poid Programme on Innovation and Diffusion

30 YEARS Centre for Economic Performance

Policies to accelerate investment and innovation to raise productivity

ESRI International Conference
December 17th 2021

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LSE and MIT

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

MIT

OUTLINE OF TALK

Background: The Challenge

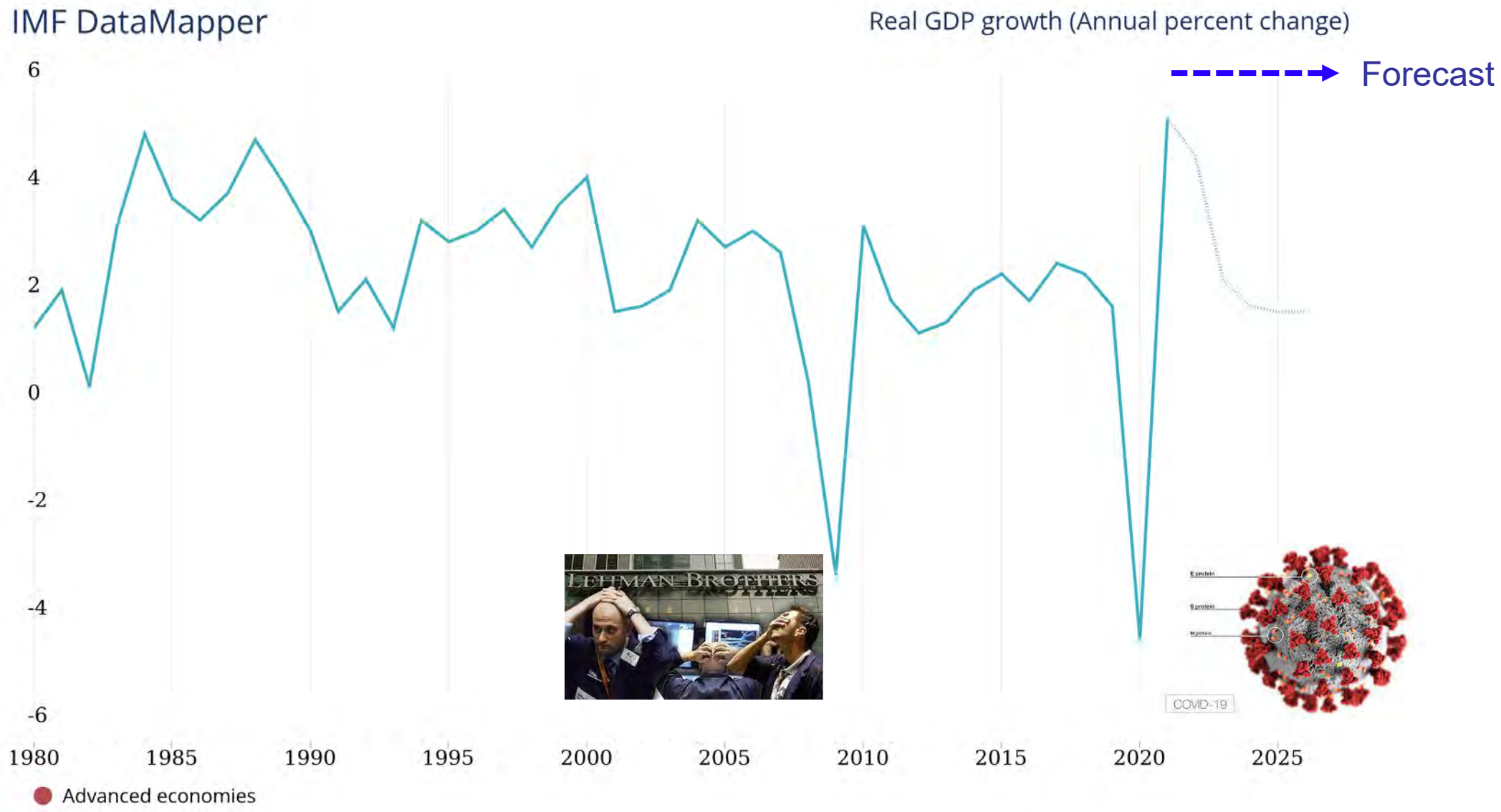
Innovation Policy

Diffusion Policy: Management

Misallocation

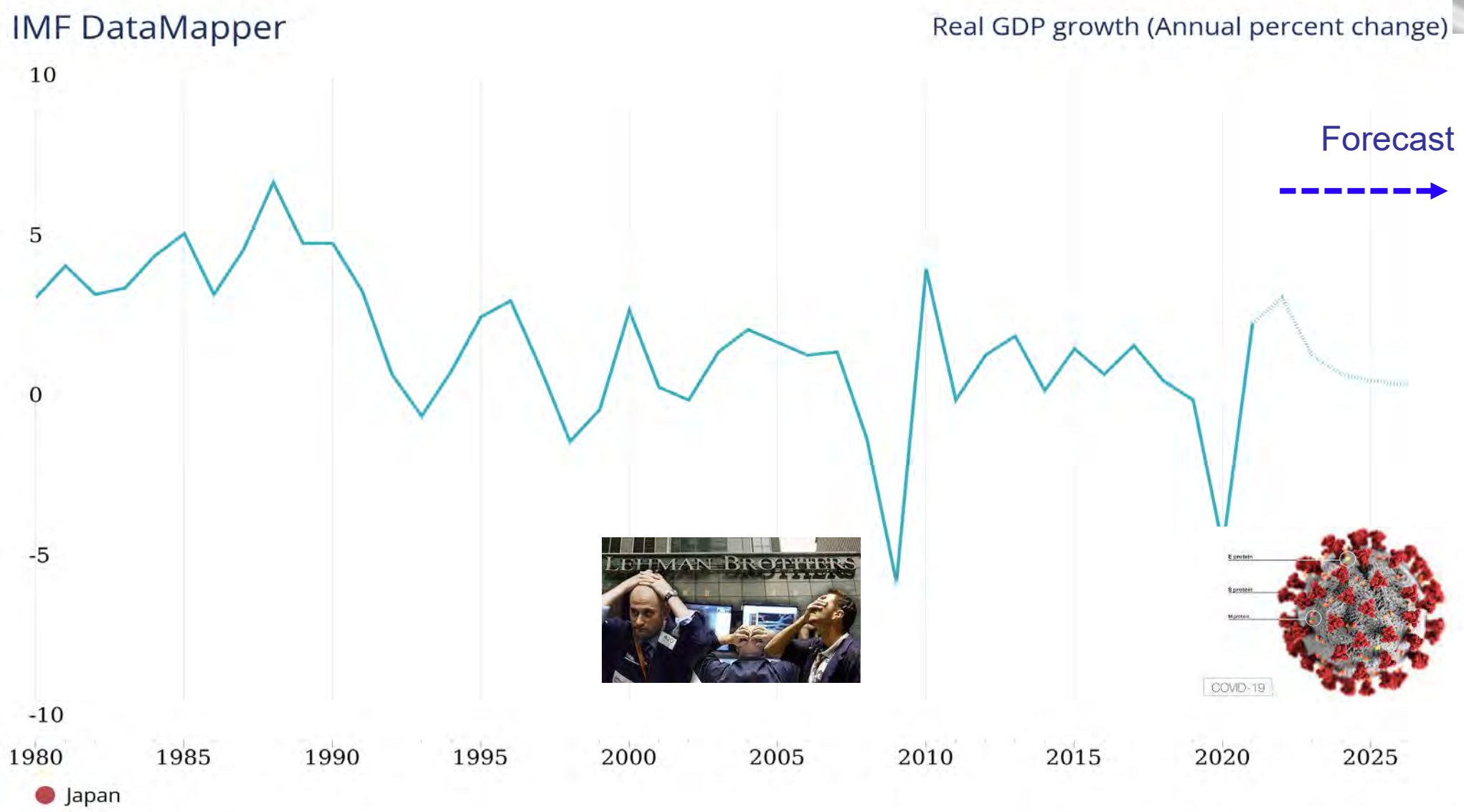
Growth Plan 2.0

The Big Hit: GDP growth in Advanced Economies, 1980-2021



©IMF, 2021, Source: World Economic Outlook (October 2021)

The Big Hit: GDP growth in Japan, 1980-2021

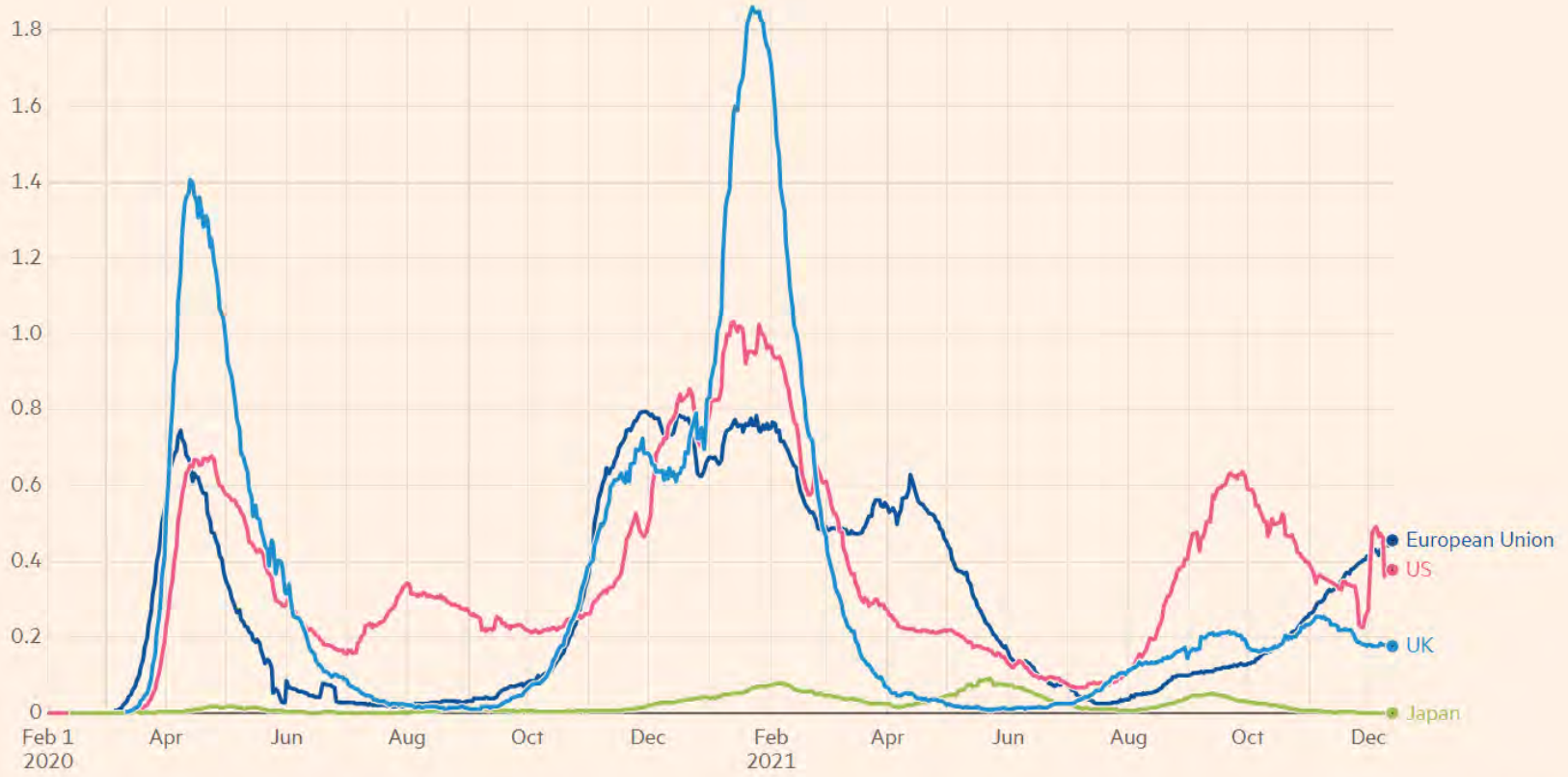


Per 100k | Raw numbers | Linear | Logarithmic | 02/01/2020 | Apply

Date must be 7 days before latest date

New deaths attributed to Covid-19 in European Union, US, Japan and UK

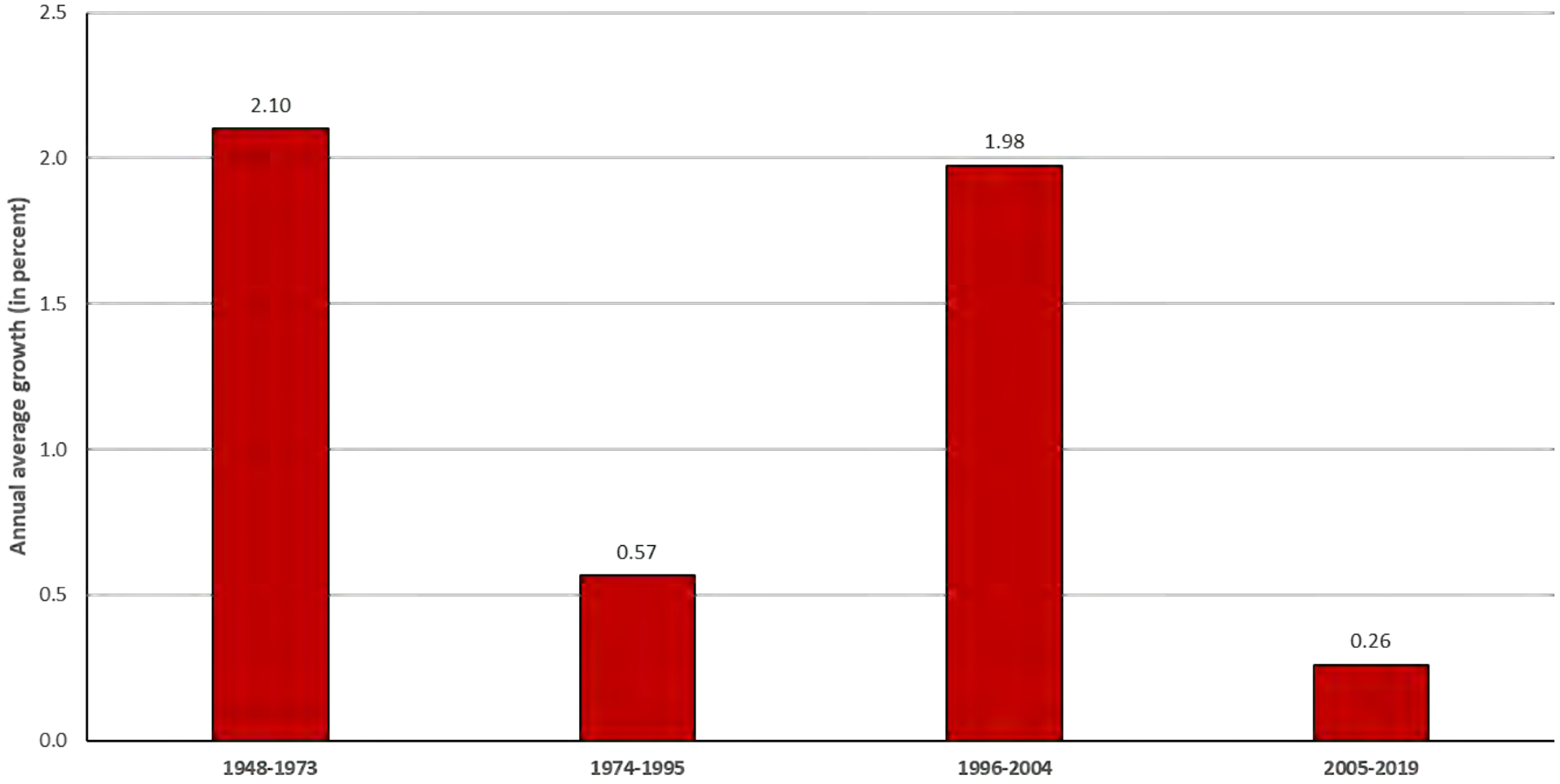
Seven-day rolling average of new deaths (per 100k)



Source: Financial Times analysis of data from Johns Hopkins CSSE, World Health Organization, UK Government coronavirus dashboard, Government of Peru, Public Health France, Slovenian Ministry of Health and the Swedish Public Health Agency.
Data updated December 14 2021 12.11pm GMT. Interactive version: ft.com/covid19

FINANCIAL TIMES

Long-term Problem: Slowdown of US TFP growth



Note: Annual average growth of Total Factor Productivity (TFP) over different periods (US)

Source: Federal Reserve Bank of San Francisco (2021)

Drivers of Aggregate Productivity

- Pushing out the **technological frontier**
  - Important for advanced countries like Japan, but not the only thing…

- **Catching Up** to frontier
  - **Diffusion** of technology
  - Reducing **Misallocation**

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Why should the government subsidize innovation?

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

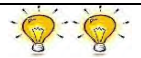
- **Empirical evidence suggests strong role for knowledge spillovers:**
  - Bloom, Shankerman & Van Reenen (2013); Lucking, Bloom and Van Reenen (2020); Jones & Summers (2021)
  - Social return to R&D is 3-4 times as large as the private return. Implies large under-investment

Innovation Policy: The “Lightbulb” Table

(1)	(2)	(3)	(4)	(5)	(6)
Policy	**Quality of evidence**	**Conclusiveness of evidence**	**Benefit - Cost**	**Time frame:**	**Effect on inequality**

Source: Bloom, Van Reenen and Williams (2019, JEP)

Innovation Policy: The "Lightbulb" Table

(1) Policy	(2) Quality of evidence	(3) Conclusiveness of evidence	(4) Benefit - Cost	(5) Time frame:	(6) Effect on inequality
Direct R&D Grants	Medium	Medium		Medium-Run	↑
R&D tax credits	High	High		Short-Run	↑
Patent Box	Medium	Medium	Negative	n/a	↑

"Demand"

Source: Bloom, Van Reenen and Williams (2019, JEP)

Innovation Policy: The "Lightbulb" Table

(1) Policy	(2) Quality of evidence	(3) Conclusiveness of evidence	(4) Benefit - Cost	(5) Time frame:	(6) Effect on inequality
Direct R&D Grants	Medium	Medium	💡💡	Medium-Run	↑
R&D tax credits	High	High	💡💡💡	Short-Run	↑
Patent Box	Medium	Medium	Negative	n/a	↑
Skilled Immigration	High	High	💡💡💡	Short to Medium-Run	↓
Universities: incentives	Medium	Low	💡	Medium-Run	↑
Universities: STEM Supply	Medium	Medium	💡💡	Long-Run	↓
Exposure Policies	Medium	Low	💡💡	Long-run	↓
Trade and competition	High	Medium	💡💡	Medium-Run	↑

"Demand"

"Supply"

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

Successful Innovation Policies: 1. R&D tax credits

- **Background facts**
  - OECD (2018): 33/42 countries have tax credits
- **Fiscal incentives increase R&D (Stantcheva, 2021)**
  - Cross country (e.g. Bloom et al, 2002)
  - Cross state (e.g. Wilson, 2009)
  - Cross firm (e.g. Hall, 1992; Rao, 2016)
  - Elasticity of R&D wrt user cost >1
- **Fiscal incentives increase Innovation**
  - Important because of relabelling concern (Chen et al, 2018)
  - Dechezlepretre et al (2016) using RD Design; Akcigit et al (2021)

Successful Innovation Policies

- R&D tax credits
- **Direct government grants (in theory, can be targeted better than tax incentives).** Examples:
  - Health, Energy, Defense (Azoulay et al ‘19; Howell et al, ‘17, ‘21)
  - **Positive crowd-in** of private by public R&D (Moretti et al ’20: a 10% increase in public R&D crowds in 5% private R&D)
- Human capital supply
- Competition and trade policy

Successful Innovation Policies

- 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

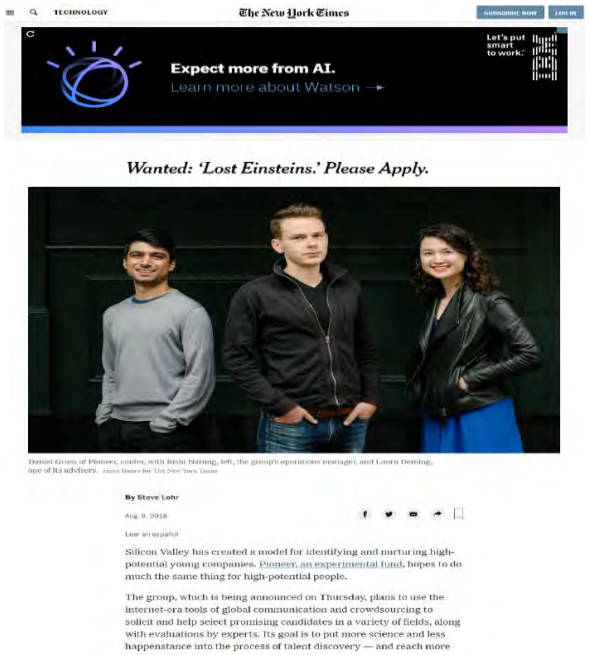
- R&D tax credits
- Direct government grants
- **Human capital supply**
  - Expanding STEM workforce
  - Universities
  - **Immigration:** Positive effects of immigrants on innovation. Can also be quickly increased, but politics hard.
  - “Lost Einsteins & Marie Curies”
- Competition and trade policy

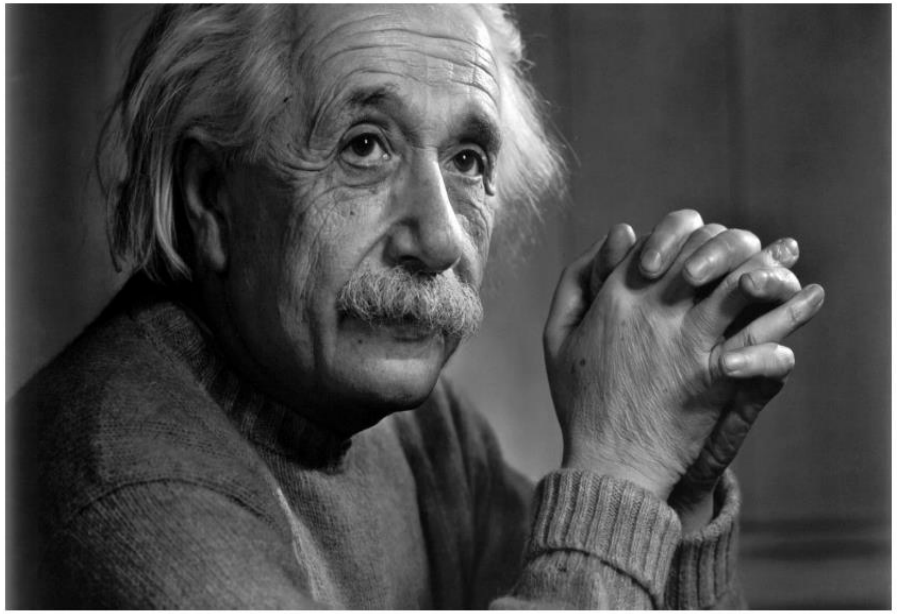
Successful Innovation Policies

- 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)
- 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; Breda et al. ’21)





Successful Innovation Policies

- 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)
- **Competition and trade policy**

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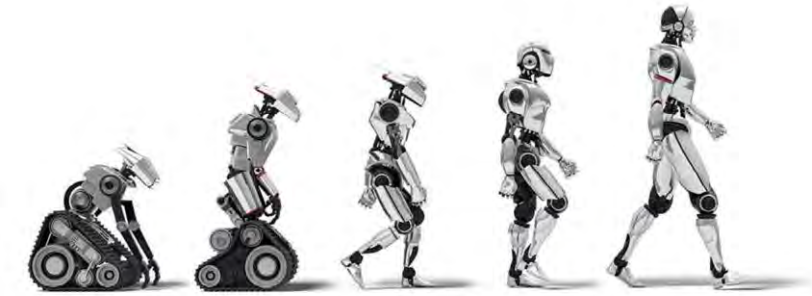
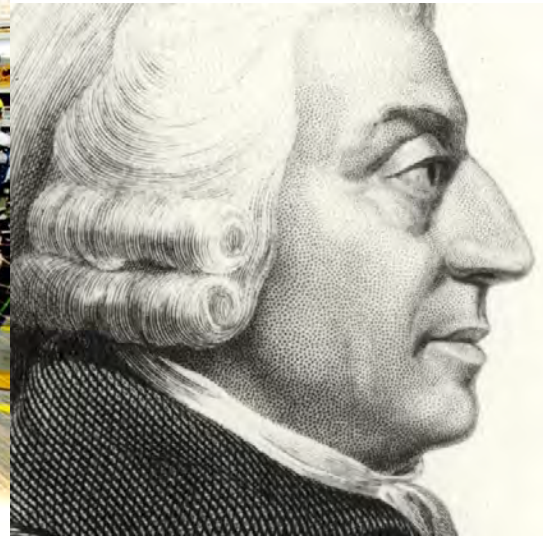
Two fundamental aspects of diffusion

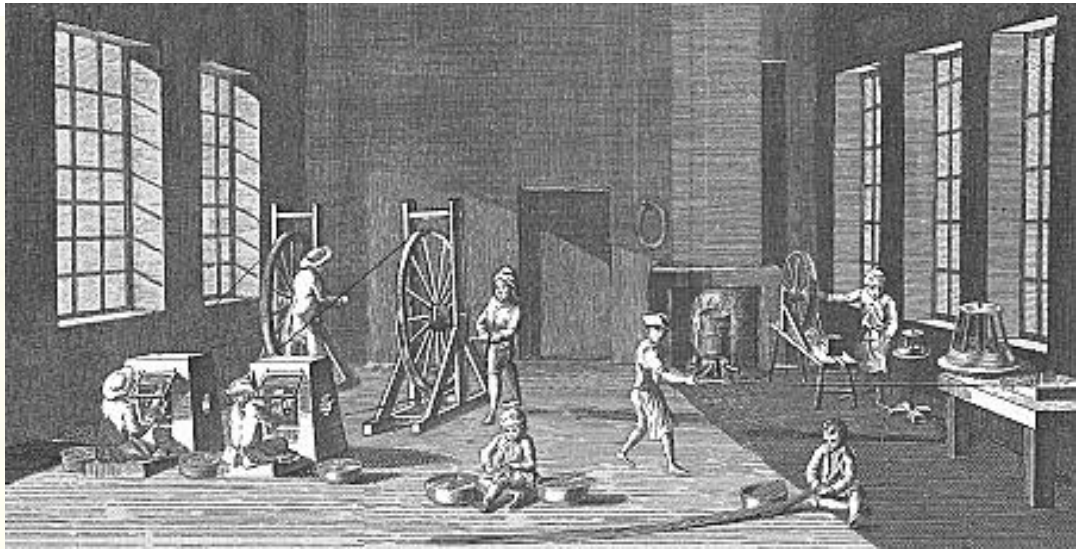


- **Technology**

- **Management practices** (focus here today)

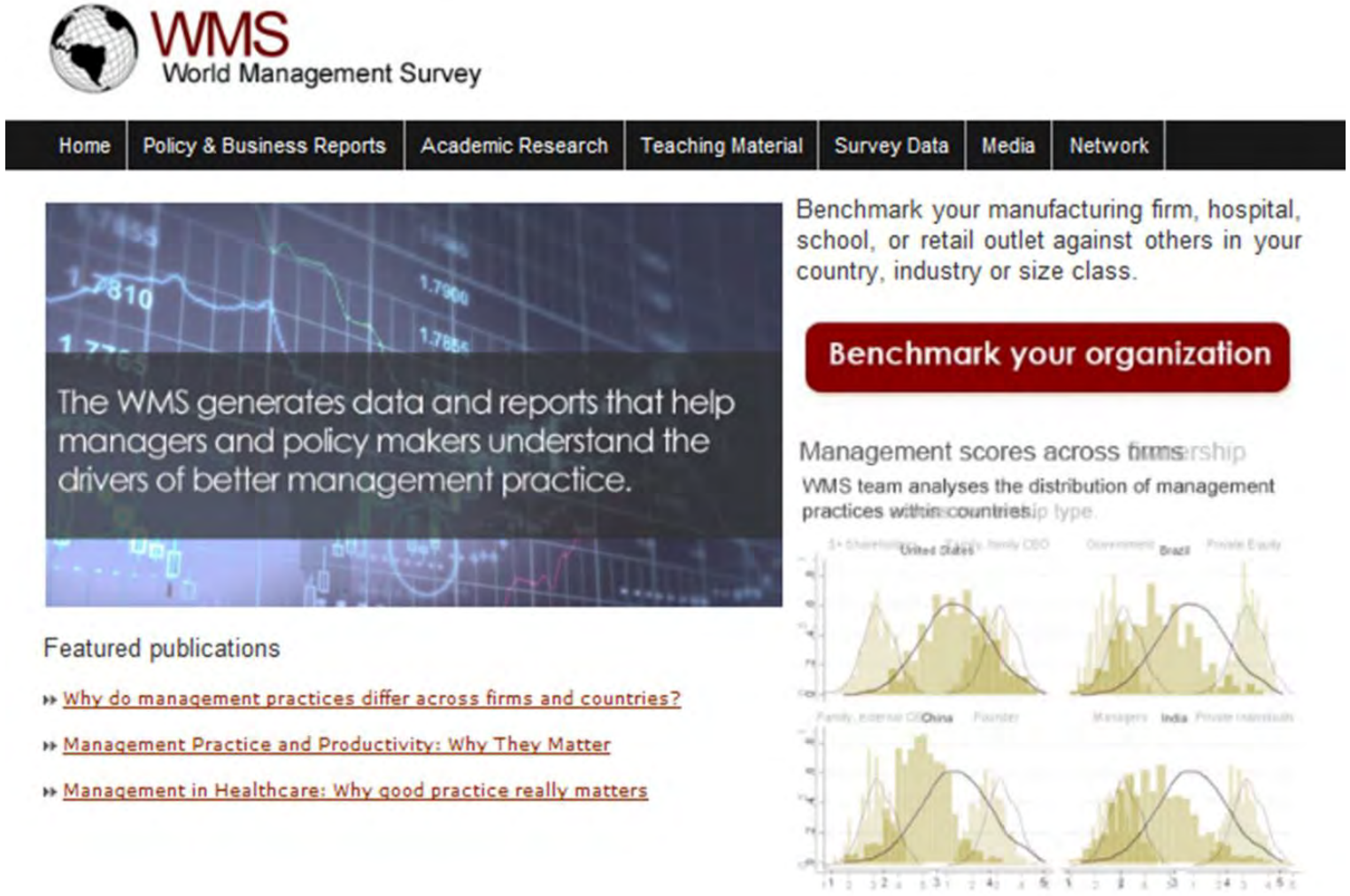
Toyota Plant





Adam Smith and the Pin Factory

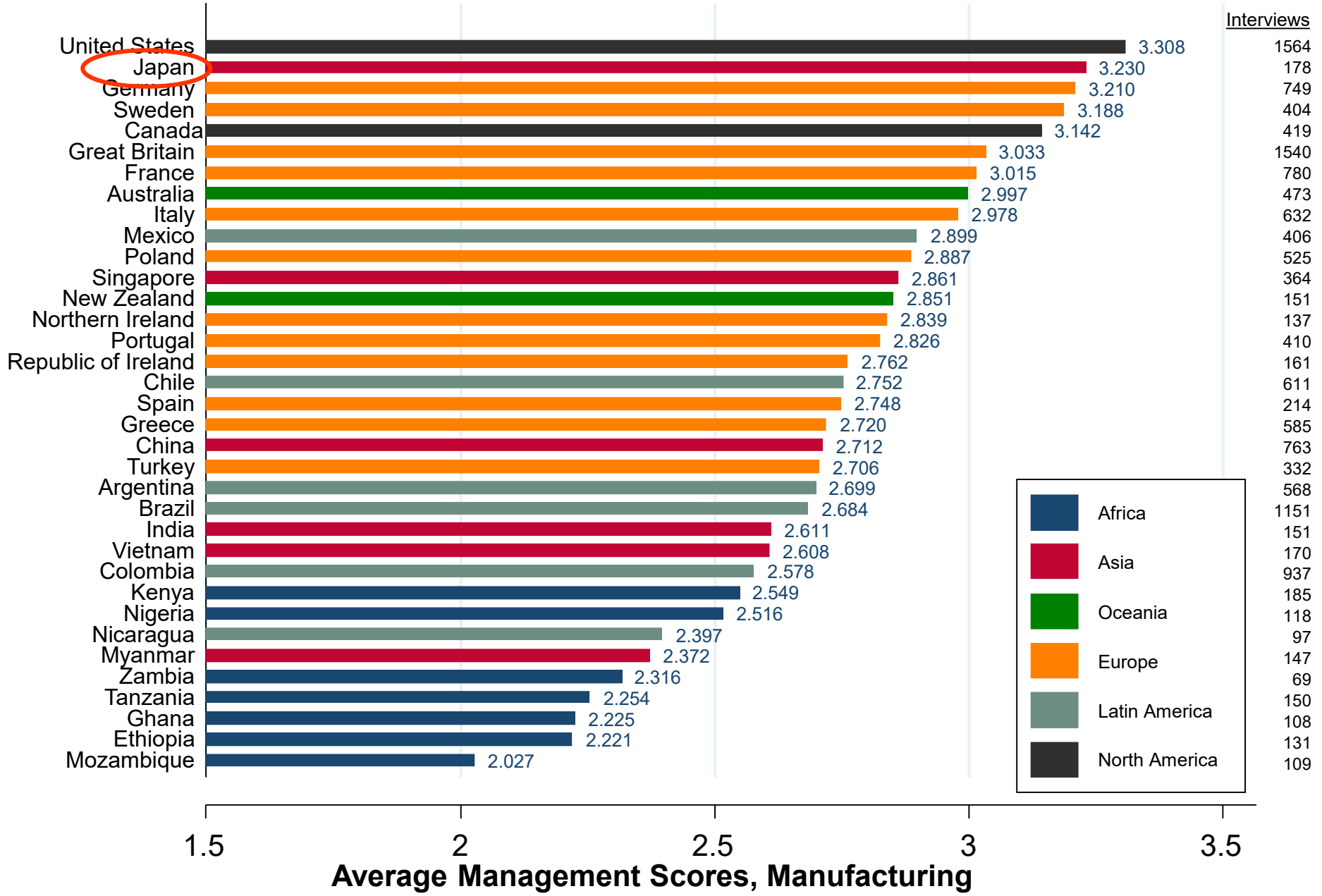
World Management Survey (~20,000 interviews, 4 major waves: 2004, 2006, 2009/10, 2013/14; 34 countries)



Medium sized manufacturing firms(50-5,000 workers, median≈250)

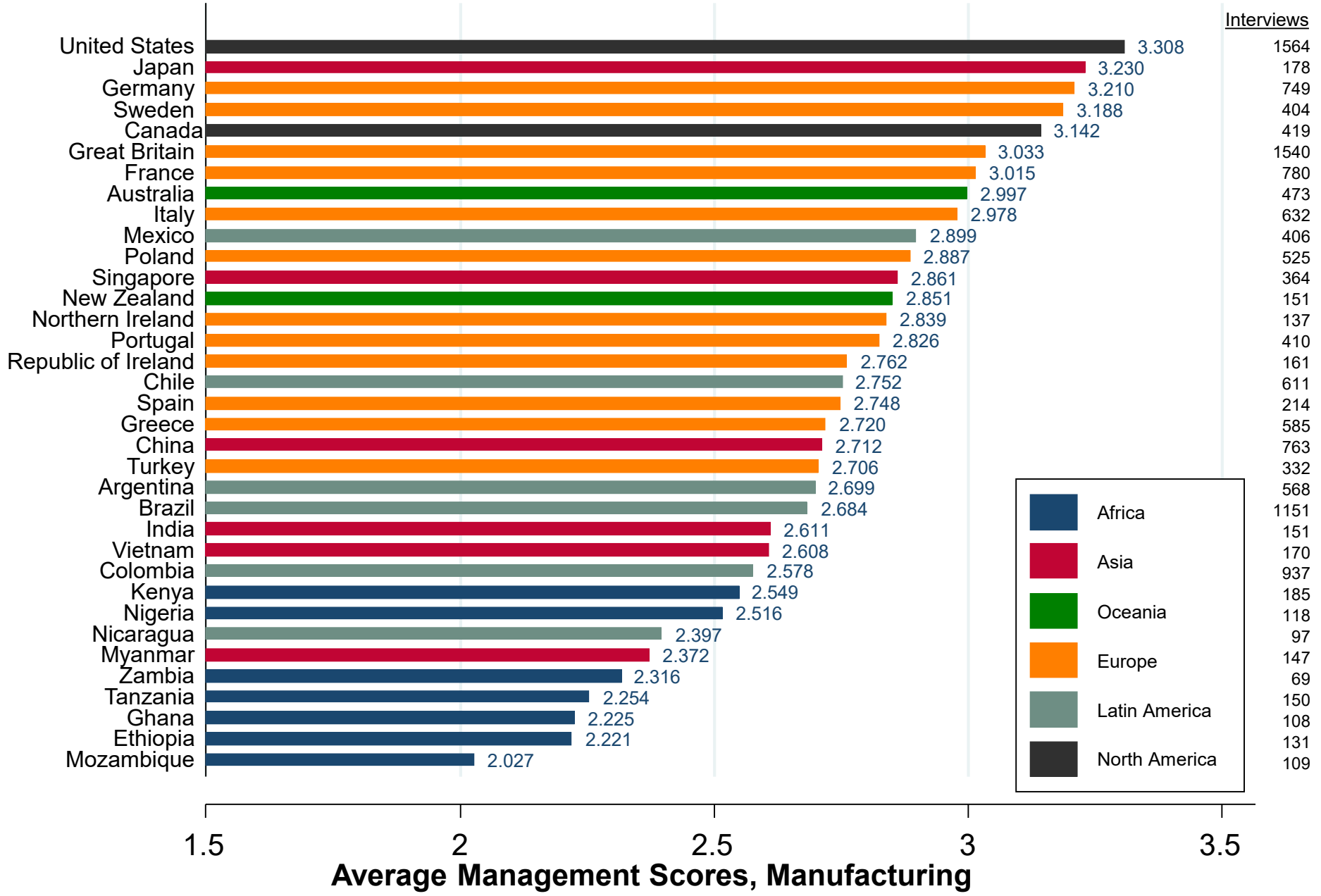
Now extended to Hospitals, Retail & Schools [& more]

Average Management Scores by Country



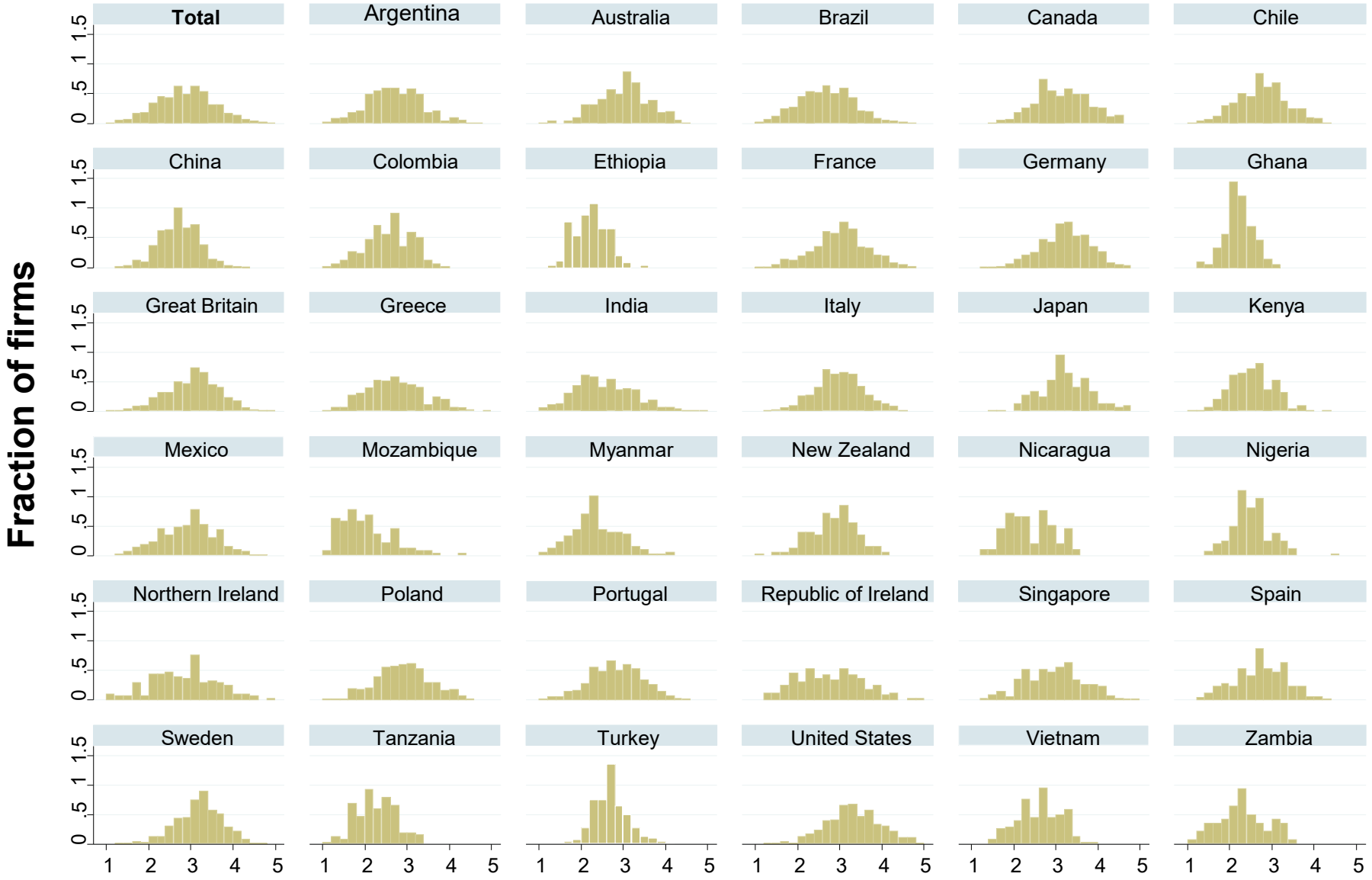
Source: Bloom, Sadun & Van Reenen (2020). **Note:** Unweighted average management scores; # interviews in right column (total = 15,489); all waves pooled (2004-2014)

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)

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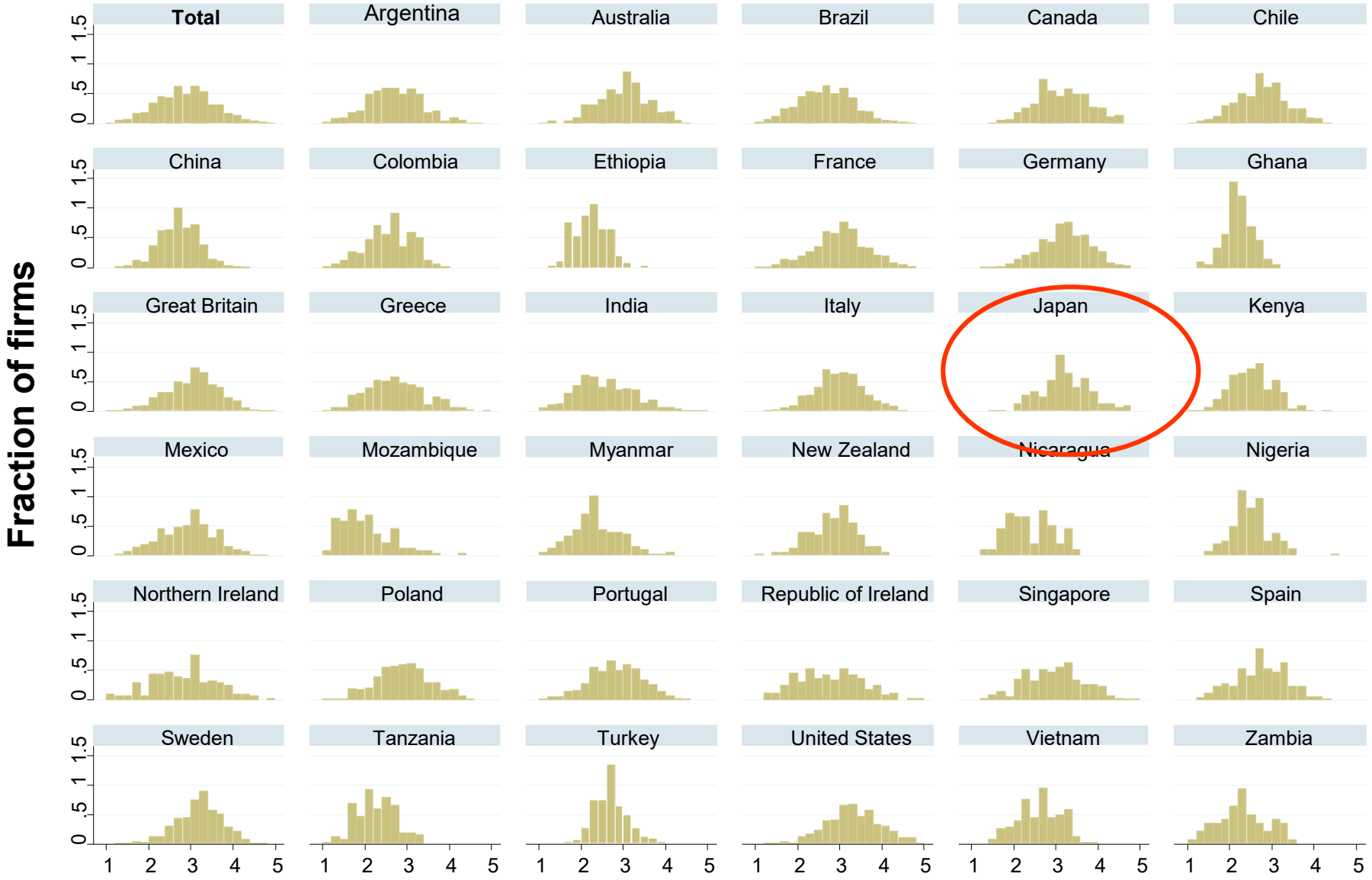
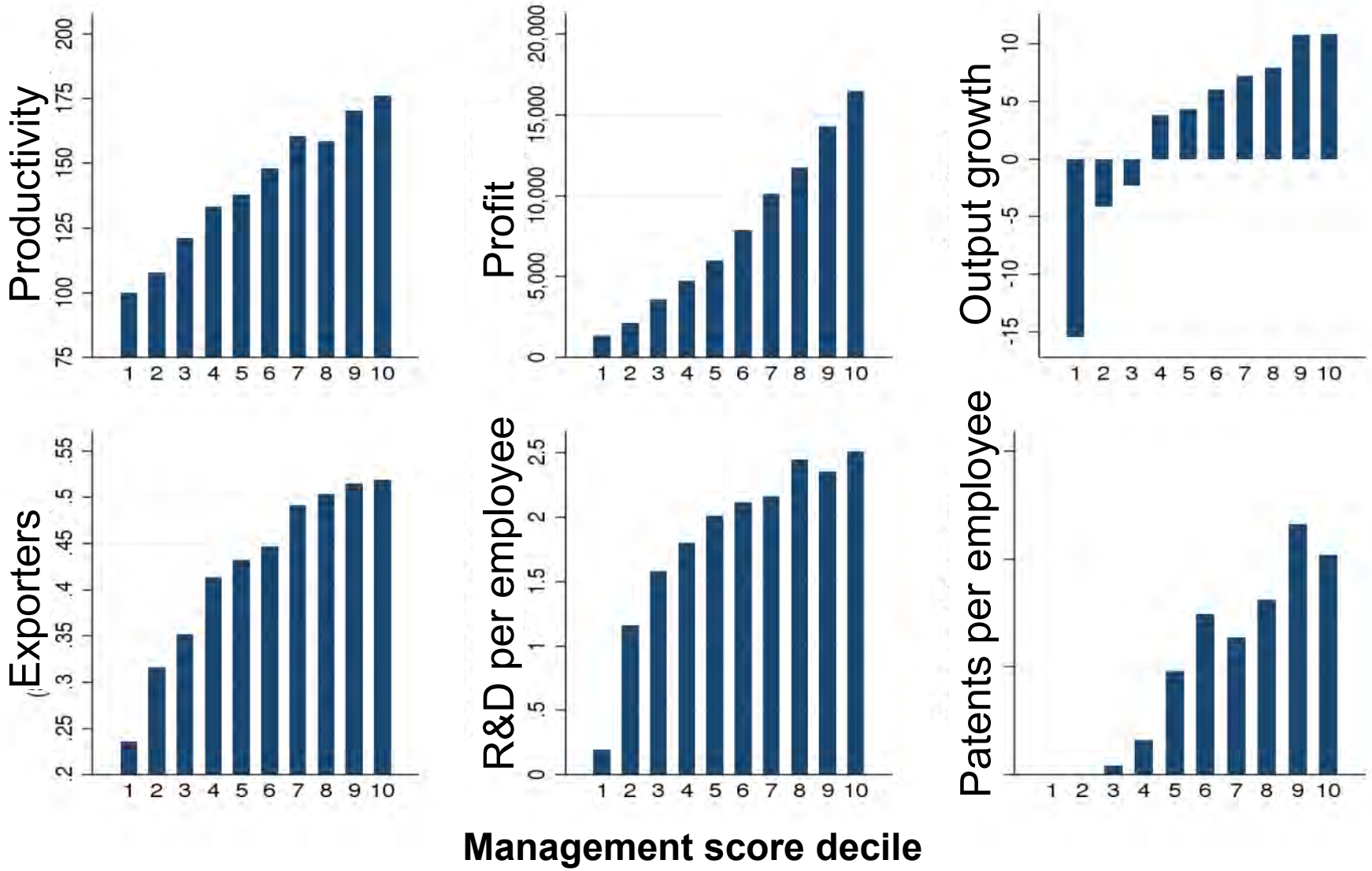


Source: Scur, Sadun, Van Reenen, Lemos and Bloom (2021)

Management scores positively correlated with many other measures of firm performance



Source: Bloom, Brynjolfsson, Foster, Jarmin, Patnaik, Saporta-Eksten & Van Reenen (2019, AER). MOPS

Toolkit of Management policies

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

Policy type	Strength of evidence	Policy Net benefit (out of 5)	Difficulty of implementation	Time frame
Structural				
Competition	H		M	medium
Trade and FDI	H		L	medium
Education	M		M	long
Deregulation	M		L	medium
Governance	M		M/L	long
Direct				
Training - consulting	H		H	short
Training - formal classroom	M		H	medium
Information/benchmarking	L/M		H	medium

Source: Scur, Sadun, Van Reenen, Lemos & Bloom (2021)

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Misallocation

- Enormous variation of productivity (& management) across firms
- About half of productivity growth is reallocation from less efficient to more efficient firms
- Productivity dispersion between firms has grown *larger* over time
  - e.g. Andrews, Criscuolo & Gal, 2015; Van Reenen, 2018; de Loecker, Obermeier & Van Reenen, 2021

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Growth Plan 2.0

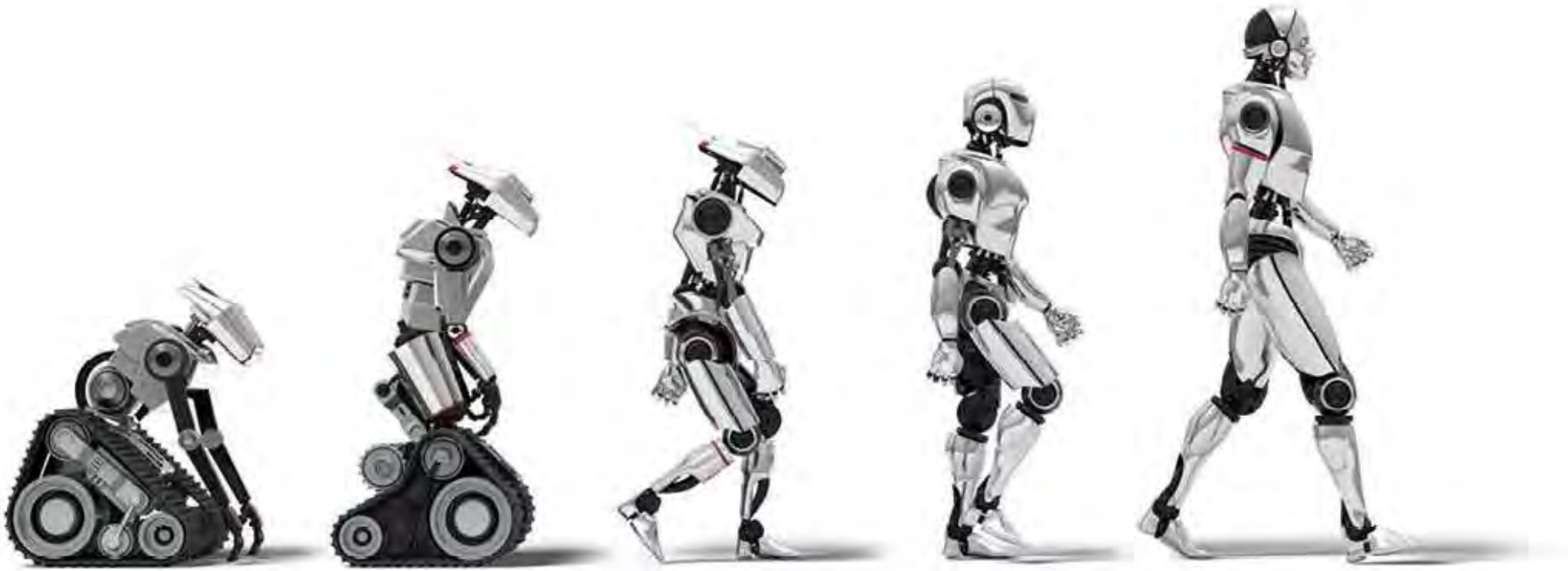
- **Short Run** Post-COVID policies balance reallocation & protection

- **Long run** policies
  - *Structural* (**competition**, trade, skills, infrastructure, tax & subsidies)
  - *Direct* (e.g. management information and training)

- Use evidence:
  - Toolkits for innovation & management policy

- Bind together in a **mission**: Climate Change

THANKS!



Some Further Reading (and viewing)

"Innovation Policies to Boost Productivity" (2020) Hamilton Policy Proposal 2020-13 https://www.hamiltonproject.org/assets/files/JVR_PP_LO_6.15_FINAL.pdf webinar

"A Toolkit of Policies to promote Innovation" (Nick Bloom, Heidi Williams and John Van Reenen), *Journal of Economic Perspectives (2019)* 33(3) 163–184 http://cep.lse.ac.uk/pubs/download/dp1634.pdf

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

"Measuring and Explaining Management practices across firms and nations" (Nick Bloom and John Van Reenen) *Quarterly Journal of Economics* (2007) 122(4), 1351–1408.

"The Costs and Benefits of Brexit" (Swati Dhingra, Hanwei Huang, Gianmarco Ottaviani, Joao Pessoa, Tom Sampson and John Van Reenen) *Economic Policy* (2017), 32(92) 651–705 Vox

"Who Becomes an Inventor in America? The Importance of Exposure to Innovation" (Alex Bell, Raj Chetty, Xavier Jaravel, Neviana Petkova and John Van Reenen), http://cep.lse.ac.uk/pubs/download/dp1519.pdf Data *Quarterly Journal of Economics* (2019)134(2) 647–713, New York Times Vox Atlantic Fortune Conversation VoxUS Economist VC Centrepiece INET

"Mapping the Two Faces of R&D: Productivity Growth in a panel of OECD industries" (Rachel Griffith, Stephen Redding & John Van Reenen) *Review of Economics and Statistics*, (2004) 86(4) 883-895. http://cep.lse.ac.uk/textonly/people/vanreenen/papers/wp0002.pdf

Further reading

- "The World Management Survey at 18" (Scur, Sadun, Van Reenen, Lemos & Bloom, 2021), *Oxford Review of Economic Policy* https://poid.lse.ac.uk/textonly/publications/downloads/poidwp002.pdf

- World Management Survey http://worldmanagementsurvey.org/

- "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 NYT NPR

- LSE Growth Commission Final Report (Aghion et al, 2013)

http://www.lse.ac.uk/researchAndExpertise/units/growthCommission/documents/pdf/GCReportSummary.pdf

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

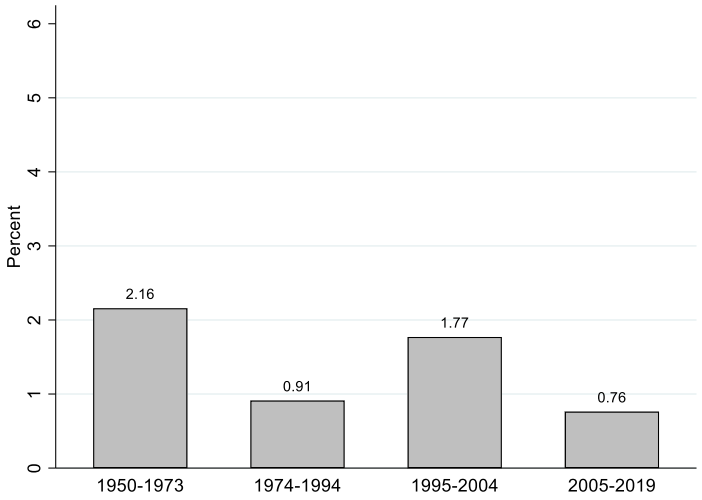
- "Do Fiscal Incentives increase innovation? An RD Design for R&D" (Antoine Dechezlepretre, Elias Einio, Ralf Martin, Kieu-Trang Nguyen and John Van Reenen), CEP Discussion Paper 1413 Vox, http://cep.lse.ac.uk/pubs/download/dp1413.pdf

Summary

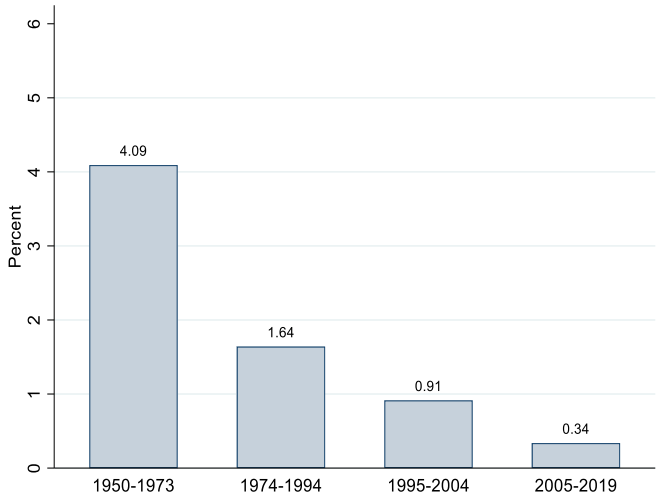
- The COVID Big Hit
- Weak growth in pay driven by weak growth in productivity since Global Financial Crisis
- So what can be done about productivity?

Productivity problems started long before COVID: TFP growth 1950-2019, US, Euro-area and UK

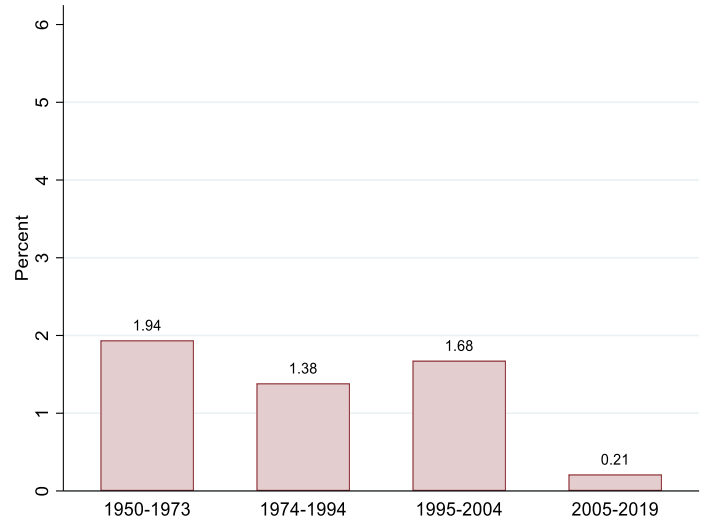
A. United States



B. Euro Area



C. United Kingdom

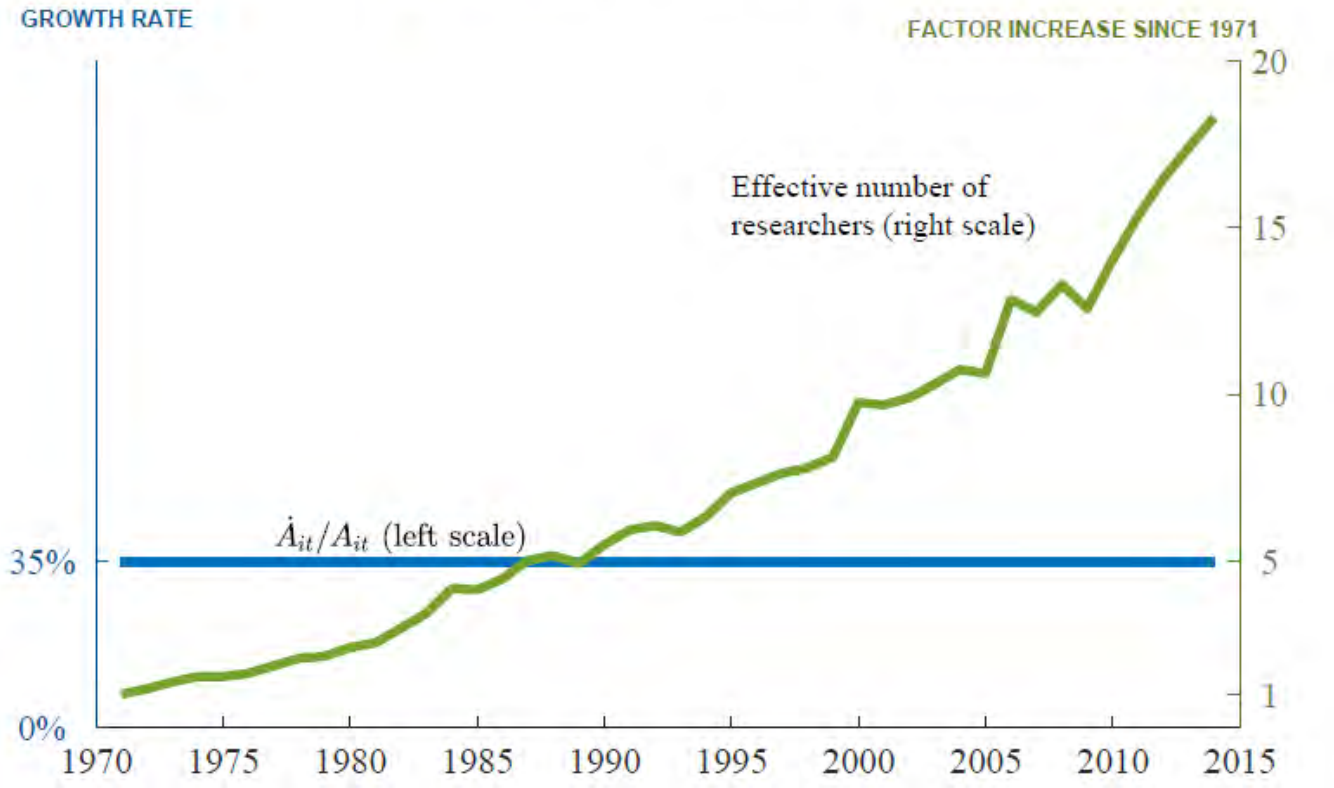


Source: Data updated from Bergeaud, Cette, and Lecat (2016). Data publicly available at: http://www.longtermproductivity.com/

Notes: Shown is the average annual TFP growth in the US (panel A), Euro-area (panel B), and UK (panel C). Insufficient data for whole EU, so we use Euro-area, represented by Germany, France, Italy, Spain, Netherlands, and Finland.

A decline in the productivity of R&D – even in semiconductors

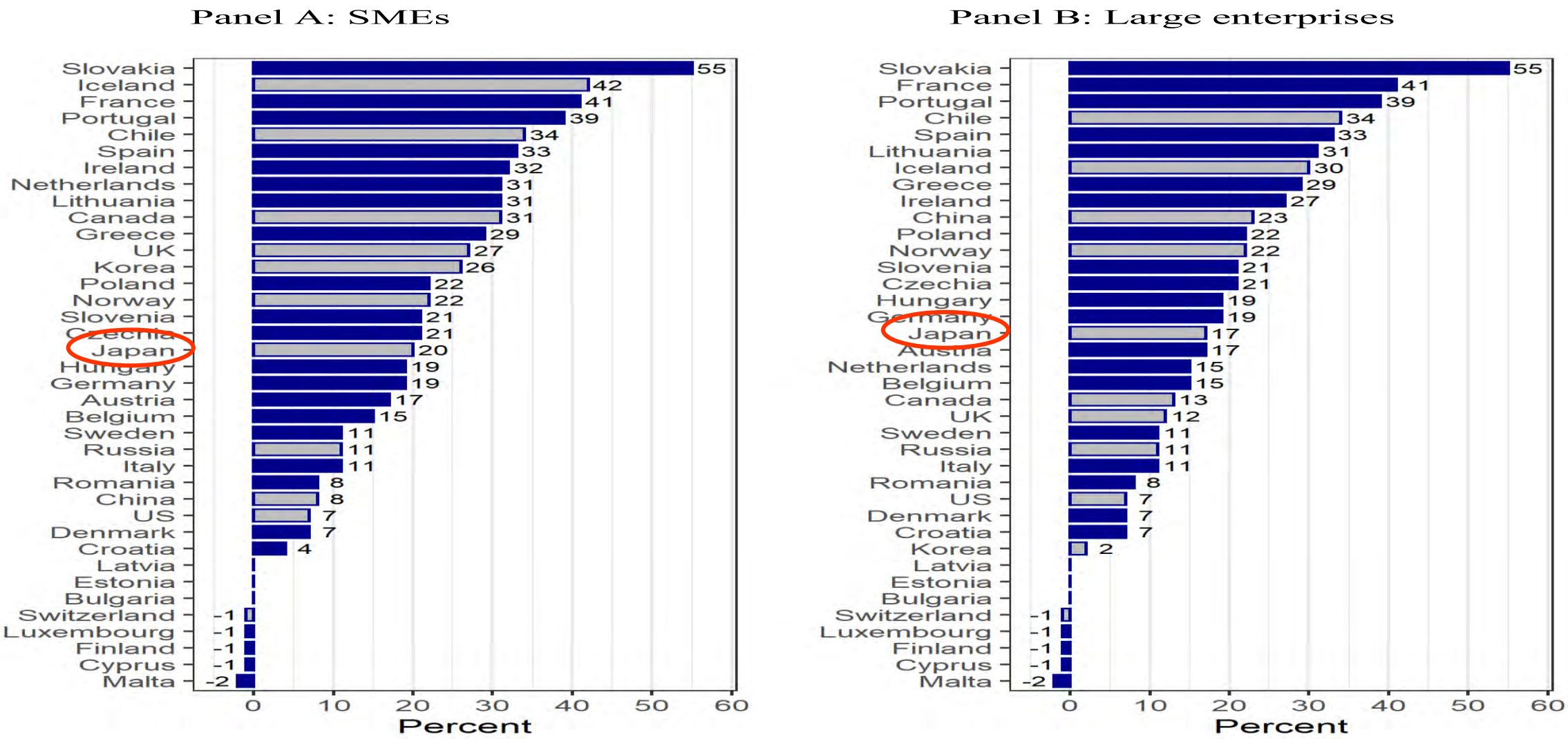
Figure 4: Data on Moore's Law



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.

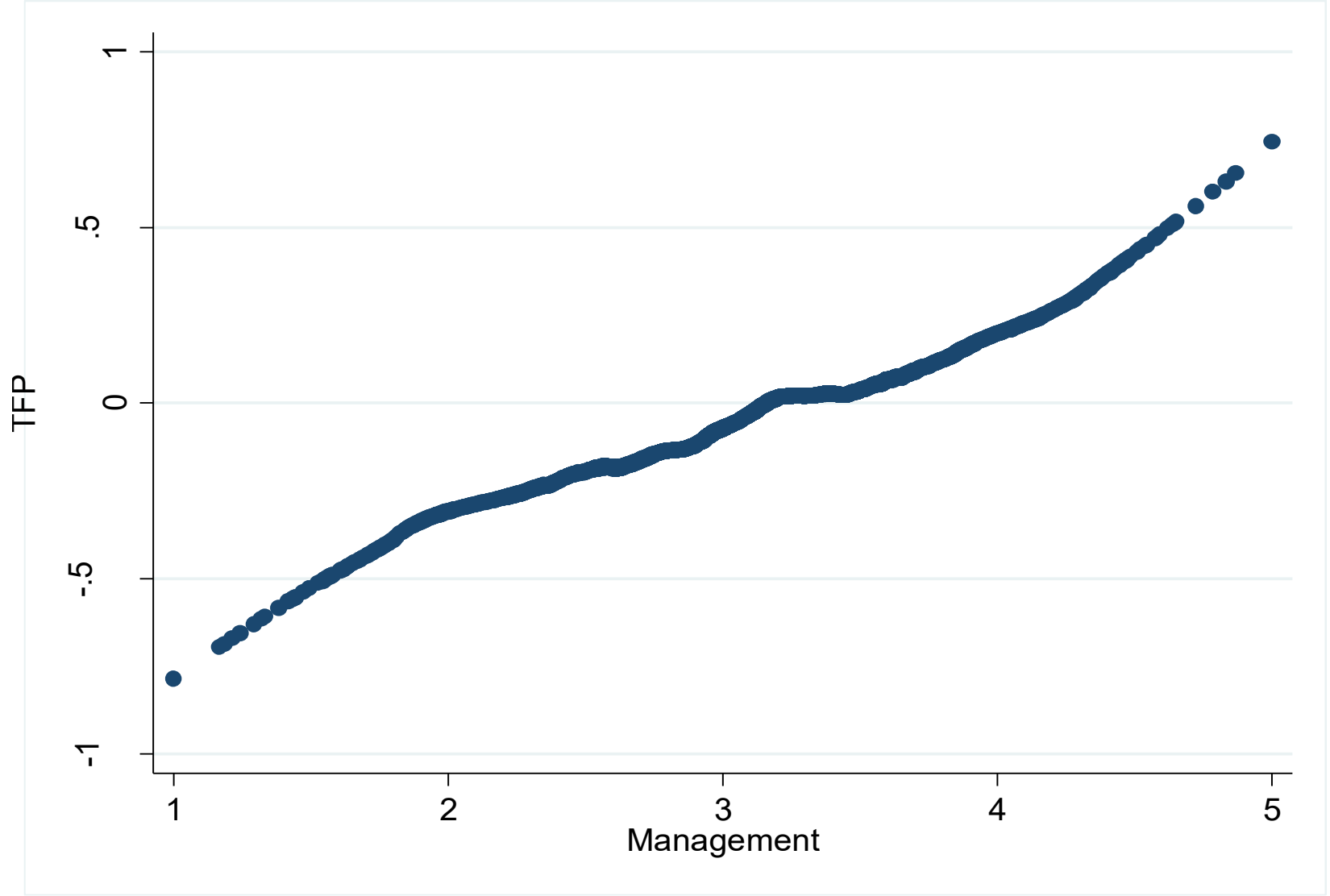
Source: Bloom, Jones, Van Reenen and Webb (2020, AER)

Figure 1: Implied tax subsidy rates on R&D expenditure in different countries in 2020

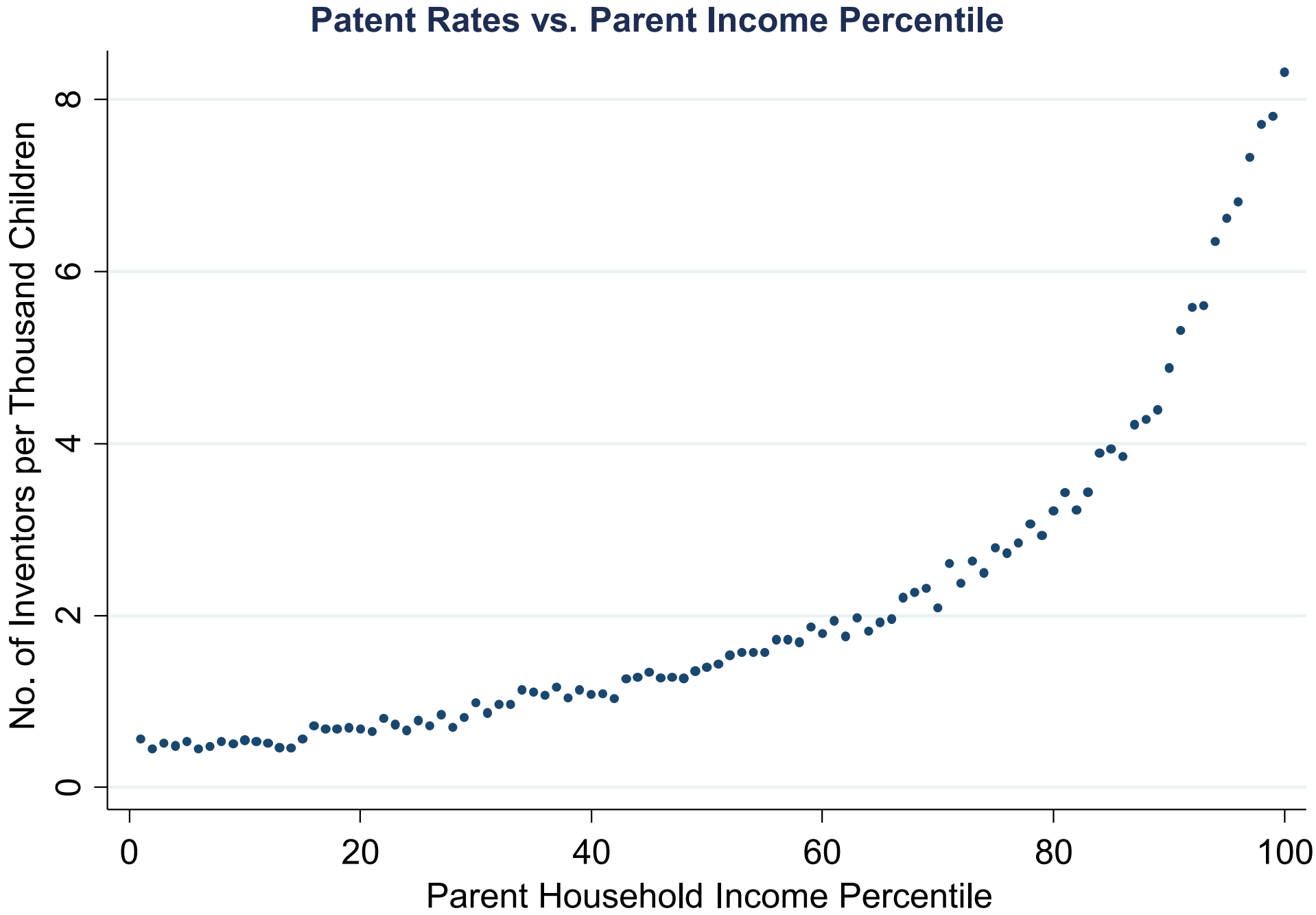


Source: OECD R&D Tax Incentives Database. https://stats.oecd.org/Index.aspx?DataSetCode=RDSUB
Notes: Shown are implied tax subsidy rates for Small and medium size enterprises (SMEs, (Panel A) and Large enterprises (Panel B) in different countries in 2020. The bars of EU countries are blue, those of non-EU countries gray. This is the "profitable scenario". For a detailed methodology behind calculations see https://stats.oecd.org/Index.aspx?DataSetCode=RDSUB#. Countries with no notable bar (i.e. Latvia, Estonia, and Bulgaria) have an implied tax subsidy rate of 0%. Countries are ordered by level of tax subsidy rate (descending order). A corresponding graph showing the values for both firm types in 2007 as a comparison can be found in the Appendix.

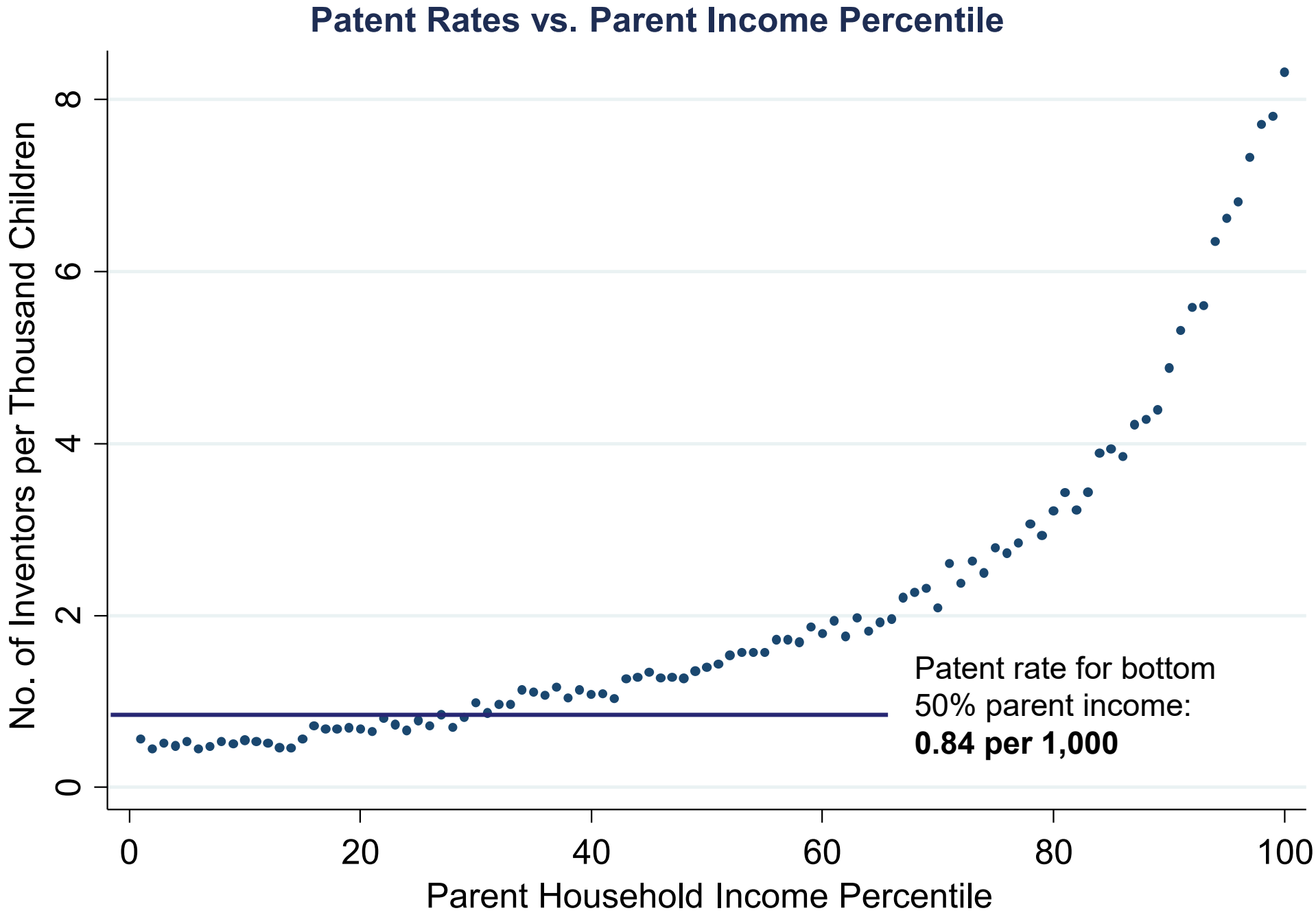
Productivity strongly positively correlated with Management Scores



Notes: Management is an average of all 18 questions (set to sd=1). TFP residuals of sales on capital, labor, skills controls plus a full set of SIC-3 industry, country and year dummies controls. N=10,900. **Source:** Bloom, Sadun and Van Reenen (2017)



Note: Sample of children is 1980-84 birth cohorts. **Source:** Bell et al (2019, QJE)



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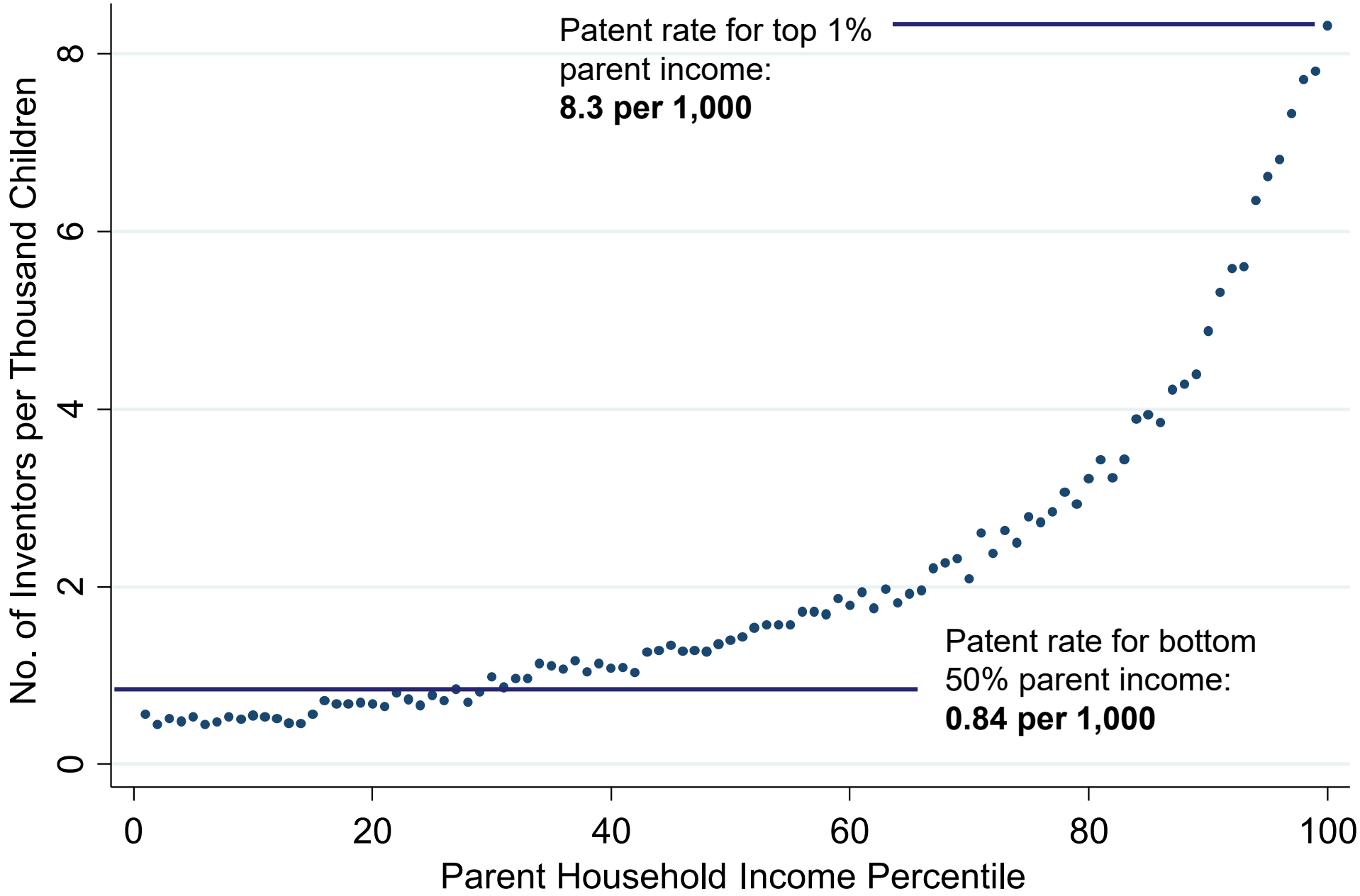
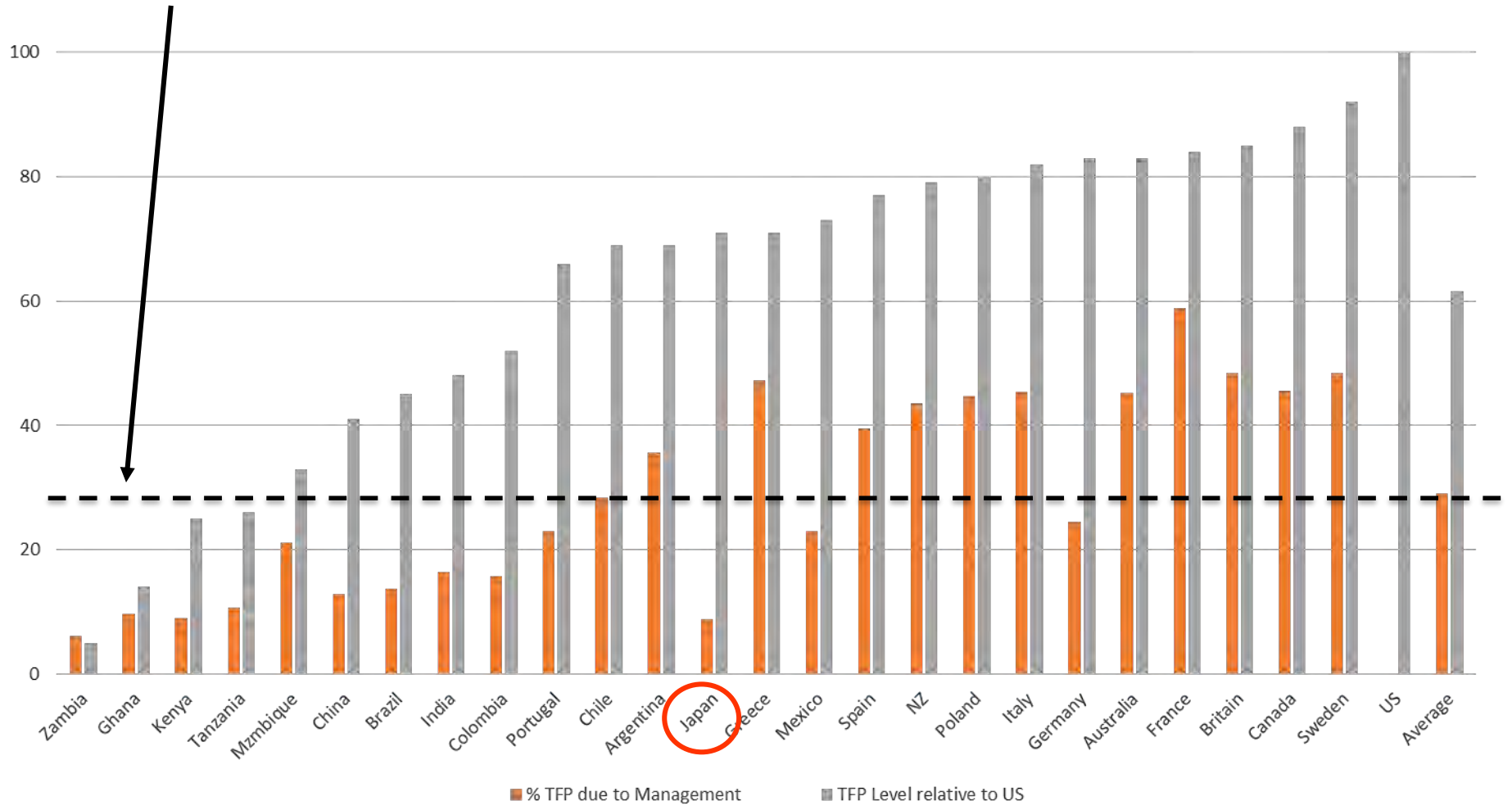
Patent Rates vs. Parent Income Percentile



Note: Sample of children is 1980-84 birth cohorts. **Source:** Bell et al (2019)

Globally Management accounts for a third of TFP Gap with US (~30% reallocation), but about 50% in Japan



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