The Case for Growth: Threats and Opportunities

OECD Global Forum on Productivity
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John Van Reenen

LSE and MIT
Summary

• OECD countries face severe growth threats arising from Pandemic & Ukraine crises.

• Even before these crises, there was global problem of low productivity growth since (at least) the 2008-9 Financial Crisis

• Opportunity for policy framework to focus on equitable and environmentally sustainable growth

• Innovation and Diffusion of better technologies and management practices are key to this

• We know much about what to do. Main challenge is political will
  – Need to join up in new Marshall Growth Plan
  – Frame around missions on climate, defense & health
OUTLINE OF TALK

Threats and Opportunities

Productivity

Climate Change

Defense

Health

The Political Challenge
## Threats and Opportunities (with examples!)

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**Threats**

**Examples**

- Post Global Financial Crisis
- Lightbulb Policy
- Toolkits
- New Marshall Plan for Growth
- Slowdown
- Post Global Financial Crisis

**Opportunities**

- Solar
- Green Tech
- COVID-19
- Vaccines, EHR
- Public-Private partnerships
- Ukraine
- Spillovers from Military Innovation
- DARPA/Open Innovation

**Environment**

- Climate Change
- Public-Private partnerships

**Health**

- COVID-19
- Vaccines, EHR
- Public-Private partnerships

**Defense**

- Ukraine
- Spillovers from Military Innovation
- DARPA/Open Innovation
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- Long-run productivity slowdown

### Examples
- Post Global Financial Crisis

### Opportunities
- New Marshall Plan for Growth

### Examples
- Policy Toolkits
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- **Long-run productivity Slowdown**: Post Global Financial Crisis, New Marshall Plan for Growth, Lightbulb Policy Toolkits
- **Environment**: Climate Change, Directed Clean Technical Change, Solar
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OUTLINE OF TALK

Threats and Opportunities

Productivity

Climate Change

Defense

Health

The Political Challenge
The Big Hit: GDP growth in Advanced Economies, 1980-2022

Real GDP growth (Annual percent change)

Forecast

IMF DataMapper

Advanced economies

©IMF, 2022, Source: World Economic Outlook (April 2022)

A. United States

B. Euro Area

C. United Kingdom

Notes: Average annual TFP growth in the US (panel A), Euro-area (panel B), and UK (panel C). Insufficient data for whole Euro-area so Germany, France, Italy, Spain, Netherlands, and Finland are used.
Drivers of Aggregate Productivity

• Pushing out the **technological frontier**
  – Important for OECD countries, but not the only thing…

• **Catching Up** to frontier
  – **Diffusion** of technology
  – Reducing **Misallocation**
Ideas Getting Harder to Find? R&D productivity decline means we need **more** investment to maintain good growth rate (not less)

**Source:** Bloom, Jones, Van Reenen and Webb (2020, AER)

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**Figure 4: Data on Moore’s Law**

Note: The effective number of researchers is measured by deflating the nominal semiconductor R&D expenditures of key firms by the average wage of high-skilled workers. The R&D data includes research by Intel, Fairchild, National Semiconductor, Texas Instruments, Motorola, and more than two dozen other semiconductor firms and equipment manufacturers; see Table 1 for more details.

**Source:** Bloom, Jones, Van Reenen and Webb (2020, AER)
OUTLINE OF TALK

Threats and Opportunities

**Productivity**

Climate Change

Defense

Health

The Political Challenge
Threats and Opportunities

Productivity:

1. Innovation Policies
2. Diffusion Policies
Why should the government subsidize innovation?

- **Multiple market failures:**
  - Knowledge spillovers most important
  - Frictions in other markets (e.g. finance and SMEs)

- **Empirical evidence suggests strong role for knowledge spillovers:**
  - Bloom, Shankerman & Van Reenen (2013); Lucking, Bloom and Van Reenen (2020); Jones & Summers (2022)
  - Social return to R&D is ~3-4 times as large as the private return. Implies large under-investment
## Innovation Policy: The “Lightbulb” Table

<table>
<thead>
<tr>
<th>(1) Policy</th>
<th>(2) Quality of evidence</th>
<th>(3) Conclusiveness of evidence</th>
<th>(4) Benefit - Cost</th>
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<td>Direct R&amp;D Grants</td>
<td>Medium</td>
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*Source:* Bloom, Van Reenen and Williams (2019, JEP)
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**Source:** Bloom, Van Reenen and Williams (2019, JEP)
Successful Innovation Policies

• **R&D tax credits**
  • Direct government grants
  • Human capital supply
    – Expanding STEM workforce
    – Universities
    – Immigration
    – “Lost Einsteins”
  • Competition and trade policy
Example of Innovation Policy: R&D tax credits

• Do Fiscal incentives increase R&D (Hall, 2022)?
  – Cross country (e.g. Bloom, Griffith & Van Reenen, 2002)
  – Cross state (e.g. Wilson, 2009)
  – Cross firm (e.g. Hall, 1992; Rao, 2016)
  – Elasticity of R&D with respect to user cost >1 (see Blandinieres et al, 2020 meta-study)

• Do Fiscal incentives increase Innovation?
  – Important because of re-labelling concern (Chen et al, 2021)
  – See also Akcigit et al (2022) and Stantcheva (2022) on general taxation
Do tax incentives for research increase firm innovation? An RD Design for R&D

Antoine Dechezleprêtre (OECD)
Elias Einiö (VATT)
Ralf Martin (Imperial College)
Kieu-Trang Nguyen (Northwestern)
John Van Reenen (LSE, MIT)

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Discontinuity effects on R&D

Source: Dechezlepretre et al (2022); Notes: 5,888 obs. Assets from FAME based on SME threshold (€86m). R&D from CT600. Sample of firms with €25m above & below the threshold. 368 obs per €3m bin.
Discontinuity effects on patenting

Source: Dechezlepretre et al (2022); Notes: 5,888 observations. Assets from FAME based on SME assets threshold (€86m) definition. R&D is from CT600. Sample of firms with €25m above & below the threshold. Outcome is average number of patents filed between 2009 and 2013.
R&D tax policy induces **spillovers**: patenting by technologically close firms (stronger in smaller technology classes).

**Source:** Dechezlepretre et al (2022); **Notes:** Semi-parametric estimates of spillover coefficient on technologically-connected firm's patents as a function of # peers in technology class (percentiles on X-axis). Uses Gaussian kernel function of the X-axis variable and a bandwidth of 20%. For example, there are 200 firms in 40th percentile technology class.
Putting this all together:
UK Business R&D/GDP ratio about 13% higher due to R&D tax policy since 2000

Source: Dechezleprêtre, Einiö, Martin, Nguyen and Van Reenen (2022). Note: The data is from OECD MSTI. The dotted line (“UK without tax relief”) is the counterfactual R&D intensity in the UK that we estimate in the absence of the R&D Tax Relief Scheme.
Innovation Policies II: Human Capital

- R&D tax credits
- Direct government grants
- Human capital supply
  - Problem with tax and grants is that they subsidize demand. If supply side inelastic, the effect is to just drive up price of R&D (scientist wages) rather than volume of R&D
  - Increasing human capital more effective: directly increases innovation and reduces cost of R&D (reduces inequality)
- Competition and trade policy
Successful Innovation Policies II

- R&D tax credits
- Direct government grants

**Human capital supply**
- Expanding STEM workforce
- Universities
- **Immigration**: Positive effects of immigrants on innovation. Can also be quickly increased, but politics hard.
  - “Lost Einsteins & Marie Curies”

- Competition and trade policy
Successful Innovation Policies II

• R&D tax credits
• Direct government grants
• **Human capital supply**
  – Expanding STEM workforce
  – Universities
  – Immigration
  – *“Lost Einsteins & Marie Curies”*: Few women, minorities & kids from low-income families in inventor pool = big loss of talent (Bell, Chetty, Jaravel, Petkova & Van Reenen, 2019, QJE)
• Competition and trade policy
Finding the “Lost Einsteins and Marie Curies”

- Kids born into richest 1% ten times more likely to grow up to be an inventor than those born in bottom 50% (not explained by early ability)
- Unlocking this hidden talent could quadruple innovation rate
- An example of policies that help growth and equity: e.g. education policies (Card & Giuliano ‘16; Cohodes ’20)
OUTLINE OF TALK

Threats and Opportunities

Productivity:

1. Innovation Policies
2. Diffusion Policies
Two fundamental aspects of diffusion

• Technology

• Management practices (focus here today)
The World Management Survey (WMS) is an extensive research project that has conducted interviews with approximately 20,000 managers from medium-sized manufacturing firms across 34 countries. The survey has been conducted in four major waves: 2004, 2006, 2009/10, and 2013/14. The data collected has helped managers and policy makers understand the drivers of better management practice.

WMS generates data and reports that help managers and policy makers understand the drivers of better management practice. The survey now includes hospitals, retail, and schools among other sectors.

Featured publications include:
- Why do management practices differ across firms and countries?
- Management Practice and Productivity: Why They Matter
- Management in Healthcare: Why good practice really matters

Medium-sized manufacturing firms (50-5,000 workers, median≈250)
Now extended to Hospitals, Retail & Schools [& more]
Average Management Scores by Country

Source: Bloom, Sadun & Van Reenen (2020). Note: Unweighted average management scores; # interviews in right column (total = 15,489); all waves pooled (2004-2014)
Management also varies heavily within countries

Source: Scur, Sadun, Van Reenen, Lemos and Bloom (2021)
Globally Management accounts for a third of TFP Gap with US

Source: Bloom, Sadun & Van Reenen “Management as a Technology”

Notes: TFP gaps from Penn World Tables; fraction accounted for by management uses the weighted average management scores and an assumed 10% impact of management on TFP
## Management policies Toolkit

L  = Low; Not politically easy  
M  = medium  
H  = Highly possible  

<table>
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<th>Policy type</th>
<th>Strength of evidence</th>
<th>Policy Net benefit (out of 5)</th>
<th>Difficulty of implementation</th>
<th>Time frame</th>
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**Source:** Scur, Sadun, Van Reenen, Lemos & Bloom (2021)
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The Political Challenge
Climate Change policies

• All countries want to reduce emissions, but incentives to free-rise off efforts of others
• Similar to (global) under-investment in R&D problem
• And need green innovation as carbon tax + regulation insufficient (even if they were politically feasible)
• Policies **can** stimulate clean innovation (Directed Technical Change):
  – Acemoglu et al (2022): Shale Gas
  – Burgess and Van Reenen (2022): **Solar Energy**
Some Good news: The rapidly falling cost of solar energy

Solar PV module prices
Global average price of solar photovoltaic (PV) modules, measured in 2019 US$ per Watt.

Source: LaFond et al. (2017) & IRENA Database
OurWorldInData.org/energy • CC BY
Rapid Growth in importance of China

Source: World’s largest solar PV producers: China, Taiwan, US, Japan, Germany, & Malaysia (1995-2013). Data sources are IEA-PVPS and Earth Policy Institute
Big policy efforts towards solar in China

Note: Policy support time series in gray comes from PKULaw dataset. Highlighted main policies are from (Shubbak, 2019)
Fraction of Chinese city-regions with Solar subsidy policies

Note: Source: PKULaw laws & regulations dataset; out of 120 adm2 regions with any Solar firms
Solar policies raise Solar production (and patenting): Diff-in-Diff Event Study (Callaway & Sant’Anna, 2021, method)

Source: Burgess and Van Reenen (2022), Preliminary
Implications

• Solar policies around the world influence innovation incentives (e.g. German feed-in tariffs in 2000s)

• Chinese Industrial policy massively increased supply, lowered prices and subsidized innovation

• If it benefited China as well as world, then helps overcome policy free riding

• Lessons for other clean technologies: Wind, Hydrogen, etc.?
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Successful Innovation Policies: R&D Grants

• Direct government grants (in theory, can be targeted better than tax incentives). Examples: Health (Azoulay et al ‘19); Green Energy (Howell, ‘17)
  – Well designed public R&D programs crowd-in private innovation on average

• Moretti, Steinwender & Van Reenen ‘22 use defense shocks across ~30 year period:
  – Industry-country AND French firm level panel data
  – Find 10% more public R&D stimulates ~5% more private sector R&D in long-run

• But nature of R&D procurement matters
OPENing up Military Innovation: Causal effects of Reforms to U.S. Defense Research

Sabrina Howell (NYU), Jason Rathje (US Air Force), John Van Reenen (LSE and MIT) and Jun Wong (Chicago)
Why is defense R&D interesting?

• US Dept. of Defense: world’s largest R&D supporting entity (6% of global R&D)
  — **Dual-use** aspect of frontier defense technology: large spillovers to private sector (e.g. GPS, cryptography, nuclear power, jet engines, Internet,..)
  — Often lauded as successful Mission-Oriented Industrial Policy from case studies (e.g. Mazzucato and Semieniuk, 2017)
  — But we show that slowdown in US defense innovation even worse than rest of economy
Successful Innovation Policies II: R&D Grants

- In response US Air Force (USAF) launched OPEN reforms to military innovation procurement in SBIR
- Conventional program took centralized top-down approach: tightly specified calls like:
  - “Affordable, Durable, Electrically Conductive Coating or Material Solution for Silver Paint Replacement on Advanced Aircraft”
- OPEN Reform allowed firms more freedom to propose the innovations they thought USAF needed “unknown unknowns”
- Admin data on all applicants, grant scores and outcomes 1983-2021 to implement a sharp Regression Discontinuity Design
Big jump in innovation near threshold of winning

Figure 7: Probability of Patents by Rank Around Cutoff

(a) Open

(b) Conventional (2017-19)

Note: These figures show the probability that an applicant firm had any ultimately granted patent applications within 24 months after the award decision. In both panels, 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 2017-19.
Findings from Howell et al (2022)

• New types of firms starting applying & winning: younger, smaller, based in VC hubs of Silicon Valley, Boston, etc.

• Positive causal effects of OPEN program on:
  – VC funding
  – Defense Department Technology adoption
  – Innovation (quality-weighted patents)

• Conventional program had no causal effect on these & (unlike OPEN) only increased chances of winning another SBIR contract (implies lock-in by “SBIR mills”)
Policy Lessons

• There will be a big increase in military spending following Russia’s invasion of Ukraine.

• Some of this spending should be focused on innovation as civilian spillovers can be large.

• Structure R&D procurement in a more decentralized way to crowdsource new ideas like OPEN program.
OUTLINE OF TALK

Threats and Opportunities

Productivity

Climate Change

Defense

Health

The Political Challenge
Broad Points

• Healthcare is huge and growing industry: 18% of US GDP
• Despite being high skilled and high tech, much inefficiency
  – Can learn a lot from attempted reforms (e.g. Propper & Van Reenen; Bloom et al, 2016; Cooper et al, 2019)
• Huge potential for new technologies, but generally disappointing results. e.g. on digital, EHR (see survey by Bronsoler, Doyle and Van Reenen, 2022)
• Rapid development of COVID Vaccines an example of what can be achieved by public and private sector co-operation
  – Massive R&D investment
  – Govt. policy to remove regulatory barriers throughout supply chain (planning permission to drug approvals)
OUTLINE OF TALK

Threats and Opportunities

Productivity

Climate Change

Defense

Health

The Political Challenge
A New Marshall for Growth

- Big threats, but also opportunities for creative policies, especially around innovation
- We know much about what can be achieved evidence: e.g.:
  - *Structural* (competition, trade, skills, tax & subsidies; infrastructure, etc.)
  - *Direct* (e.g. management information and training)
- Country-specific plans based on best evidence:
  - Toolkits for innovation & management policy
- Bind together in a **mission**:
  - Climate Change; Defense; Healthcare
Major Challenge is Political rather than Economic

• Productivity challenge requires long-run policy plans
• Governments suffer Policy Attention Deficit Disorder (PADD)
• Lurch to populism has made this worse (e.g. Brexit and Trump)
• Importance of national & international institutions that can “lean in” against this tendency
  – Independent Central Banks; Competition Authorities, Fiscal Councils, Health regulators
  – Examples of infrastructure reforms in LSE Growth Commission
• And of course, OECD itself!
THANKS!
Some Further Reading (and viewing)

https://www.hamiltonproject.org/assets/files/JVR_PP_LO_6.15_FINAL.pdf webinar


“Why Do We Undervalue Competent Management” (Raffaella Sadun, Nick Bloom and John Van Reenen) *Harvard Business Review* (2017), September-October


“The Intellectual Spoils of War: Defense R&D, Productivity and Spillovers” (Enrico Moretti, Claudia Steinwender and John Van Reenen) http://cep.lse.ac.uk/pubs/download/dp1662.pdf Vox
Further reading

  [https://poid.lse.ac.uk/textonly/publications/downloads/poidwp002.pdf](https://poid.lse.ac.uk/textonly/publications/downloads/poidwp002.pdf)


- “Increasing Difference Between Firms” Changing Market Structures and Implications for Monetary Policy, Jackson Hole Symposium (Van Reenen, 2018) 19-65 [http://cep.lse.ac.uk/pubs/download/dp1576.pdf](http://cep.lse.ac.uk/pubs/download/dp1576.pdf) NYT NPR


- “Management as a Technology” (Bloom, Sadun and Van Reenen, 2017): [http://cep.lse.ac.uk/pubs/download/dp1433.pdf](http://cep.lse.ac.uk/pubs/download/dp1433.pdf)