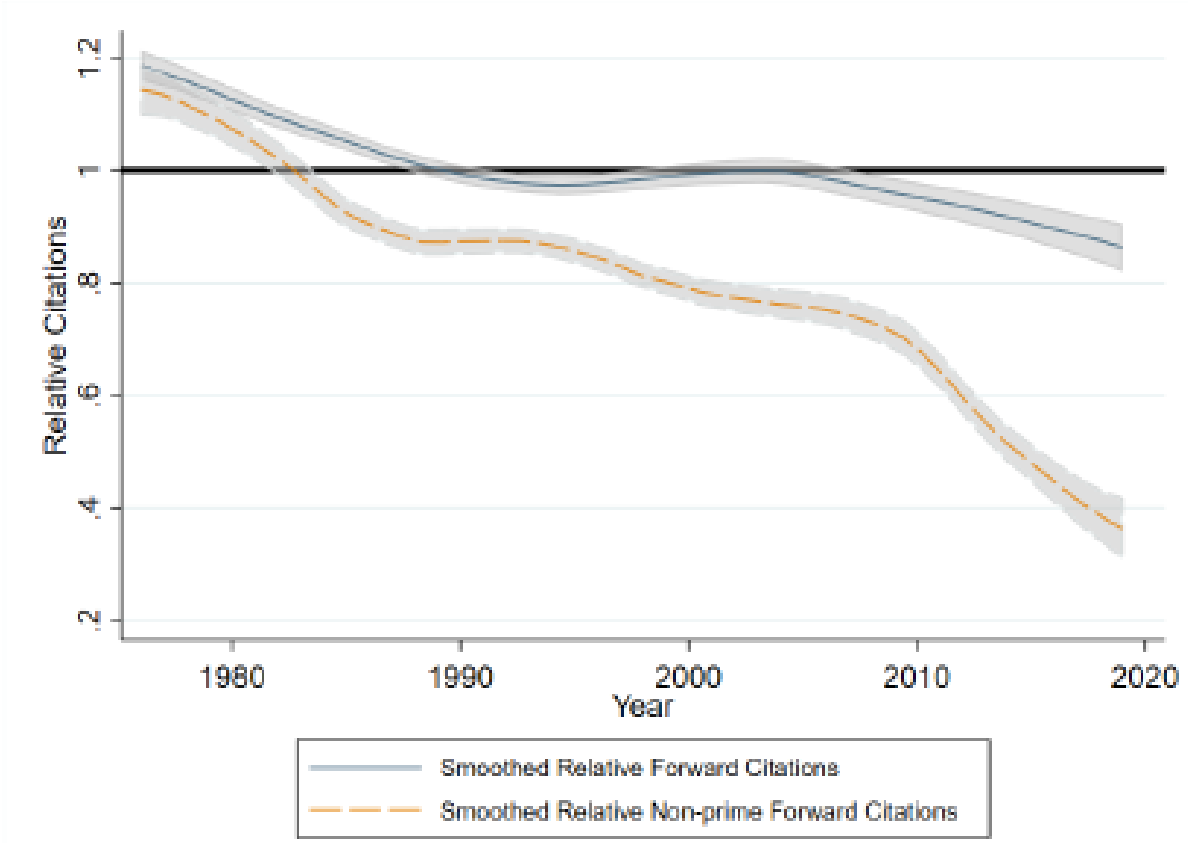
How to improve R&D procurement?

- Traditional approach to defence R&D procurement in US (& most countries) is top-down and highly centralized
- This has gone along with high & increasing concentration
- Defence innovation base weakening over last 40 years

US Defence firms go from 20% more innovative than average in 1976 to 10-40% *less* innovative in 2019



Relative cite-weighted patents

Relative cite-weighted Patents (drop self-cites)

Notes: *Patents weighted by future citations in six "Prime" defense contractors (Lockheed Martin, Boeing, Raytheon/UTC; Harris/L3; Northrop-Grumman, General Dynamics) & all their post 1976 acquisitions. Innovation measures relative to other firms in same technology-class by year (so 1.2 means 20% higher relative innovation rate). Dashed line drops all self-cites.*

US Air Force reforms: OPEN Topics

- USAF leaders believe that part of declining innovation was an excessively “Top Down” Approach to (Griffin, 2019). In **Conventional** competitions:
  - Procurement narrowly specified
  - Siloed in a small group of defense-specialist firms. Little “bottom-up” innovation with broad private sector collaboration
  - Too little radical thinking on “tough tech” problems

- **In 2018** USAF reformed SBIR into new **OPEN Topics** program, which took a decentralized innovation model (increasingly popular in private sector, e.g. Unilever)

Summary of Howell et al. (2025)

- Admin data on >21k applications & evaluation scores of SBIR proposals 2003-19 & outcomes through 2021. Focus 2017-19 proposals: Open & Conventional programs run simultaneously

Key Findings:

- Open attracted more **new entrants** – e.g. young firms & those that had never applied for SBIR in the past
- RDD: **Open has better outcomes than Conventional**: VC Funding; non-SBIR DoD contracts (tech adoption); Patenting
- Conv. “better” only for future SBIR contracts (lock-in by “mills”)

Mechanism:

- Mainly through **bottom-up** innovation: **less tightly specified** (using ML) Conventional topics also more successful
- Also some effect via selection of young firms

DoD Tech adoption 10 percentage points higher for Open program. Zero Effect for Conventional program

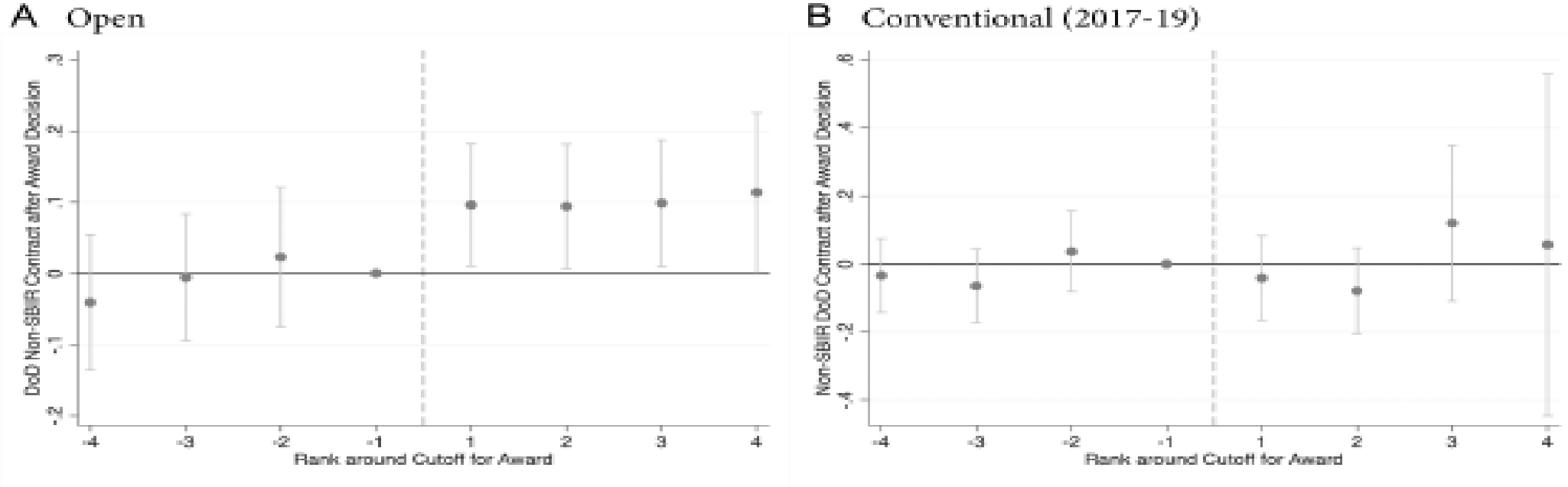


FIG. 3.—Probability of technology adoption (DoD non-SBIR contract) by rank around cutoff. The figure shows the probability that an applicant firm had any non-SBIR DoD contracts valued at more than $50,000 after the award decision. The *x*-axis shows the applicant's rank around the cutoff for an award. A rank of 1 indicates that the applicant had the lowest score among winners, while a rank of −1 indicates that the applicant had the highest score among losers. We plot the points and 95% confidence intervals from a regression of the outcome on a full complement of dummy variables representing each rank as well as fixed effects for the topic. The omitted group is rank = −1. We include first applications from 2017 to 2019.

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Some aspects of UK Defence policy

1. **Finance.** Raised defence as % of GDP (2025 Spending Review increase to 2.6%)

2. **Structure.**

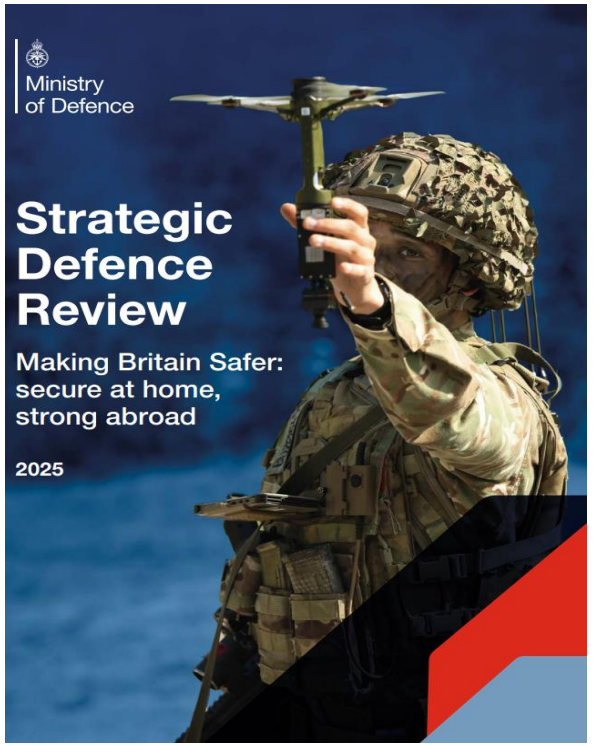
3. **R&D.**

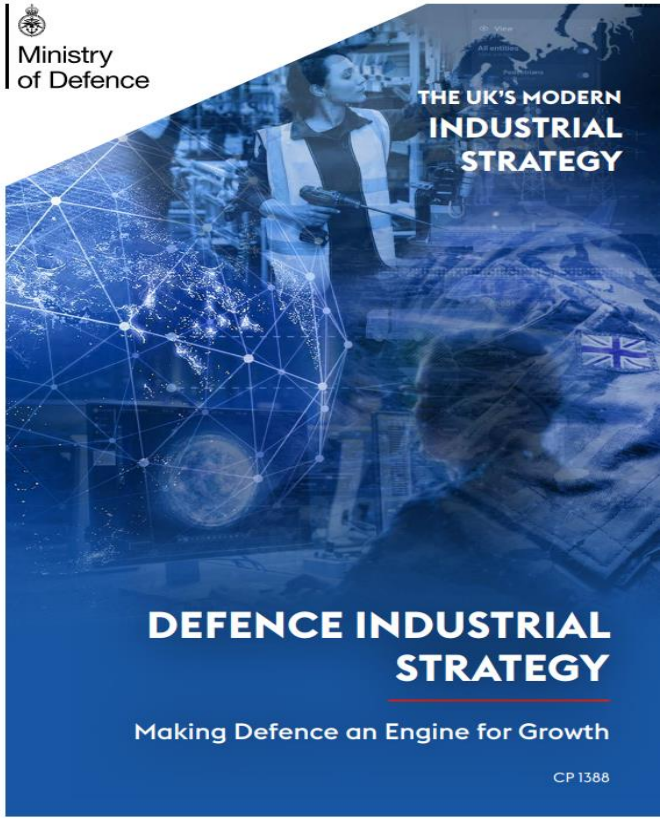
4. **Co-operation**

Some aspects of UK Defence policy

1. **Finance.** Raised defence as % of GDP (SS25 increase first to 2.6%)

2. **Structure.** Strategic Defence Review & Defence Industrial Strategy





Elements of UK Defence Strategy

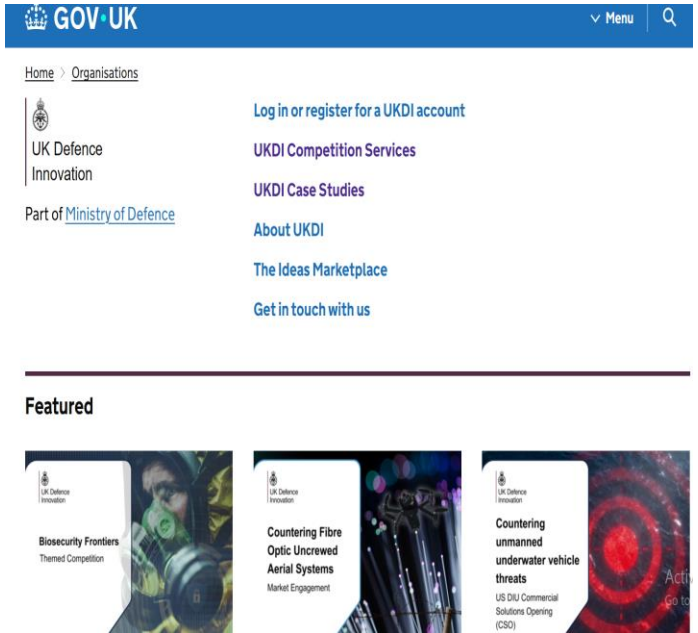
- **Priorities**
  - Growth Focus (e.g. alignment on standards)
  - Strengthen UK industrial base (e.g. stronger competition)
  - Reducing waste
  - Innovation

- **Broader Industrial Strategy**
  - Defence one of the 8 key sectors. UK has relatively strong sector so could benefit from global increases in demand for defence
  - Use state convening power as a co-ordinating role for business (not just subsidies)
  - Public good provision: skills, R&D, etc.

Some aspects of UK Defence policy

1. **Finance.** Raised defence as % of GDP (SS25 increase first to 2.6%)
2. **Structure.** Strategic Defence Review & Defence Industrial Strategy

3. **R&D.** Raised R&D budget by 12% (£3.1bn in 2025/24 vs. £2.6bn in 2024/23). Created UK Defence Innovation (Defence and Security Accelerator like OPEN part of UKDI)



Some aspects of UK Defence policy

1. **Finance.** Raised defence as % of GDP (SS25 increase first to 2.6%)

2. **Structure.** Strategic Defence Review & Defence Industrial Strategy

3. **R&D.** UK Defence Innovation (Defence and Security Accelerator part of UKDI)

4. Greater **co-operation** with European partners– Draghi Report

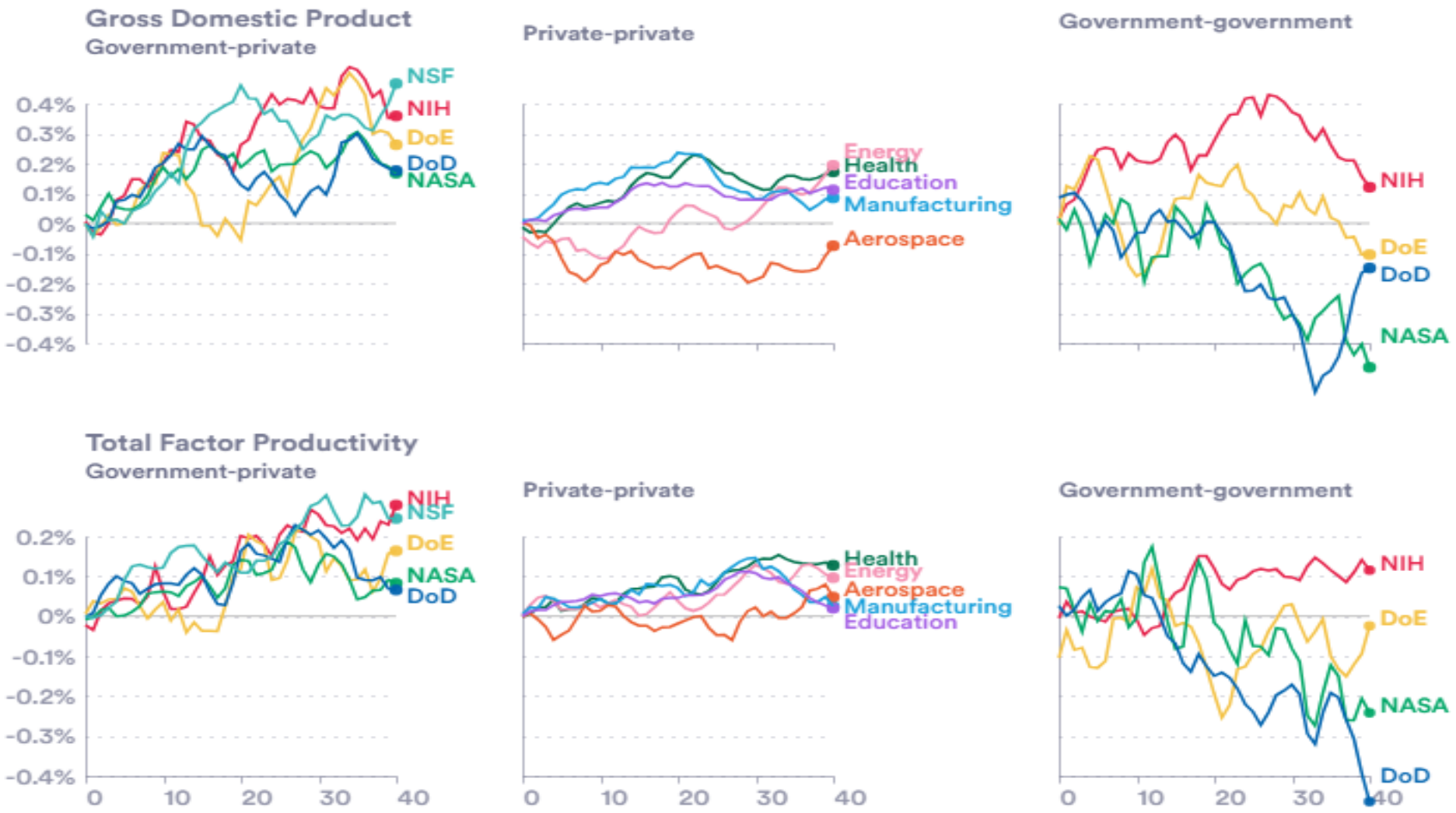
Conclusions

- Defence spending has to rise. Key issue is how to finance

- Use as an opportunity to maximize impact on innovation/growth
  - Make increase in defence spending as R&D heavy as possible
  - Reforms to make R&D increase more efficient (e.g. using Open style programs)
  - Co-operation with European & other NATO partners

Back Up

Macro Approach: Non-defence R&D has bigger impact

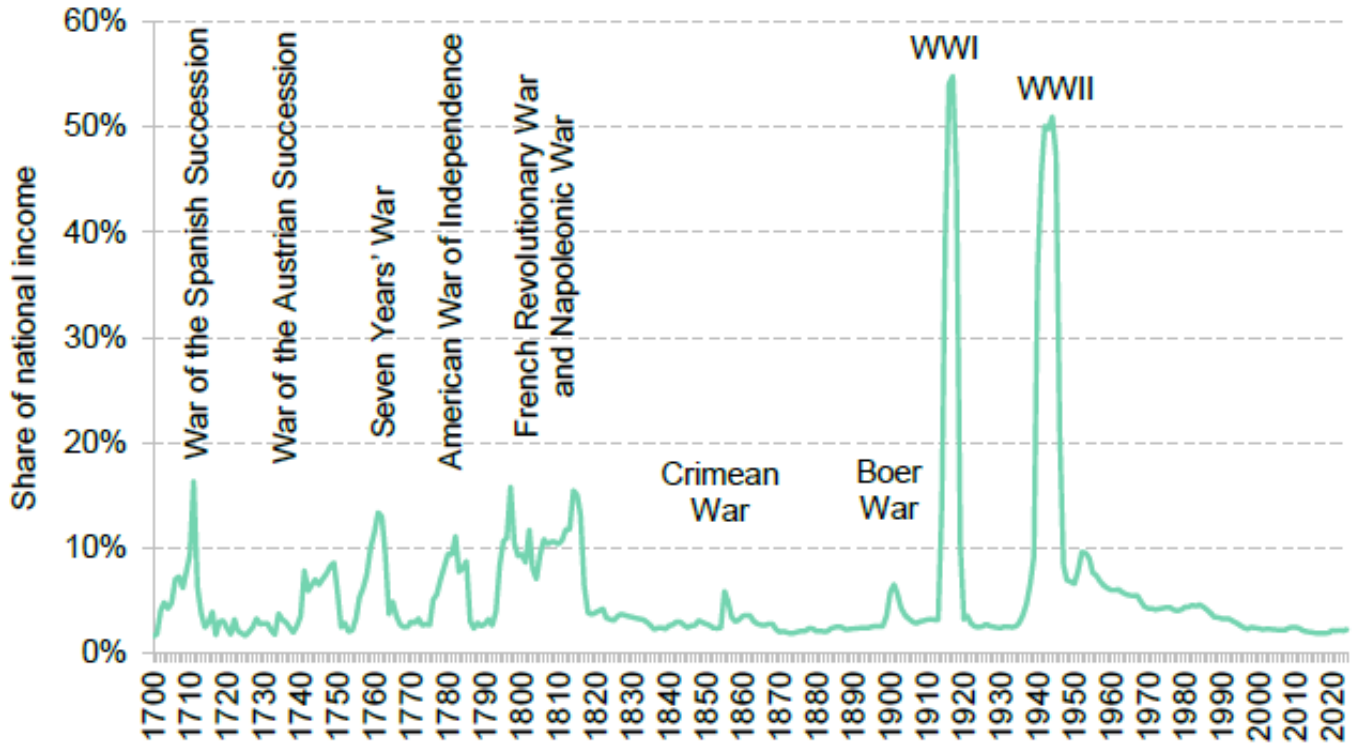


Source: Gavanni et al (2026)

Elements of Defence Strategy

- Reduce Barriers to entry. “for projects valued above £20m, it takes 6.5 years on average for a contract to be awarded.” (p.51 of SDR)
- £2.6bn in R&D in 2023/24 raised to £3.1bn in 2024/25 (a 12% increase)
  - NB: last government plans were to cut real public investment, AB25 raised public investment by about 1% of GDP 2025-2030 £120bn)
- In 2024/25 UK spent £66 billion (2.3% of national income) on defence. More than France or Germany.
- The proportion of funding allocated to capital investment, stayed constant at around 25% between 2002–03 and 2019–20. It then climbed to 35% in 2023–24, and is set to rise to 43% by 2028–29
- When defence spending was last at 3.5% of GDP, in 1987–88, health spending stood at 4.0% of GDP
- Defence Research and Evaluation (DRE) in National Armaments Unit to help deliver R&D

C. Defence spending as a share of national income between 1700 and 2024–25



Note: Departmental definition is for MoD only and takes plans as of Spending Review 2025 and adjusts spending backwards using growth rates from old Public Expenditure Statistical Analyses (PESAs). MoD spending is adjusted to account for changes to employer National Insurance contributions, Machinery of Government changes, increased pension contributions (SCAPE), and budget cover transfers in 2023–24. Functional line takes out-turns directly from PESAs (various). NATO line is drawn from various NATO documents; figures for 2024–25 and 2025–26 are estimates on 3 June 2025. The definition of NATO-qualifying defence spending most notably shifted in 2005, when military pensions began to be included. Panel C uses the functional definition of defence spending.

Source: Authors' calculations using: HM Treasury, PESAs (various), Autumn Budget 2024, Spring Statement 2025 and Spending Review 2025; GDP deflator as of 30 June 2025; Office for Budget Responsibility, Fiscal Risks and Sustainability – July 2022; and NATO, Defence Expenditure of NATO Countries (2014–25).

Motivation: Why is defense R&D interesting?

- But all is not well in US Defense Innovation….
  - Bloom, Jones, Van Reenen & Webb (2020): R&D productivity falling for decades. May be because increasingly hard to know what good ideas are out there
  - Defense innovation in decline relative to rest of economy

- *"The U.S. government no longer has the leading edge developing its own capabilities, particularly in information technology."*

  Michael Dumont, Deputy Assistant Sec. of Defense

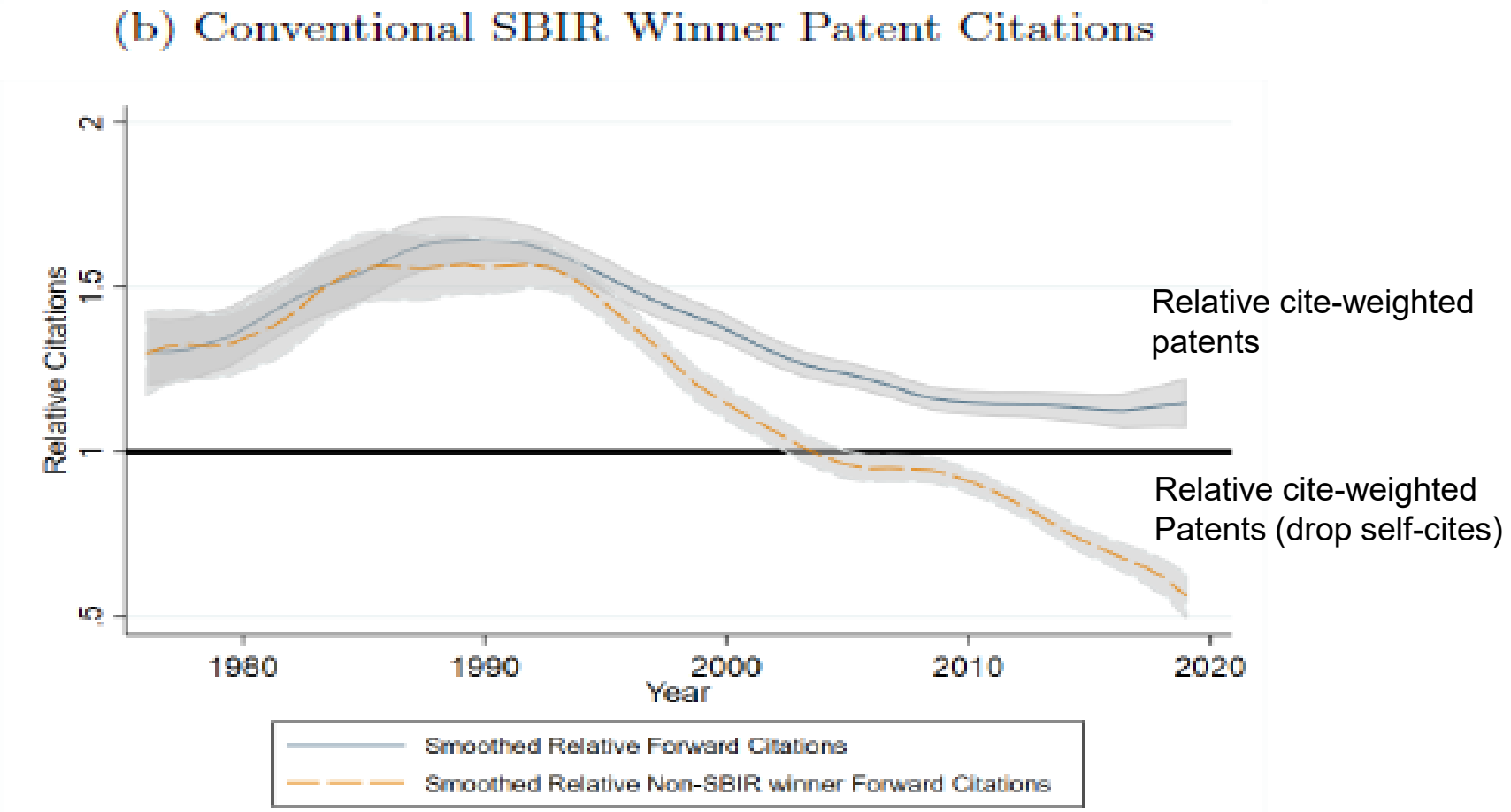
- *"The swift emergence of information-based technologies as decisive enablers of advanced military capabilities are largely developed and produced outside of the technologically isolated defense industrial base"*

  Under Secretary of Defense memo (Griffin, 2019)

Motivation: SBIR in defense R&D

- SBIR program one of world's largest & most influential government small business innovation programs
  - $3.11 billion across 11 Federal agencies in 2018
  - Of this, DoD accounted for $1.32 billion
  - Of this, Air Force had largest single program, $664 million
  - DoD SBIR also shows decline in innovation impact

Declining relative innovation for DoD SBIR winners



Notes: *Patents weighted by future citations among Air Force ABIR winners. Innovation measures relative to other firms in same technology-class by year (so 1.2 means 20% higher relative innovation rate). Dashed line drops all self-cites from other SBIR winner. Kernel smoothed. 95% confidence intervals shown in grey.*

VC funding 20% higher for Open R&D program

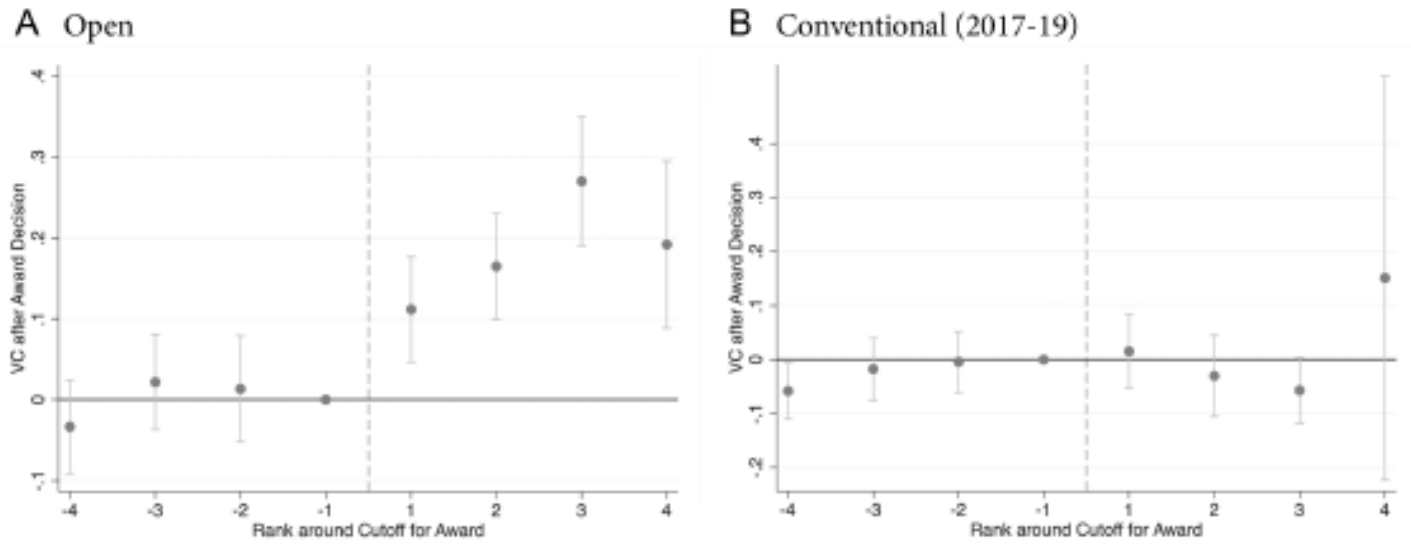


FIG. 4.—Probability of VC by rank around cutoff. The figure shows the probability that an applicant firm raised VC investment after the award decision. The *x*-axis shows the applicant's rank around the cutoff for an award. A rank of 1 indicates that the applicant had the lowest score among winners, while a rank of −1 indicates that the applicant had the highest score among losers. We plot the points and 95% confidence intervals from a regression of the outcome on a full complement of dummy variables representing each rank as well as fixed effects for the topic. The omitted group is rank = −1. We include first applications from 2017 to 2019.

Figure 4: The nationwide defence industry

Figure 5: Market segmentation for smarter procurement