Innovation and the Future of Europe

John Van Reenen,
LSE Ronald Coase School Professor
Digital Fellow, MIT

CEPR RPN on
Growth, Innovation and the Social Model

Paris, June 4th 2026

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 also worked with Mario Draghi on his report
- I am no longer in government and speak solely in a personal capacity

Outline

- European Challenges
- *Climate Change:* Cleaning up Innovation
- *Security:* Defending Innovation
- *Inequality:* Finding the Lost Innovators
- *AI:* Managing Innovation
- Politics of Innovation Policy
- [Econometrics of Innovation]

European Challenges

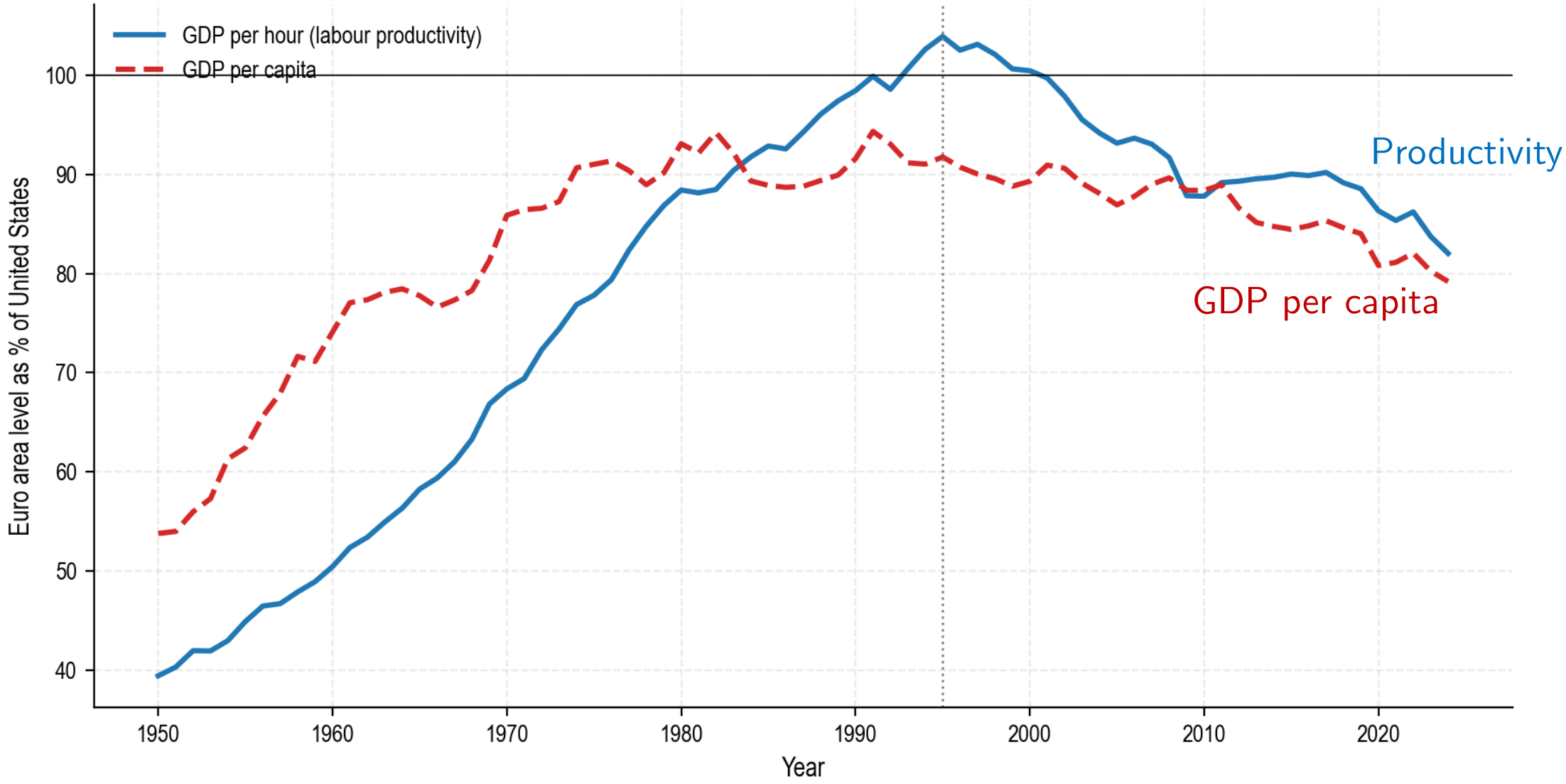
The Productivity Challenge

- Since the global financial crisis, growth has slowed across OECD - including in the US
  - Productivity growth roughly halved in US & in Europe
- But US productivity growth was stronger since mid-1990s, so productivity gap between US & Europe has widened

	Eurozone	US
1995-2007	1.3%	2.2%
2010-2024	0.6%	1.1%

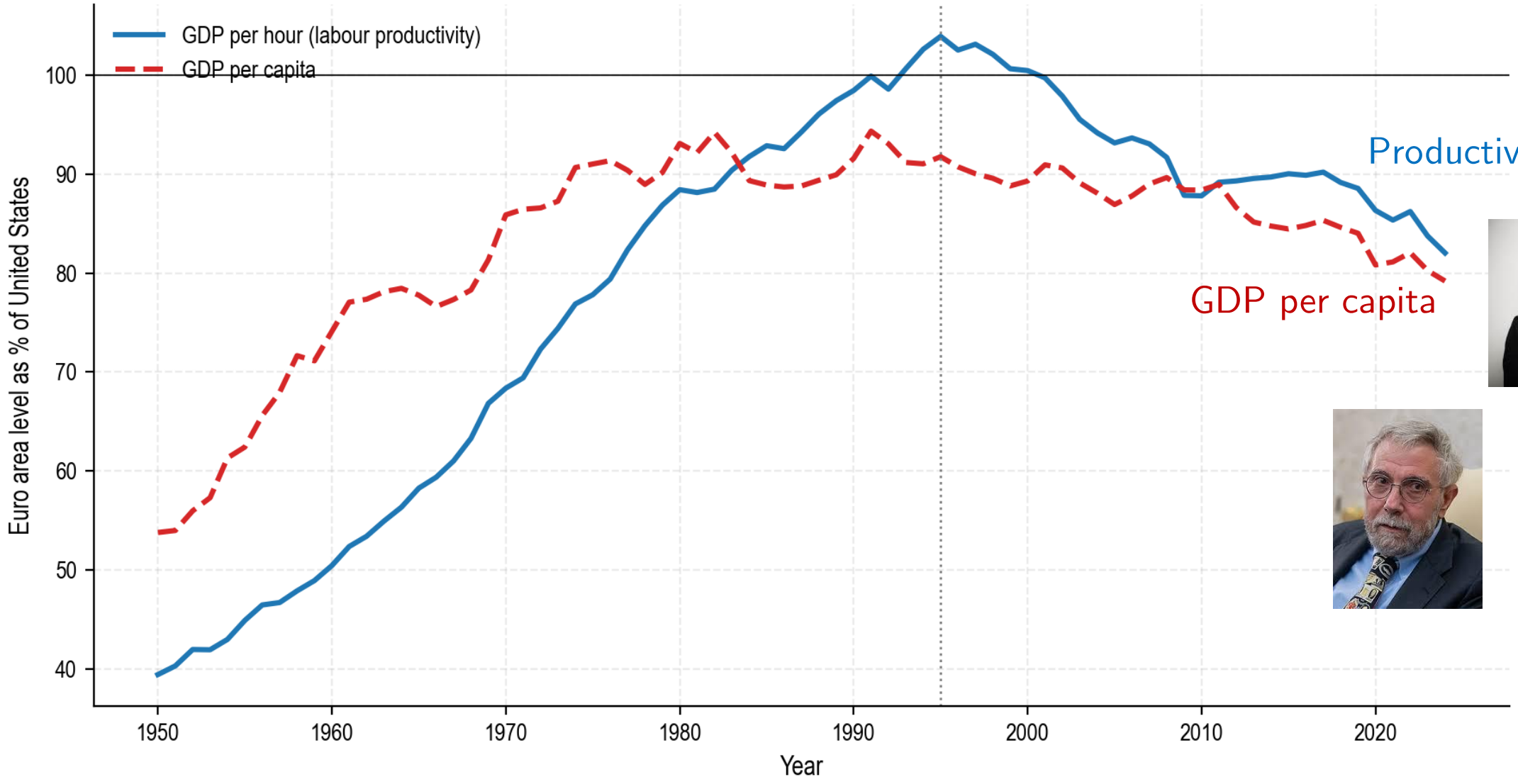
Notes: GDP per hour annual growth, Whole Economy, Bergeaud (2026)

Eurozone-US Gap in Productivity & GDP/capita since 1950



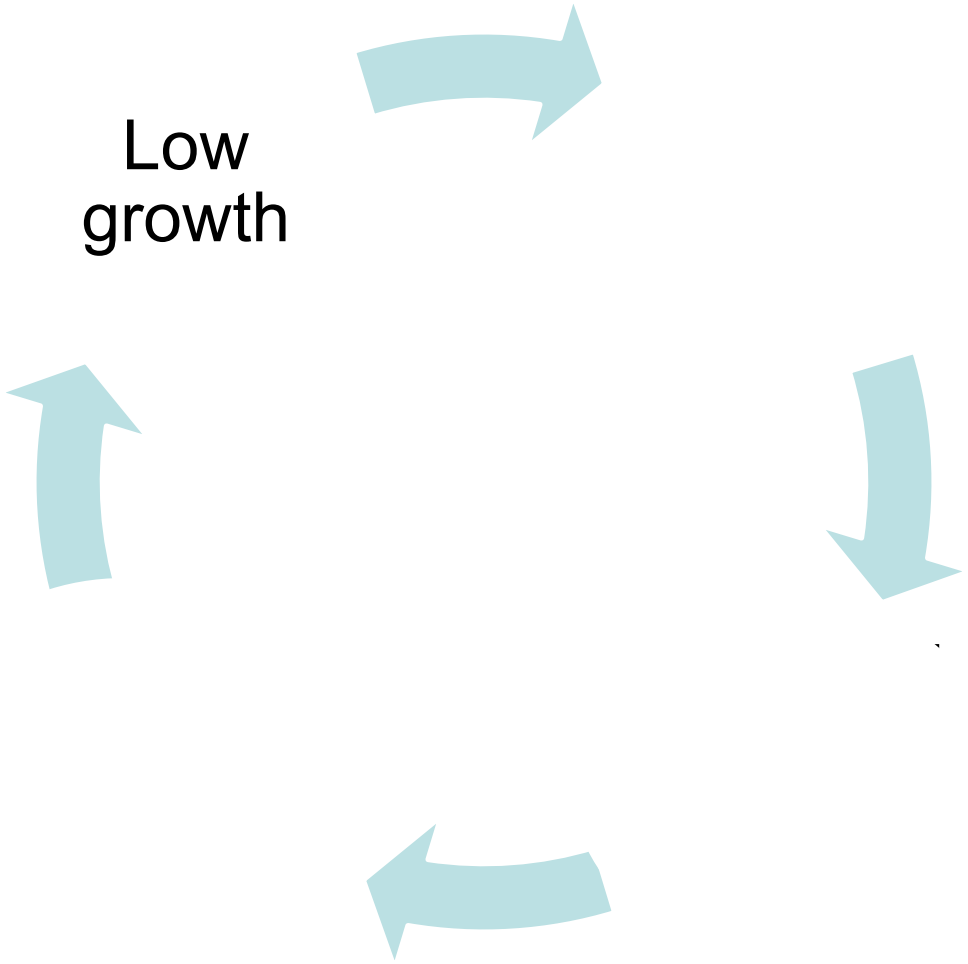
Source: Bergeaud (2026)

Eurozone-US Gap in Productivity & GDP/capita since 1950



Source: Bergeaud (2026)

The Populist Policial Economy Doom Loop



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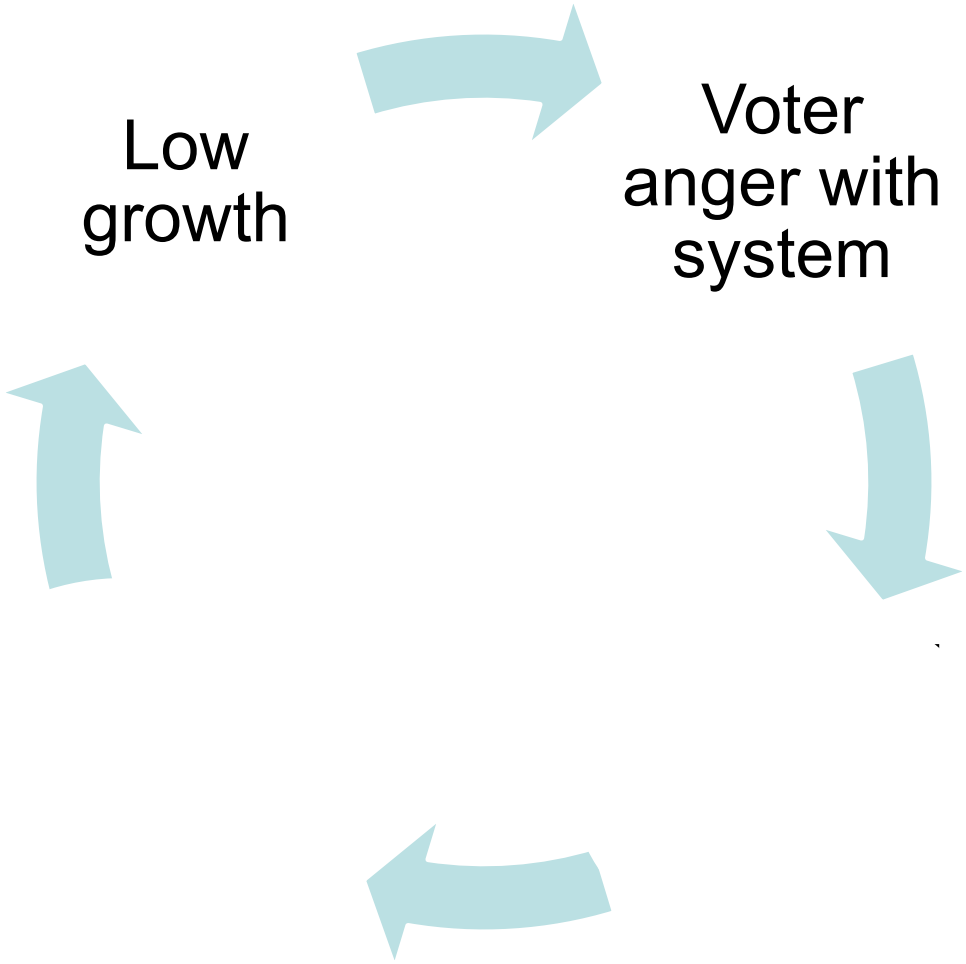

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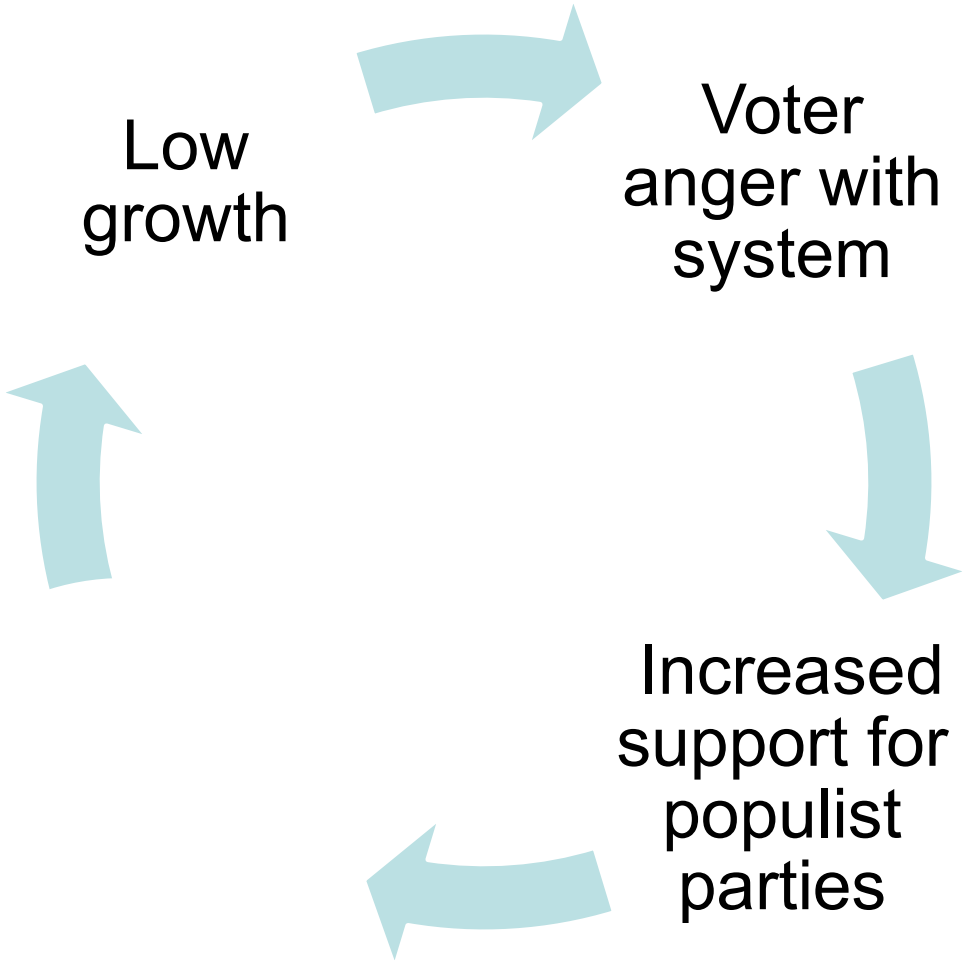

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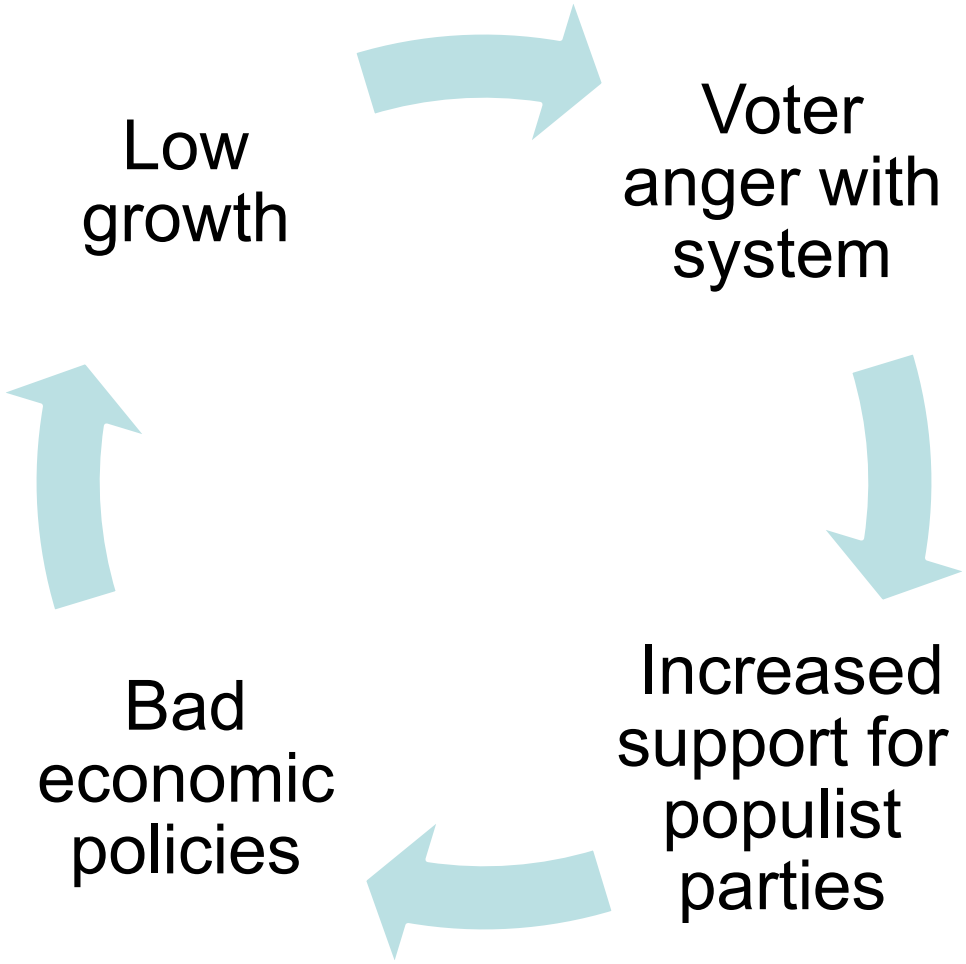

The Populist Policial Economy Doom Loop

Case Study of Brexit

Low growth

Voter anger with system

Increased support for populist parties

Bad policies

Challenges for Europe

- Old assumptions about global order have shifted fundamentally
  - US **security** umbrella weakens ⇒ European defence spending ↑
  - International **trading** system undermined ⇒ alternative trading blocs
  - International **climate change** agreements faltering ⇒ other approaches like green industrial policy

Challenges for Europe

- Old assumptions about global order have shifted fundamentally
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  - International **trading** system undermined ⇒ alternative trading blocs
  - International **climate change** agreements faltering ⇒ other approaches like green industrial policy
- **Productivity growth** is only escape: Innovation ↑ , Diffusion ↑ , Reallocation ↑
  - Need for radicalism in structural reform & greater investment
- Political economy barriers to this progressive supply side agenda?
  - Many policies can be complementary (e.g., inequality & growth; industrial & competition policy)
  - But some tough choices are inevitable (e.g., welfare; taxes)

Outline

- European Challenges
- ***Climate Change:*** **Cleaning up Innovation**
- *Security:* Defending Innovation
- *Inequality:* Finding the Lost Innovators
- *AI:* Managing Innovation
- Politics of Innovation Policy

Climate Change:
Cleaning up Innovation

Growth, Environment and innovation

- Climate Change is enormous challenge for humanity
  - But also an enormous opportunity for growth.

- Reducing demand for fossil fuels via carbon prices & regulation desirable. But public weariness & fragmenting global deals

- Only way to deal with climate change is through green innovation

- But what policies can help?
  - Antonin & Maarten's presentations today
  - Aghion et al. (2016) on carbon pricing & auto innovation
  - Industrial policy (Draghi Report & Biden). Consider the case study of China, focus on solar industry…..

Ray of Hope? China and the Rise of Solar Energy

CEPR RPN, June 2026

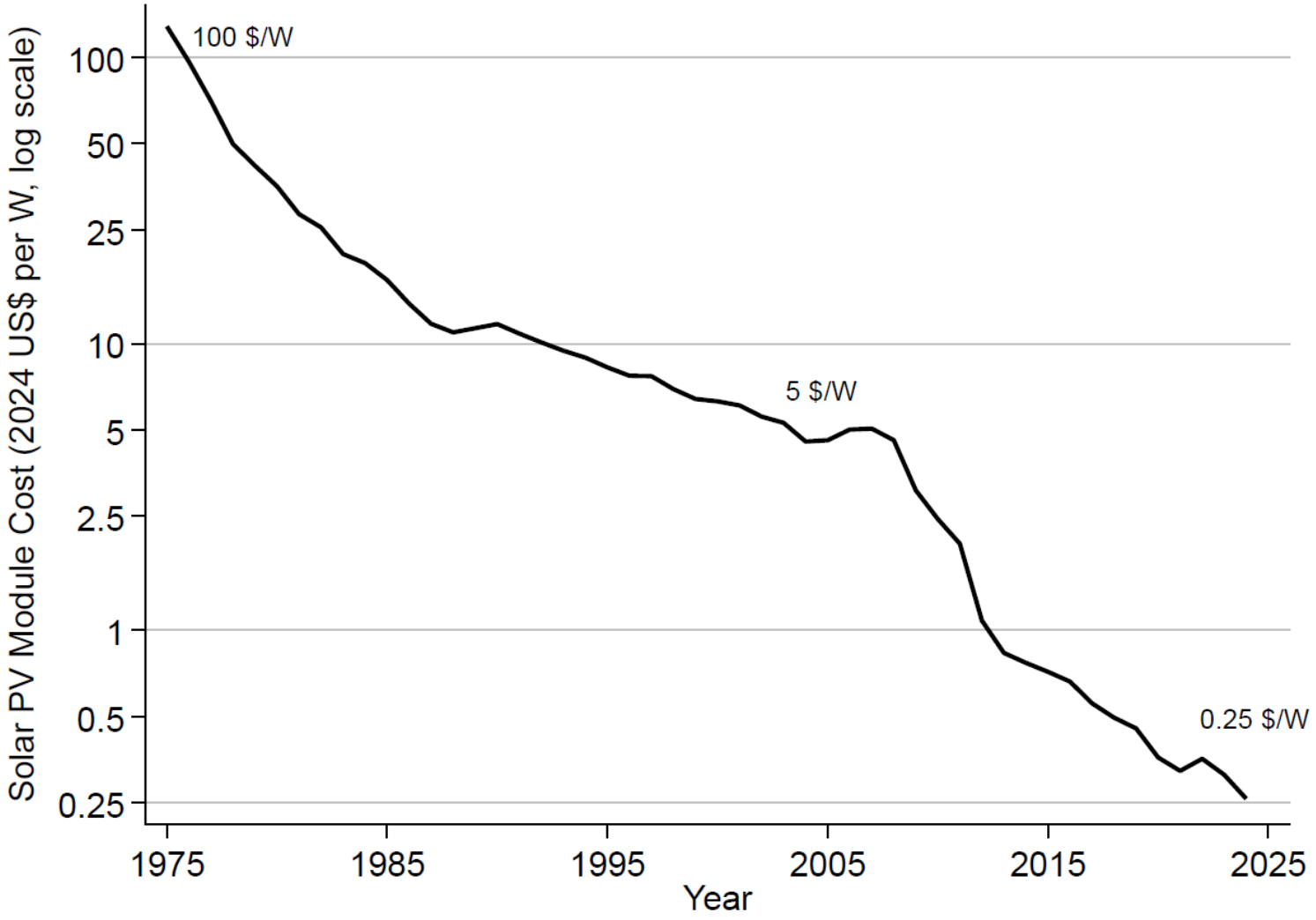
Ignacio Banares-Sanchez[1], Robin Burgess[1 2], David Laszlo[1],
Pol Simpson[1], **John Van Reenen**[1 2], Yifan Wang[1]

[1] London School of Economics [2] CEPR

May 17, 2026

Cost of solar has fallen dramatically

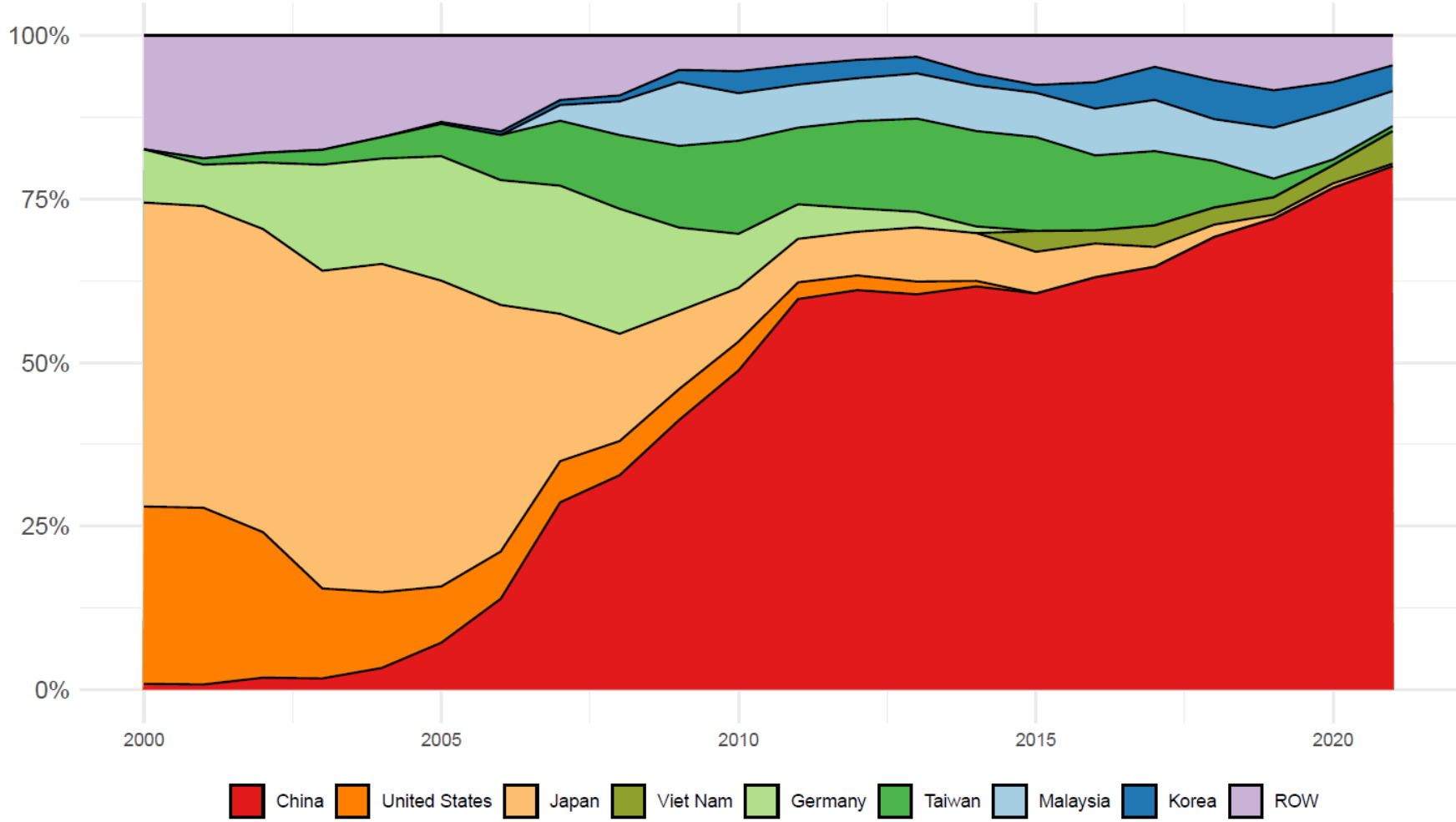
Figure: Global average price of solar PV modules (in 2024 US$ per Watt)



Source: Our World in Data, LaFond et al. (2017) & IRENA Database

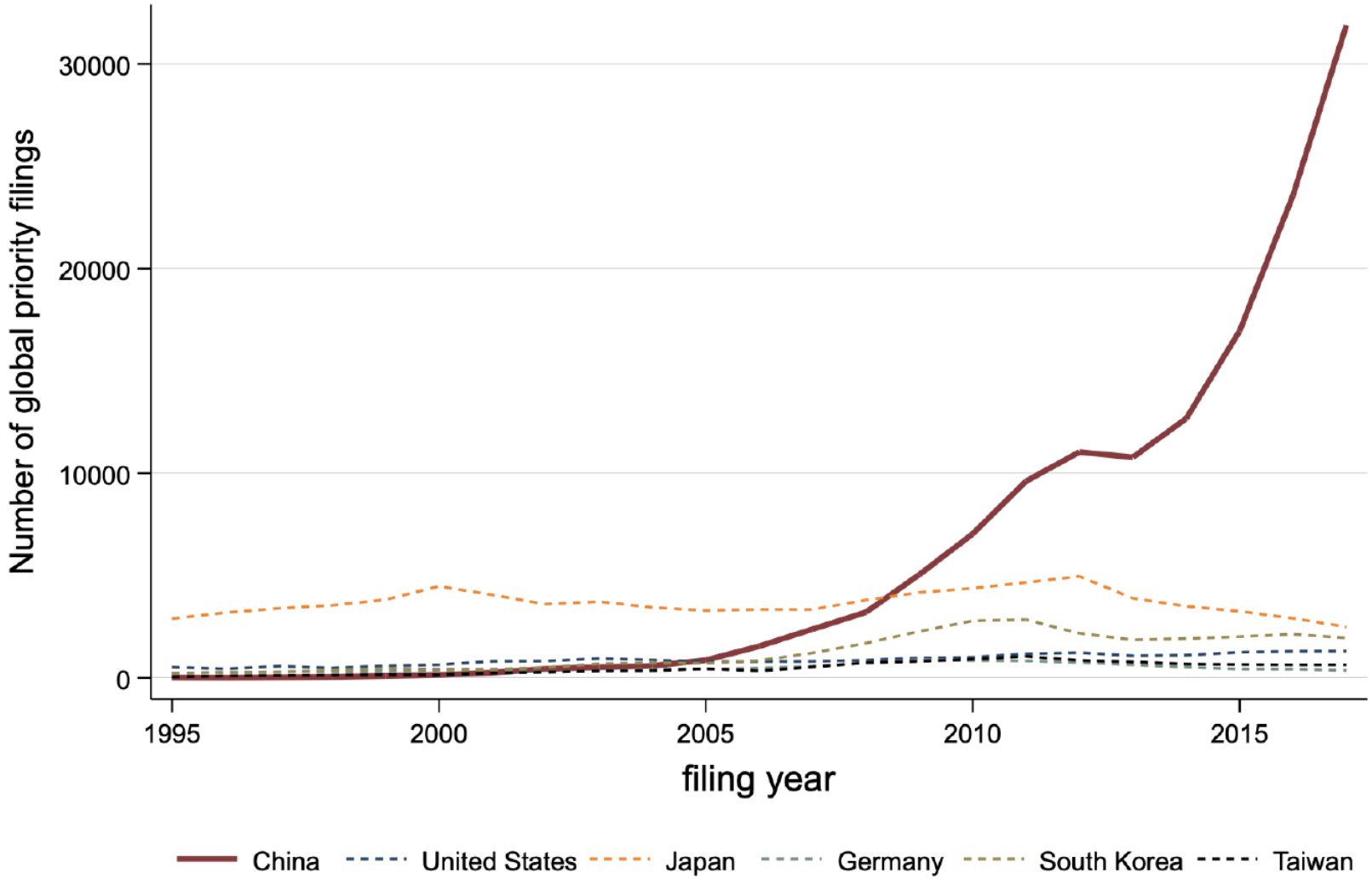
China’s global share of solar production rose from near zero to n than 80 % in 2021

Figure: Share of Annual Solar Photovoltaics Cell Production in Leading Countries, 2000-2021



Source: International Energy Agency (IEA) & Earth Policy Institute

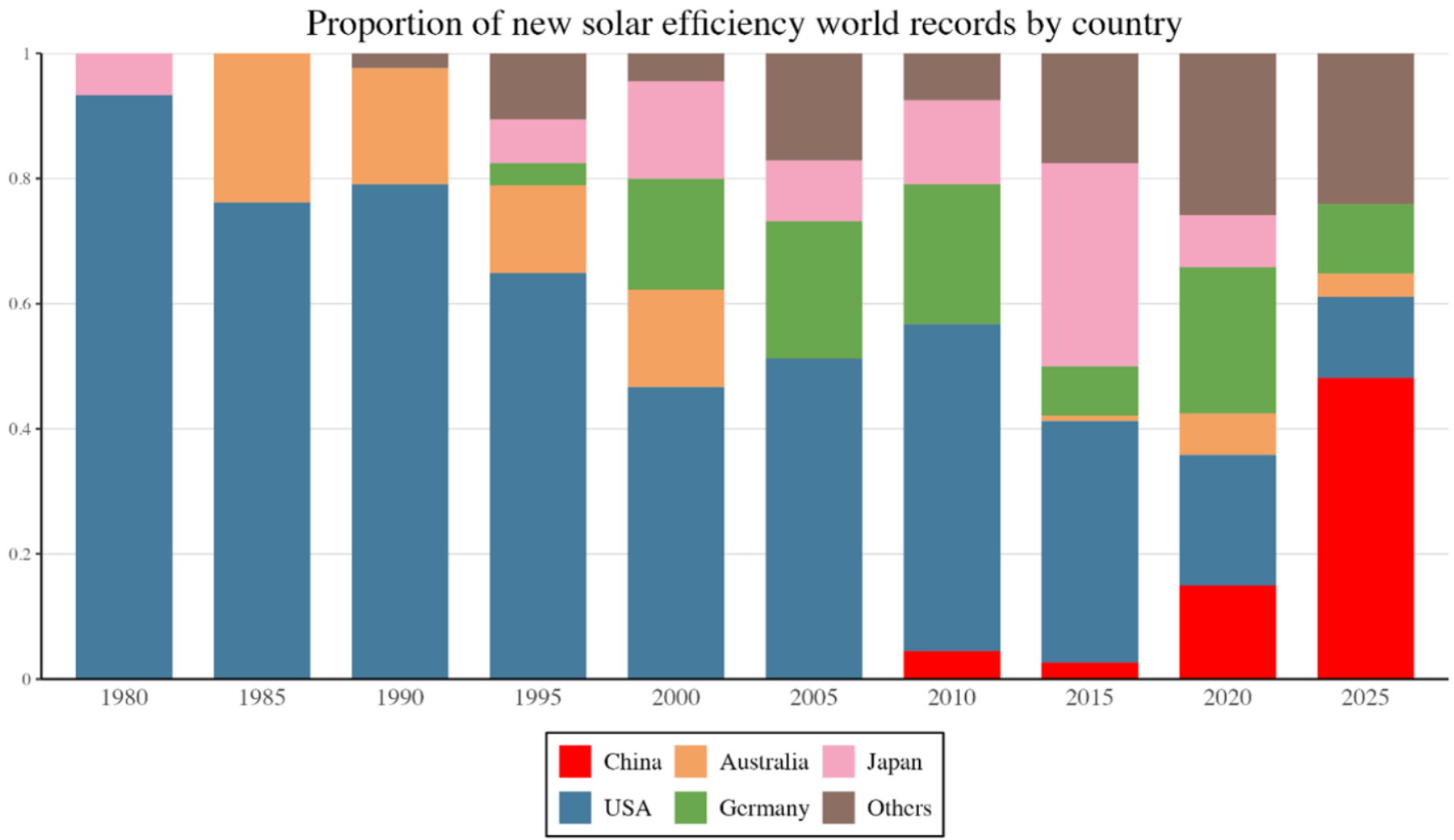
China is not just imitating: Massive growth in Solar Patents



Source: PATSTAT - solar patents based on IPC/CPC codes.

Citations | Triadic Patents

China is innovating not just imitating: Technological Frontier



Source: Solar World Record Database (https://www.nrel.gov/pv/cell-efficiency)

Note: Year refers to average over previous 5 years, so "2025" refers to competitions between 2021 and 2025, etc.

What we do

- Evaluate role of Chinese **solar industrial policy** to the growth of industry, innovation & fall in prices
- Construct panel data on universe of solar firms in China
- China's model of economic development led by local leaders competing to grow
- Exploit staggered adoption of city-region subsidies
  - Analyse 3 types of subsidies separately: (i) Demand (e.g. feed-in-tariffs & installation), (ii) Production and (iii) R&D
  - Use Synthetic Difference in Differences

What we do

- These are city-specific impacts: reduced forms at local level

- To examine macro-economic implications, we develop & estimate structural equilibrium model
  - **Spatial model:** many cities with different productivities & demands. Grid planner builds clean (solar) and dirty (coal) plants
  - **Heterogeneous Input suppliers** (e.g. solar panel makers) make endogenous decisions over: entry/exit, production, exporting & innovation
  - **Multiple spillovers:** business stealing, knowledge spillovers & cross-city demand
  - Use our estimates to discipline parameters of the model

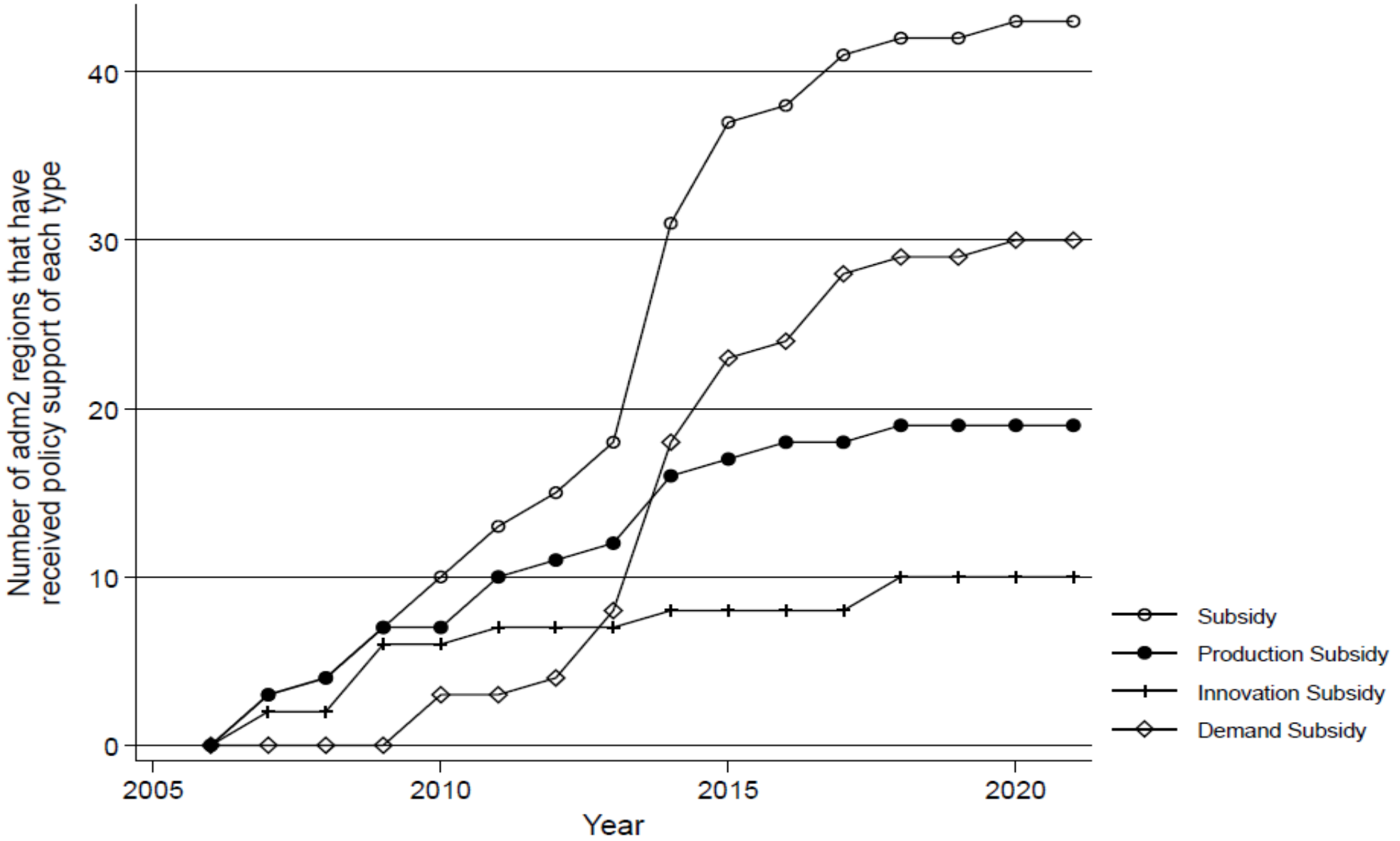
Measure solar industrial policy using PKULaw Database

Table: City-level solar policies

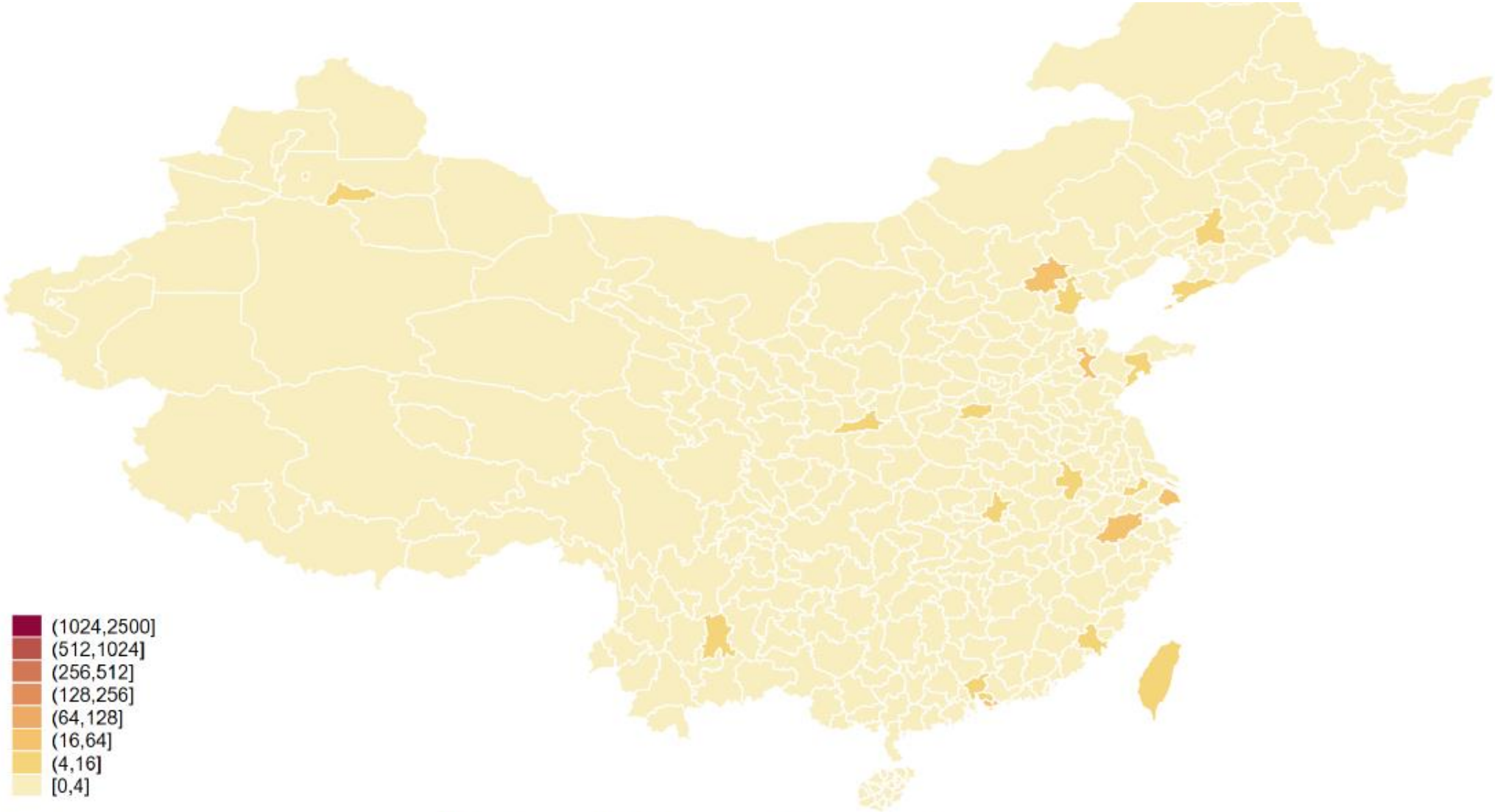
Type of policy	Number	Example
Subsidy	78	
1. Production subsidy	27	*"The cost of a new solar production line built in Hefei will be subsidized by 12% (2018)"*
2. Innovation subsidy	12	*"Firms will be awarded 10,000 RMB if they earn provincial level R&D center certification (Guilin, 2011)"*
3. Demand subsidy	61	*"1 RMB per watt for the electricity generated by solar projects installed in Beijing (2010)"*

Source: Own analysis using PKULaw data

Figure: Number of cities treated with supply & demand subsidies

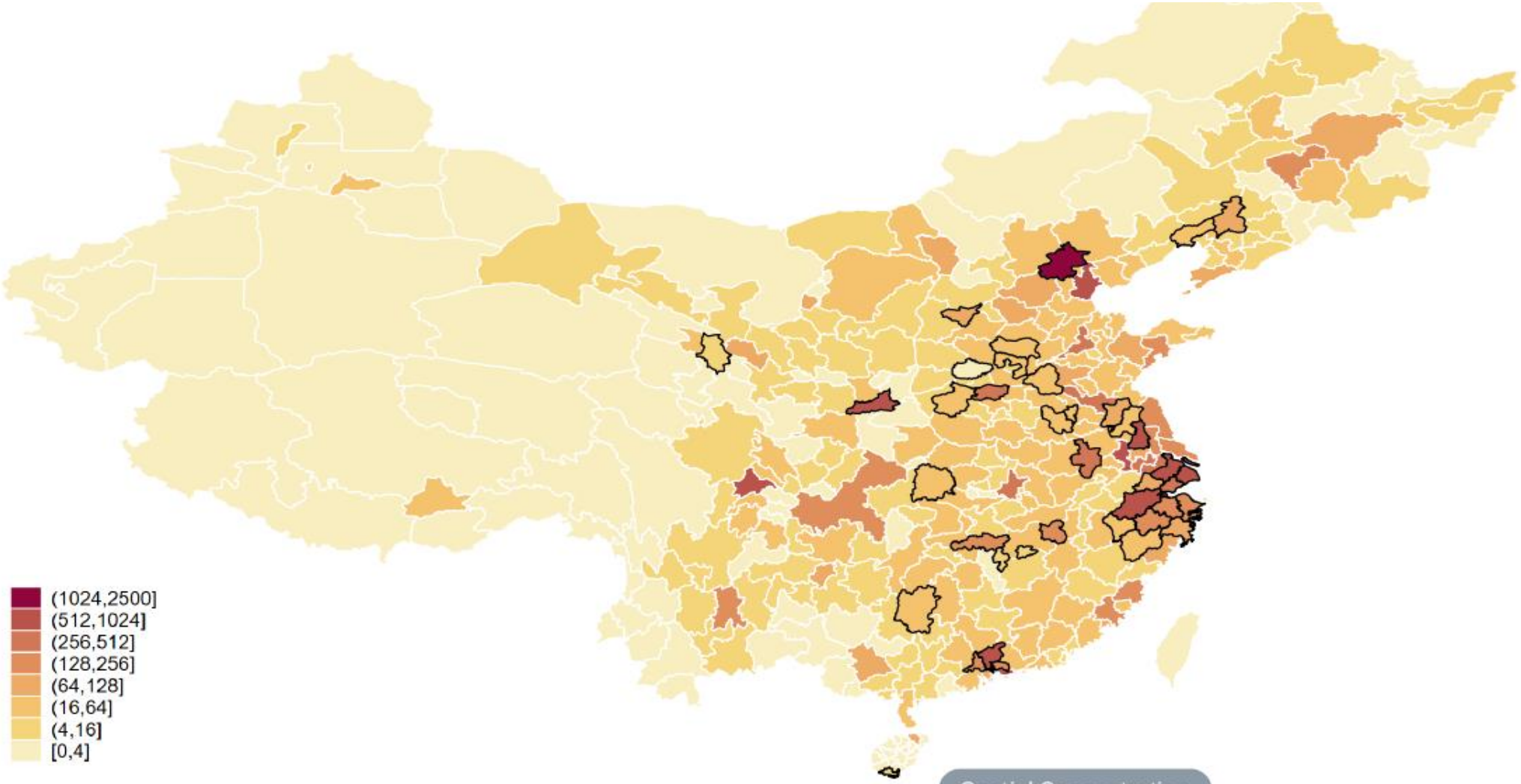


Chinese Solar Subsidy policies (none!) and solar patenting: 2004, city level



Note: black circled cities are treated by any subsidy policy

Chinese Solar Subsidy policies and solar patenting: 2019, city level



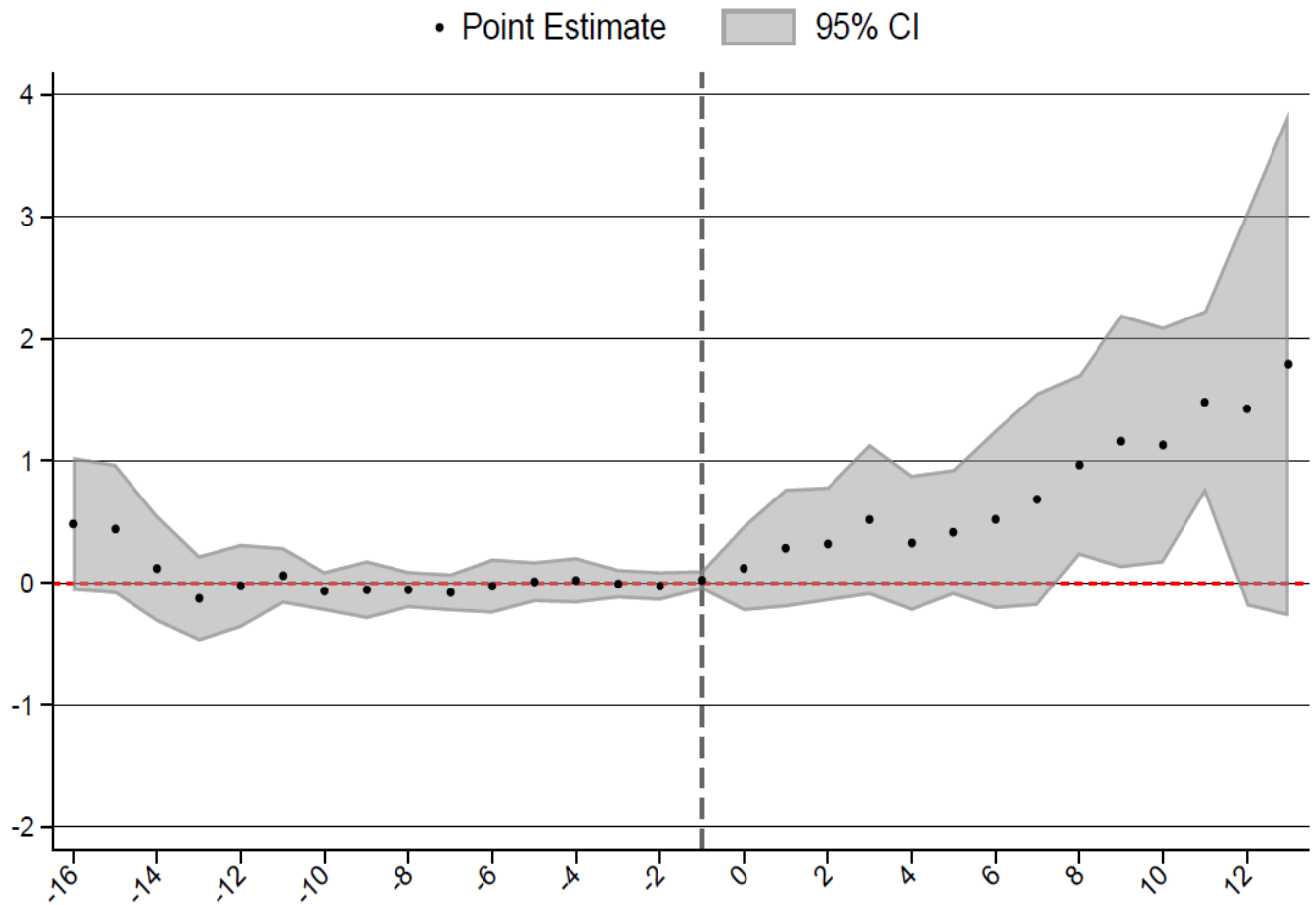
Note: black circled cities are treated by any subsidy policy

Spatial Concentration

What we find

- **At local level of city:**
  - **Production and innovation subsidies** substantially raised innovation, output, exports, net entry, etc.
  - **Demand subsidies** had little effect on economic outcomes, but did reduce pollution

Results: Patents, Any subsidy



Notes: SDID on 358 cities with 43 treated. Cohort-year specific ATTs aggregated into event studies. Outcome: IHS of patents by solar firms in a city-year.

Treatment is any subsidy. 95% SE cluster bootstrapped by city.

Production & Innovation subsidies big effects, demand subs small effects

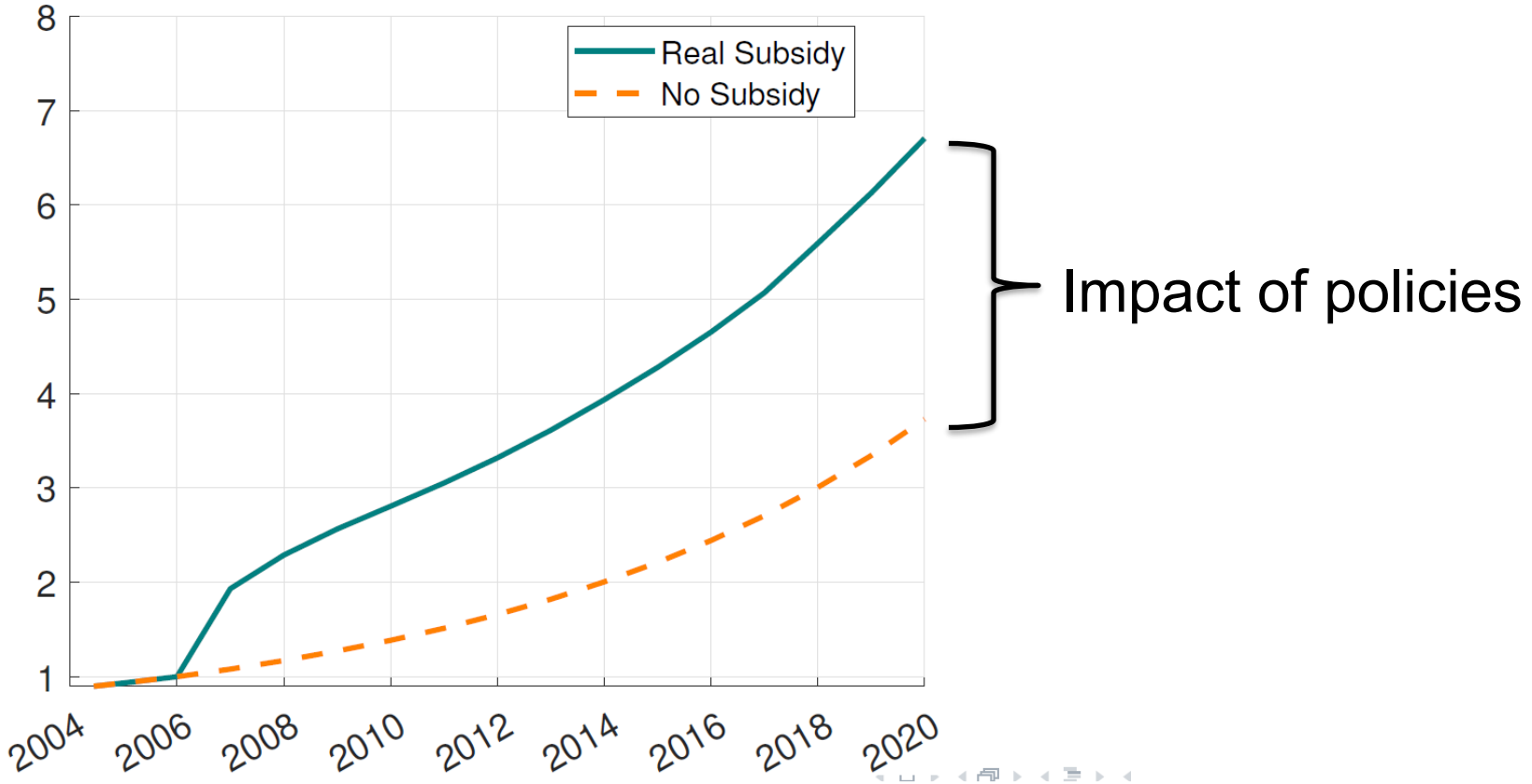
Table: Patent Counts (Aggregate ATT)

	Any subsidy	*Demand subsidy*	*Production subsidy*	*Innovation subsidy*
All patents	0.496**	0.236	0.871***	1.060***
	(0.200)	(0.275)	(0.227)	(0.367)
Observations	6,086	6,086	6,086	6,086

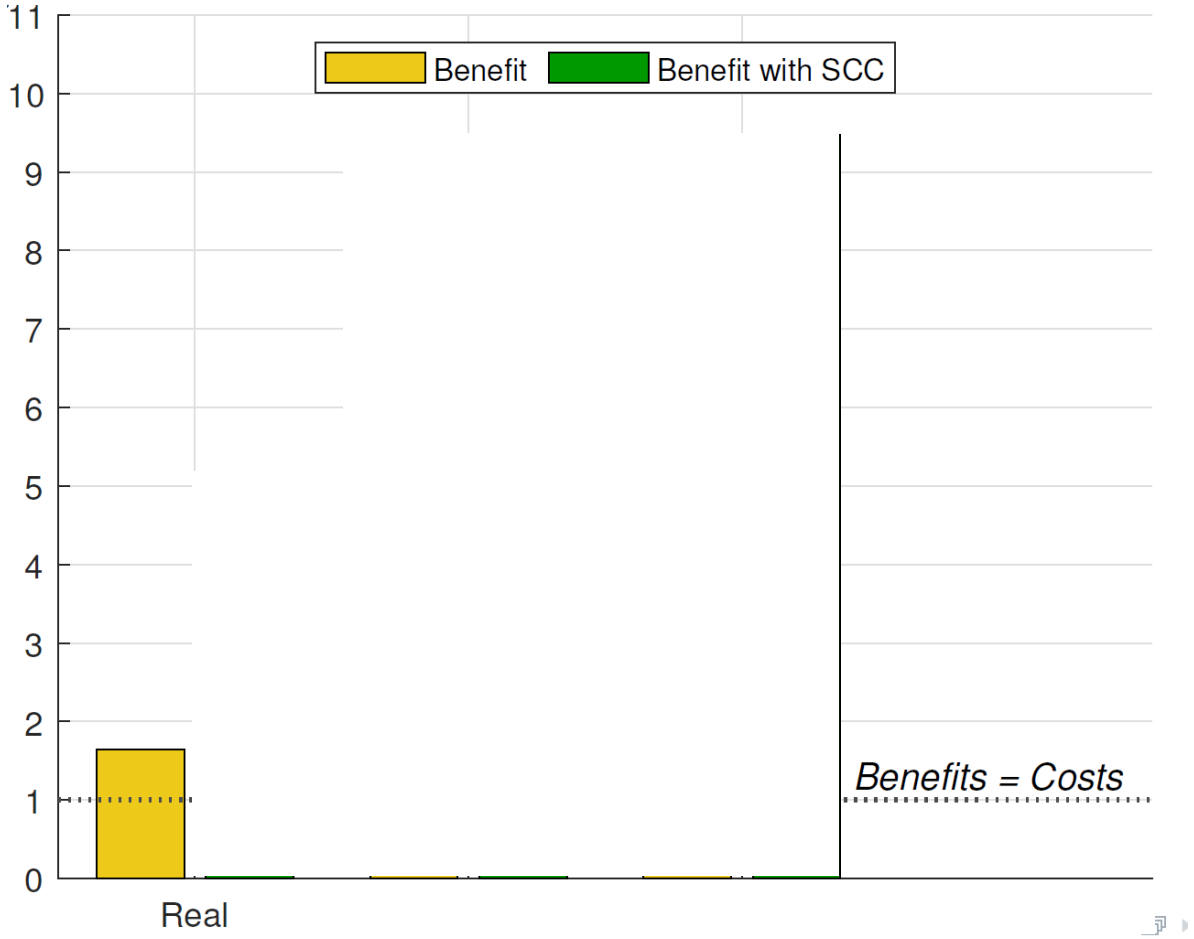
Notes: * 0.1 ** 0.05 *** 0.01. SDID on 358 cities 2004-2020. Outcome is IHS of patent count by solar firms in city-year pair (level av. = 13.1). SE cluster bootstrapped by city.

What we find (using estimates to discipline structural model)

- **At national level:**
  - Policies responsible for 40-50% of change in Chinese solar output, prices & **innovation**:



High Social Benefit-Cost Ratio of Chinese Solar Industrial Policy



1. $1 of subsidy increased welfare of Chinese citizens by $1.65

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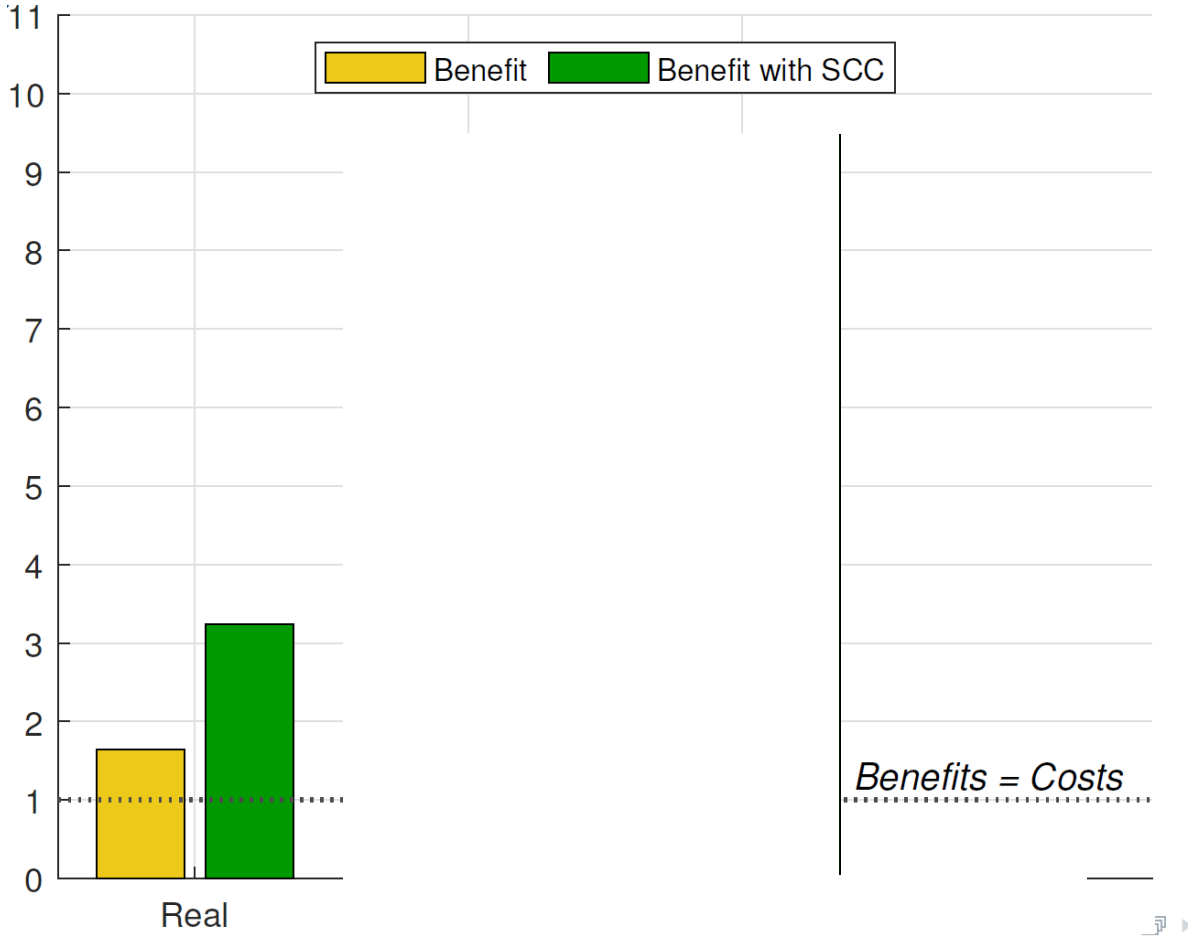

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2. Including a (low) Social Cost of Carbon **doubles** these benefits

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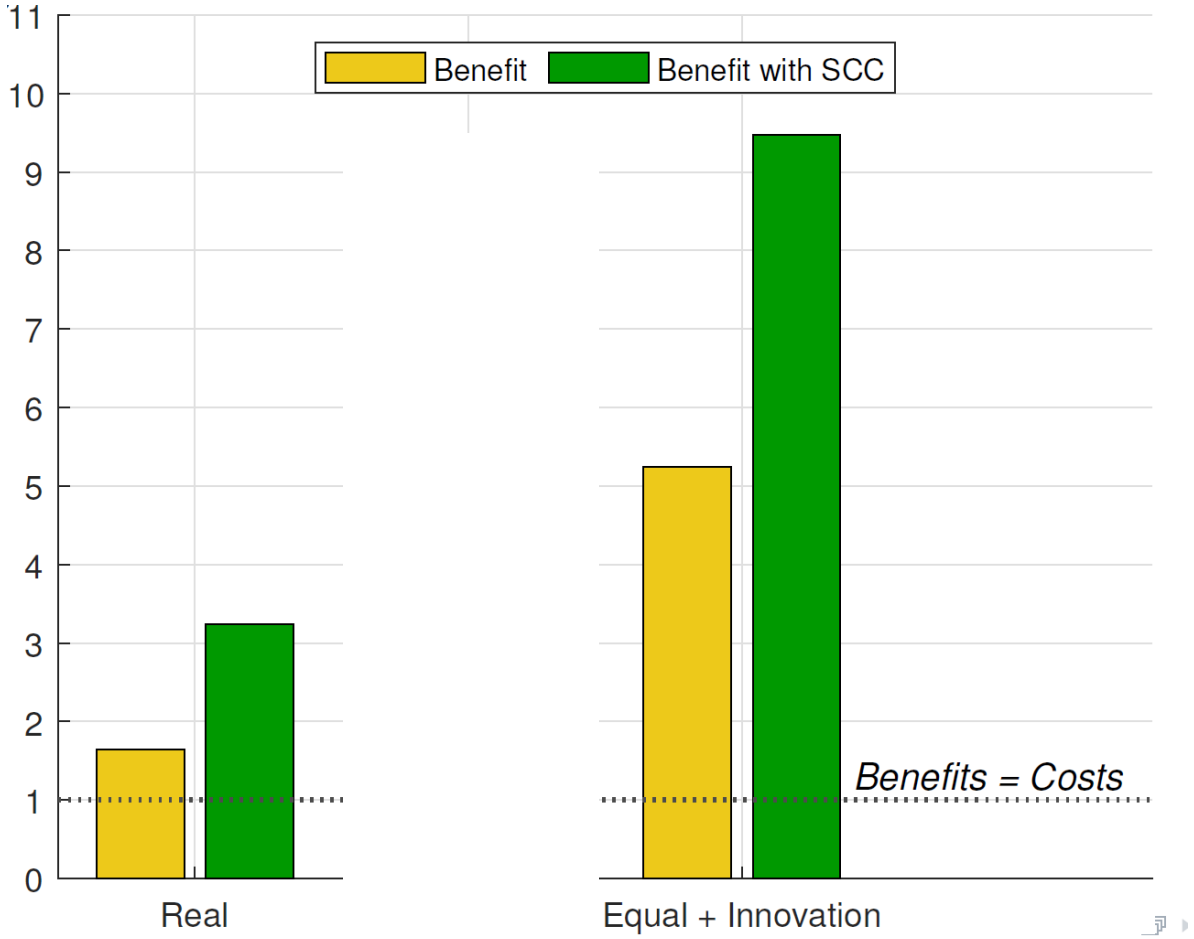

1. $1 of subsidy increased welfare of Chinese citizens by $1.65

2. Including a (low) Social Cost of Carbon **doubles** these benefits

3. An ‘innovation heavy’ subsidy program would have delivered much greater benefits

Why this matters

- **International agreements failing**
  - Green industrial policy politically feasible solution? Generates country-specific benefits even without environmental benefits
- **Suggests potential role for industrial policy in some areas**
  - Innovation role critical: High tech, high externality
  - Where region has some actual/latent comparative advantage
- **Impact outside of China**
  - Negative business stealing effects may be offset by benefits from lower prices & learning externalities
  - We see this within China, but likely the same mechanisms when thinking of global impacts

Outline

- European Challenges
- *Climate Change:* Cleaning up Innovation
- ***Security:* Defending Innovation**
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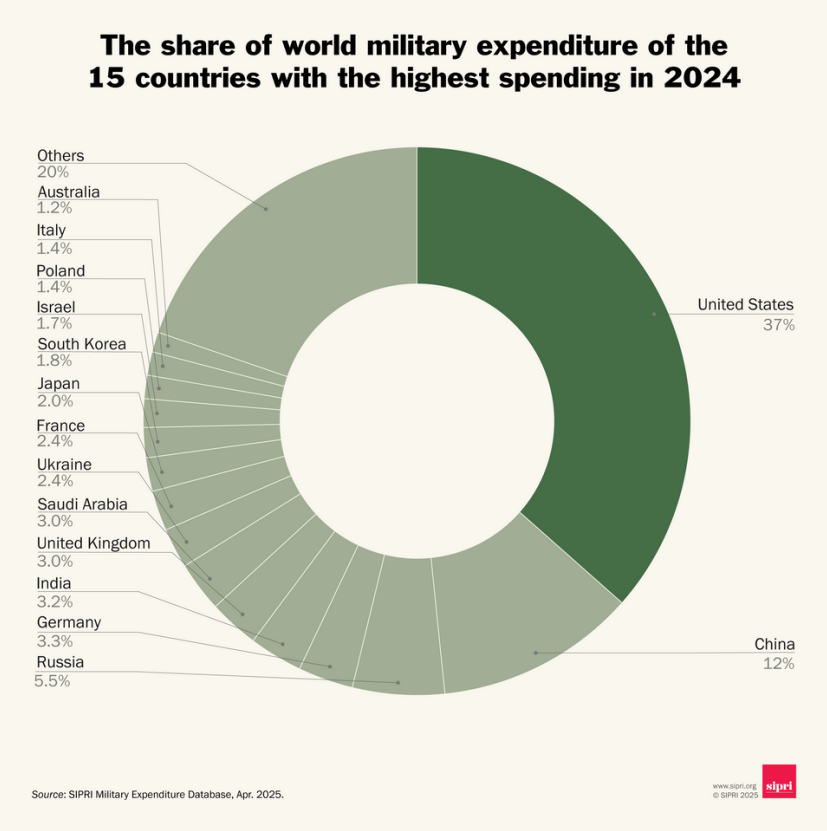
Security:
Defending Innovation

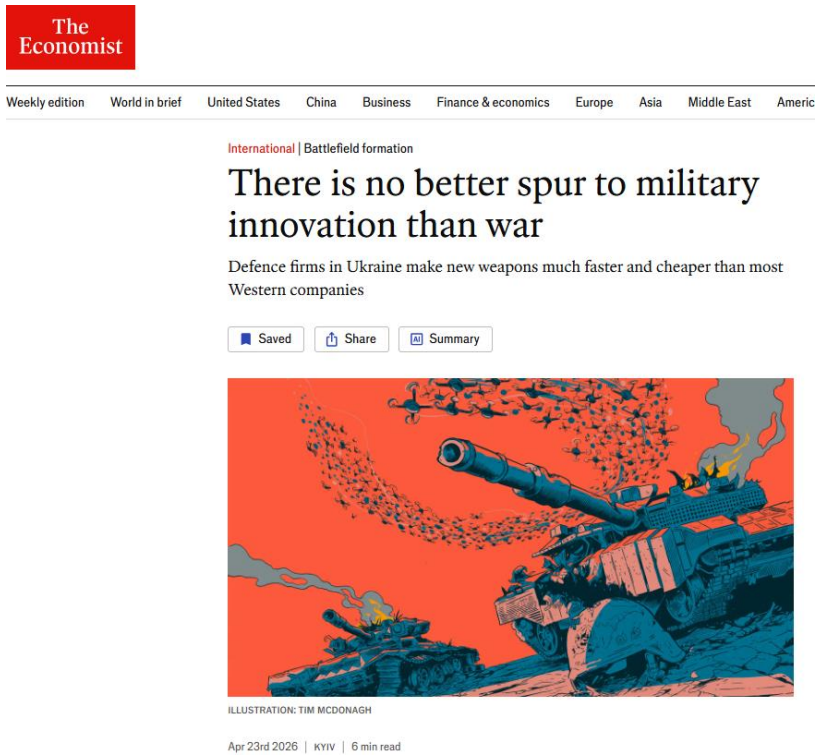
The need to raise defence spending

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



How can we make defence spending more pro-growth?

- Using defence spend to spur innovation
  - Focus on raising R&D element of defence spend (Moretti et al, 2025)
  - Increase effectiveness of military R&D budget through making it more open & decentralized (Howell et al., 2025)



The Economist

Weekly edition | World in brief | United States | China | Business | Finance & economics | Europe | Asia | Middle East | Americ

International | Battlefield formation

There is no better spur to military innovation than war

Defence firms in Ukraine make new weapons much faster and cheaper than most Western companies

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ILLUSTRATION: TIM MCDONAGH

Apr 23rd 2026 | KYIV | 6 min read

Historically, military necessity has been the mother of invention

Historically, military necessity has been the mother of invention

- **Dual-use** aspect of frontier defense technology: large spillovers to private sector (e.g. GPS, cryptography, nuclear power, jet engines, Internet,..)

- But can we go from story-telling to hard evidence?

Volume 107, Issue 1

January 2025

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Article Contents

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

- Recent **macro studies** confirm these effects (e.g., Fieldhouse & Mertens, 2023; Gavanni et al., 2026)
  - Secondary question: is non-defence R&D better?

How to get more innovation from defence R&D?

PREVIOUS ARTICLE NEXT ARTICLE

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

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

Abstract | Full Text | PDF | PDF PLUS | Supplemental Material

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.

Details | Figures | References | Cited b

Journal of Political Economy
Volume 133, Number 11
November 2025

How to improve R&D procurement?

- Traditional approach to defence R&D procurement in US (& most countries) is top-down and highly centralized (DARPA is exceptional)
- US defence innovation base weakening over last 40 years
- This has gone along with high & increasing concentration
- In 2018, **US Air Force** reformed SBIR into new **OPEN** Topics program, which implemented a decentralized innovation model
  - Competition asked firms what innovation **they** thought would be beneficial to military

Findings of Howell et al (2025) evaluation of OPEN program

Data:

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

Findings:

- Open Program attracted more **new entrants** – e.g. young firms from Silicon Valley who had never applied for SBIR in the past
- RDD: **Open has better outcomes than Conventional program**
  - Tech adoption (non-SBIR DoD contracts); Patenting; VC Funding.
  - Conventional increases chances of winning future contracts creating lock-in & persistent dominance

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

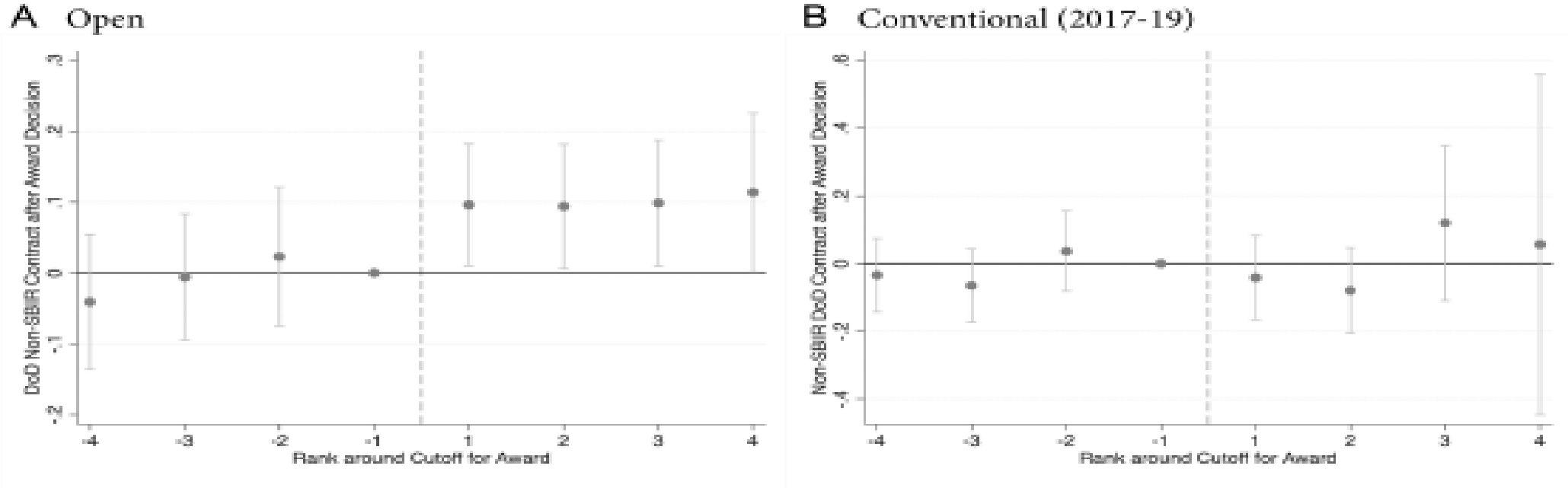

FIG. 3.—Probability of technology adoption (DoD non-SBIR contract) by rank around cutoff. The figure shows the probability that an applicant firm had any non-SBIR DoD contracts valued at more than $50,000 after the award decision. The *x*-axis shows the applicant's rank around the cutoff for an award. 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.

Why was OPEN approach to R&D procurement so successful?

Mechanism:

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

Implications:

- Open being rolled out across other parts of DoD & government
- Starting to be used in other countries (e.g. UK DASA)
- Ukraine has been using analogous model to crowdsource technology

Summary on defence spending

- European defence spending must rise and we must raise taxes (and/or cut other spending to pay for it)

- Focus on using the spending increase in a pro-growth way
  - Increase fraction of spending dedicated to R&D and innovation
  - Use the R&D budget better. For example, through a more open approach

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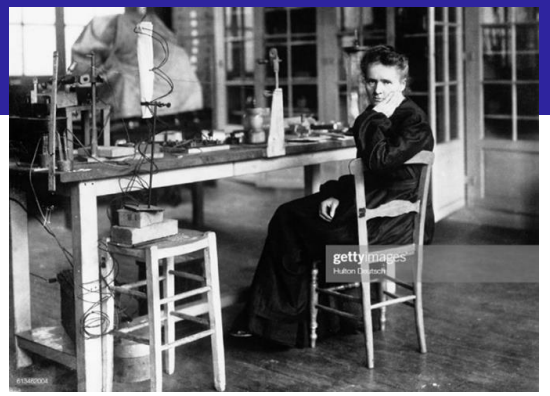
Inequality:
Finding the Lost Innovators

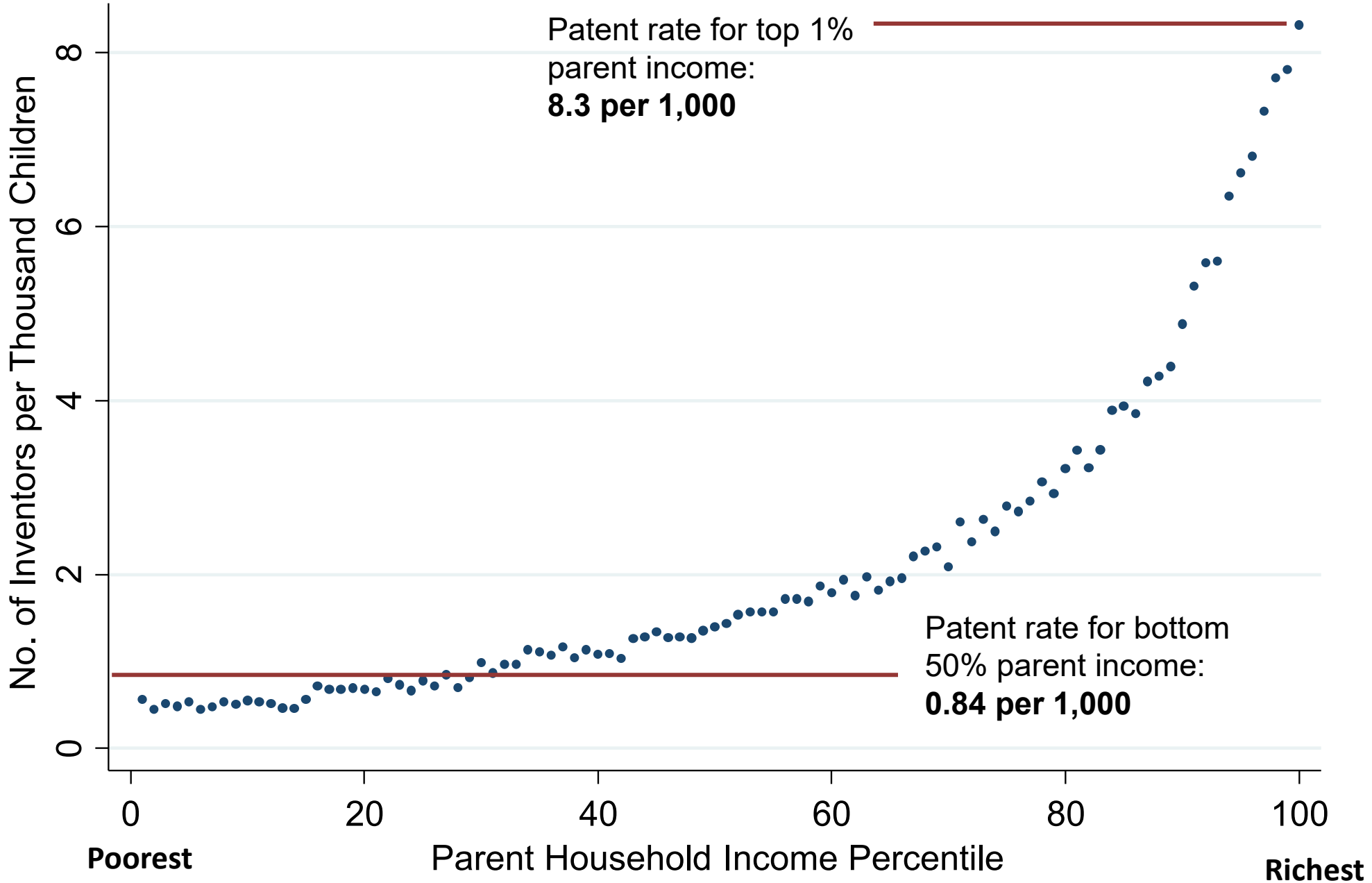
Boosting innovation and reducing inequality



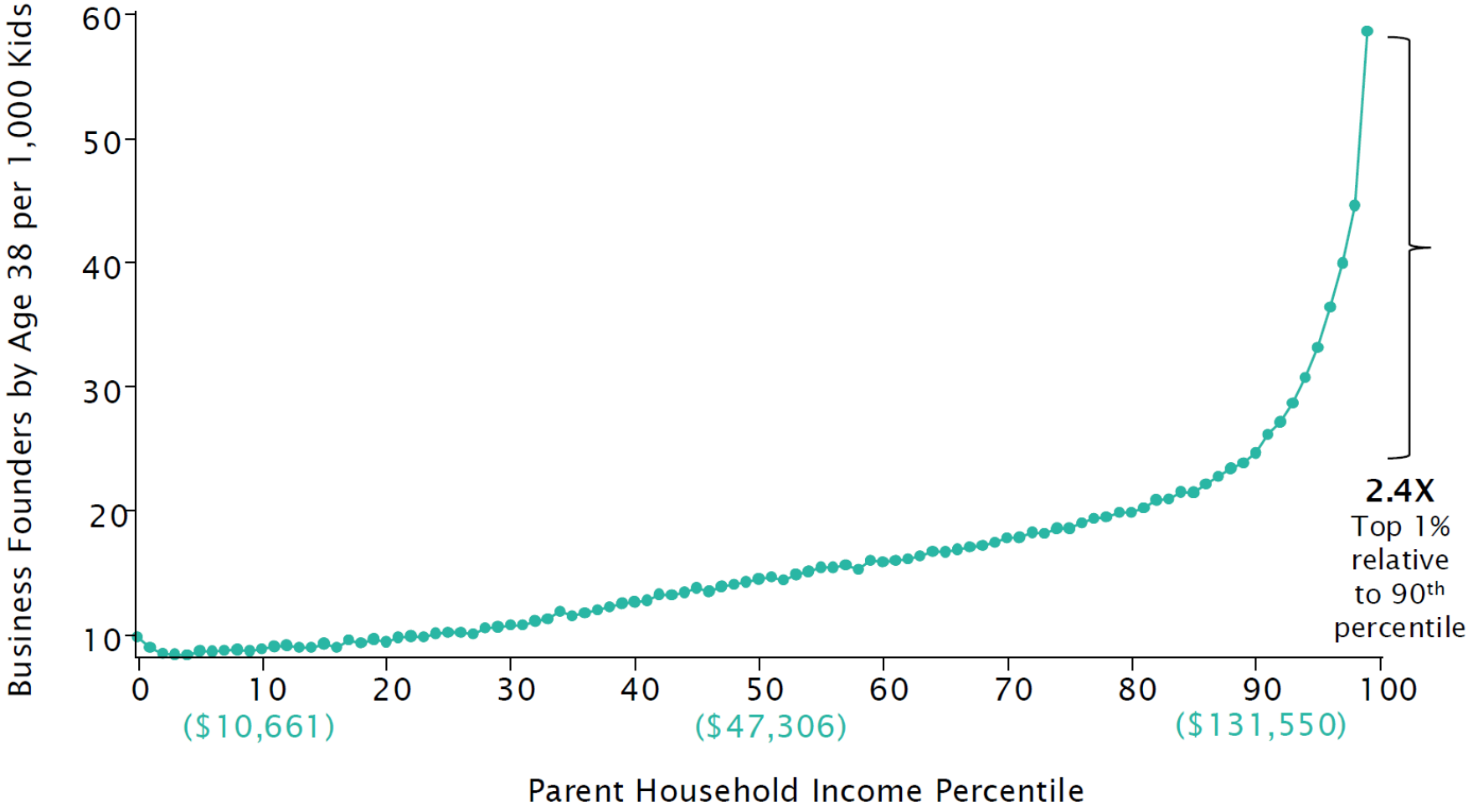
- Hard to reduce inequality in the context of slow growth
  - Not enough rich people to go around…
- **Alternative:** policies to reduce inequality & support growth
- **Human capital focus in innovation policy**
  - Finding & nurturing talented people who typically don't become innovators (e.g. kids from lower income families, women & minorities)
  - 'Lost' Einsteins, Marie Curies & Steve Jobs
  - Boosts innovation and improves equality of opportunity
  - Supply side innovation policy more effective in long-run than just demand side

Being born into top 1% makes it 10 times more likely you become an inventor than born in bottom 50%

Source: Bell, Chetty, Jaravel Petkova, & Van Reenen (2019)



Entrepreneurship Rates as a function of parental income



Source: Chetty, Dossi, Van Reenen, Zidar & Zwick (2026)

Lost Innovation Policies

- **Education policies**
  - Tracking (e.g., Card and Giuliana, 2016; Cohodes, 2020)
  - Information/exposure treatments (Breda et al., 2023)
- **Mentorship/internship programs** (early labour market experience critical, esp. for entrepreneurship)
- Competitions (e.g., Conrad Foundation Inventor Education Competition)
- Anti-Discrimination policies

- **Need to have more!**

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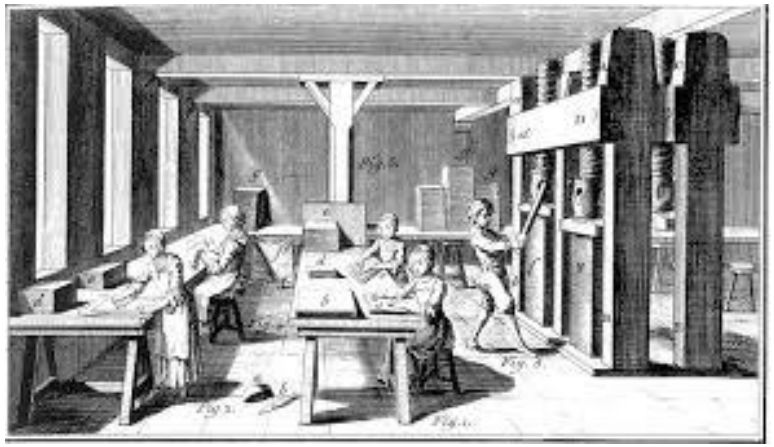
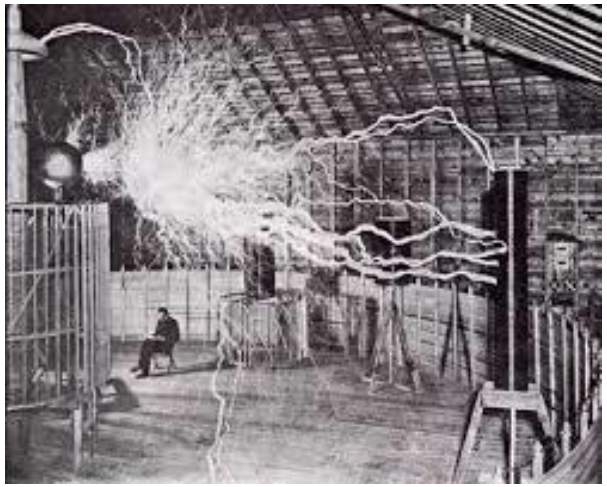
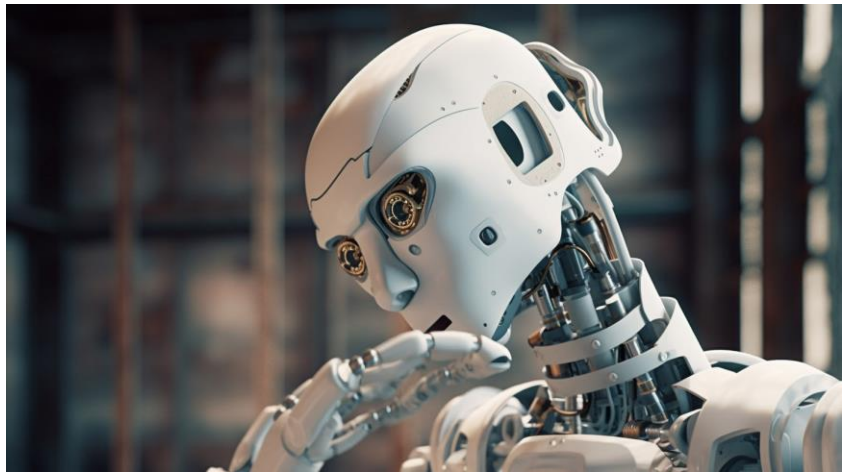
AI:
Managing Innovation

AI: Technology, management & complementarities

- Need to change work organization/management to make best use of innovation (textiles, electricity, computers, **AI,** …)







Technology, management & complementarities

- History teaches that productivity (& labour) impacts of AI diffusion likely to be slow

- Case studies show that many organizations can invest heavily in digital technology (e.g. IT in UK NHS) & make little/no return

- Econometric work on impact of digital technologies on firm performance shows very heterogeneous impacts (e.g. Stiroh, 2010)

- Much evidence of technology & managerial practice complementarity in productivity: Bresnahan, Brynjolfson & Hitt (2002) US; Bloom, Sadun & Van Reenen (2012) EU; Atkin et al (2017)

AI: Complementarities with management practices

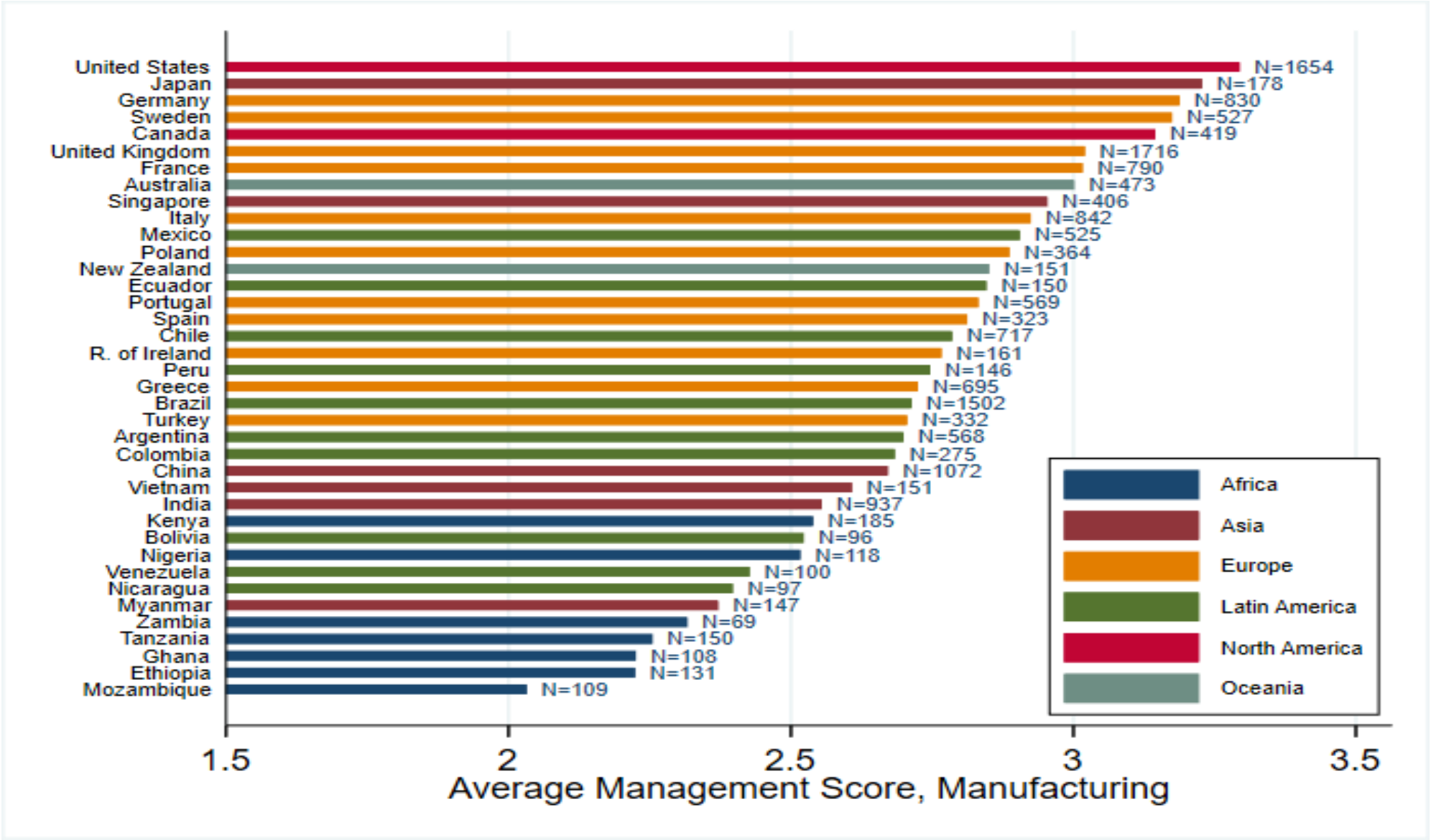
- Some large AI effects in detailed micro studies

- But small/unclear impacts at higher level of overall firm, industry & economy wide

- We are still in early days of AI and maybe effects will be faster than in previous GPTs.

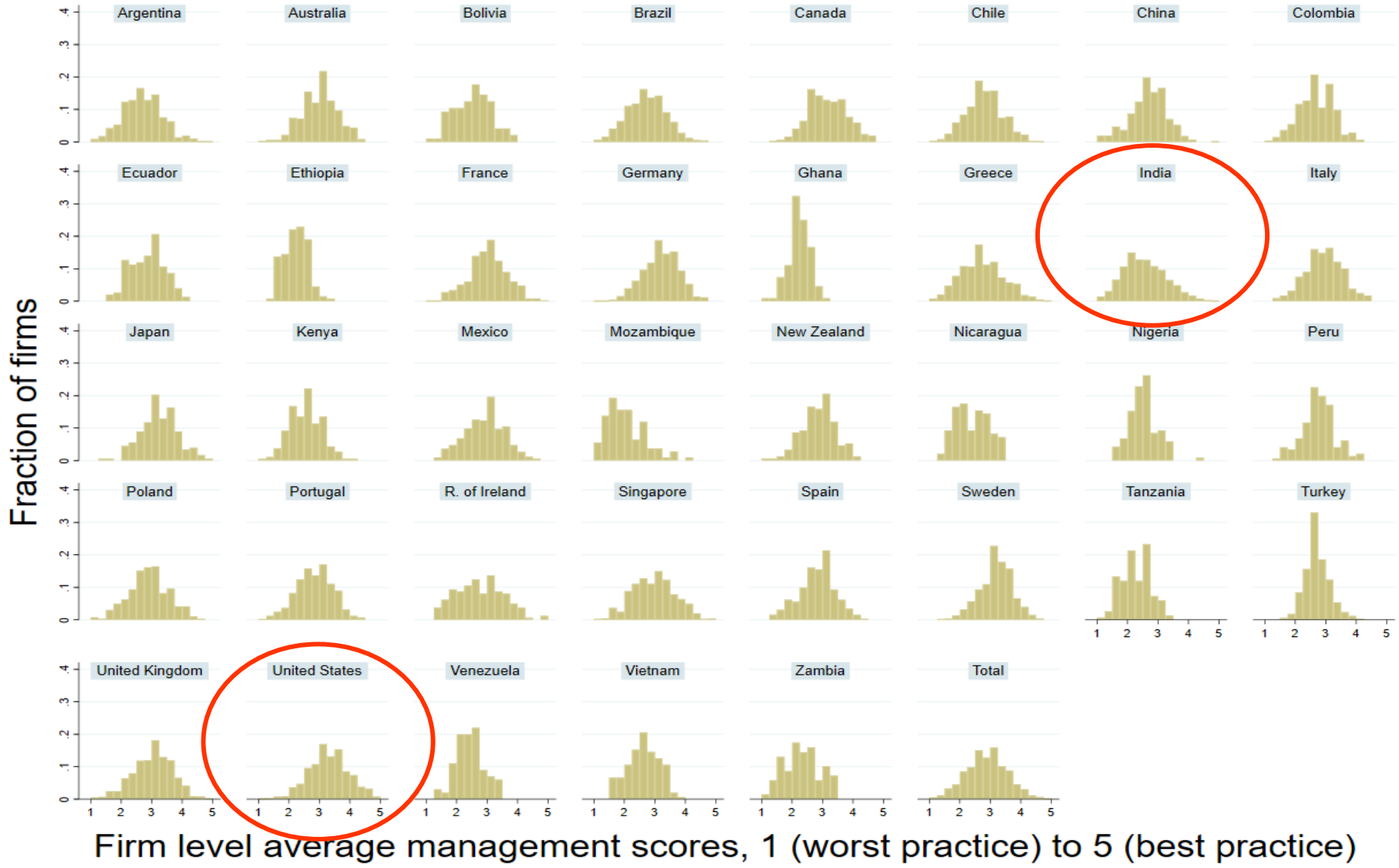
- Improving management as a way to improve productivity and labour benefits of AI
  - Structural policies: competition, governance, FDI, regulation,
  - Direct policies: consultancy, training & information
  - Scur et al (2021) Management policy toolkit

WMS Management Scores across Countries



Note: Unweighted average management scores; # interviews in right column (total = 17,783); all waves pooled (2004-2022)

Management also varies heavily within countries



Source: Scur et al (2023)

AI: Complementarities with management practices

- Improving management as a way to generate greater productivity benefits of AI

- See Scur et al (2021) Management policy toolkit
  - **Structural policies:** Competition, governance, FDI, regulation,
  - **Direct policies:** consultancy, training & information
  - Scur et al (2021) Management policy toolkit

Outline

- European Challenges
- *Climate Change:* Cleaning up Innovation
- *Security:* Defending Innovation
- *Inequality:* Finding the Lost Innovators
- *AI:* Managing Innovation
- **Politics of Innovation Policy**

Outline

- *Europe* needs to **grow** & surest path to this is through **innovation** (includes faster diffusion & reducing misallocation)

- Innovation Policy toolkit helps

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
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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)

Politics of Innovation Policy: Dilemma of long policy lags

Even the speediest policies take time. Consider R&D tax credit

Politics of Innovation Policy: Dilemma of long policy lags

Even the speediest policies take time. Consider R&D tax credit

- Even if all of these steps occur, many years through an electoral cycle
- And other policies (e.g. education interventions) take even longer
- Political survival reflects public desires for quick results & dislike of trade-offs
- Of course, such problems not confined to innovation policy (e.g. deficit reduction)

What is the Way out?

- No easy solutions, but there is no alternative – we either act now with purpose or face crisis.
- A vision around innovation and growth is a positive story
- There are many priorities that seem to only have costs. But all can have innovation benefits with create policies. Examples:
  - **Climate Change:** green industrial policy
  - **Defence:** enhance R&D component & make it more open
  - **Inequality:** searching for lost innovation
  - **AI:** improving management practices

- Requires better research and policy engagement. Purpose of the network and workshop!

Thanks!

Some Econometrics of Innovation

- Measures of innovation often nonlinear, discrete, zero for vast majority of firms, & not in a $ or € numeraire
  - Patents, R&D, adoption measures, etc.
  - New qualitative econometric techniques (e.g. dynamic count data models with fixed effects: Blundell et al, 1995, 1999)

- These issues make TFP growth an attractive measure
  - Burgeoning literature on estimating firm-level production functions to recover productivity
    - Proxy methods following Olley & Pakes (1996)
    - Dynamic Panel Data following Blundell & Bond (2000)
  - **Both have Mixed success.** Invoke David Card Maxim: Use better data for a new method - **NPR**

Estimating Production Functions with Expectations Data

Agnes Norris Keiller [1] Áureo de Paula [2]
John Van Reenen [3]

[1]LSE
[2]UCL, IFS and CeMMAP
[3]LSE and NBER

Example of Cobb-Douglas Production Function

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \omega_{it} + \epsilon_{it}$$

- ω_{it} follows a Markov process

$$\omega_{it} = \mathbb{E}[\omega_{it}|\omega_{it-1}] + \xi_{it} = g(\omega_{it-1}) + \xi_{it}$$

- Capital evolves according to

$$K_{it} = (1 - \delta)K_{it-1} + I_{it-1}$$

where δ = the depreciation rate; I_{it-1} = investment

- OP: firms' investment policy $\rightarrow \omega = \Phi^{OP}(i_{it}, k_{it})$
- LP: firms' material input policy $\rightarrow \omega = \Phi^{LP}(m_{it}, k_{it})$
- ACF: firms' material input policy $\rightarrow \omega = \Phi^{ACF}(m_{it}, l_{it}, k_{it})$
- Invertibility of input demand is typically justified by a model of optimal firm decisions

NPR does not need strong assumptions on input choice

- Expected output next year given this year's information set, Ω_{it}

$$\mathbb{E}_{it}[y_{it+1}|\Omega_{it}] = \beta_o + \beta_k k_{t+1} + \beta_l \mathbb{E}_{it}[l_{it+1}|\Omega_{it}\ ] + \mathbb{E}_{it}[\omega_{it+1}|\Omega_{it}\ ]$$

- Using law of motion for ω_{it}

$$\mathbb{E}_{it}[y_{it+1}|\Omega_{it}] = \beta_o + \beta_k k_{t+1} + \beta_l \mathbb{E}_{it}[l_{it+1}|\Omega_{it}\ ] + g(\omega_{it}\ )$$

- Example:

Cobb-Douglas production and $\omega_{it} = \rho\omega_{it-1} + \xi_{it}$ implies

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \omega_{it} + \epsilon_{it}$$

$$= \frac{\rho - 1}{\rho}\beta_0 + \beta_k k_{it} + \beta_l l_{it} + \frac{1}{\rho}\mathbb{E}_{it}[y_{it+1}|\Omega_{it}] - \frac{\beta_k}{\rho}k_{it+1} - \frac{\beta_l}{\rho}\mathbb{E}_{it}[l_{it+1}|\Omega_{it}] + e_{it}$$

- If measurements on the variables in red are available, we can identify and consistently estimate all the parameters!

Yes, Virginia, there is a. . . Management and Expectations Survey!

Looking ahead to the 2021 calendar year, what is the approximate turnover you would anticipate for this business in the following scenarios?

Lowest turnover

Report to the nearest £1,000. For example, £1,357,689 would be reported as £1,358,000

£ 2,800,000

Low turnover

£ 4,200,000

Medium turnover

£ 5,000,000

High turnover

£ 6,300,000

Highest turnover

£ 7,500,000

For the approximate turnover values you have just given for 2021, how likely do you think each scenario is to occur?

Your answers should add up to 100%

Likelihood of lowest turnover occurring

5 %

Likelihood of low turnover occurring

10 %

Likelihood of medium turnover occurring

60 %

Likelihood of high turnover occurring

20 %

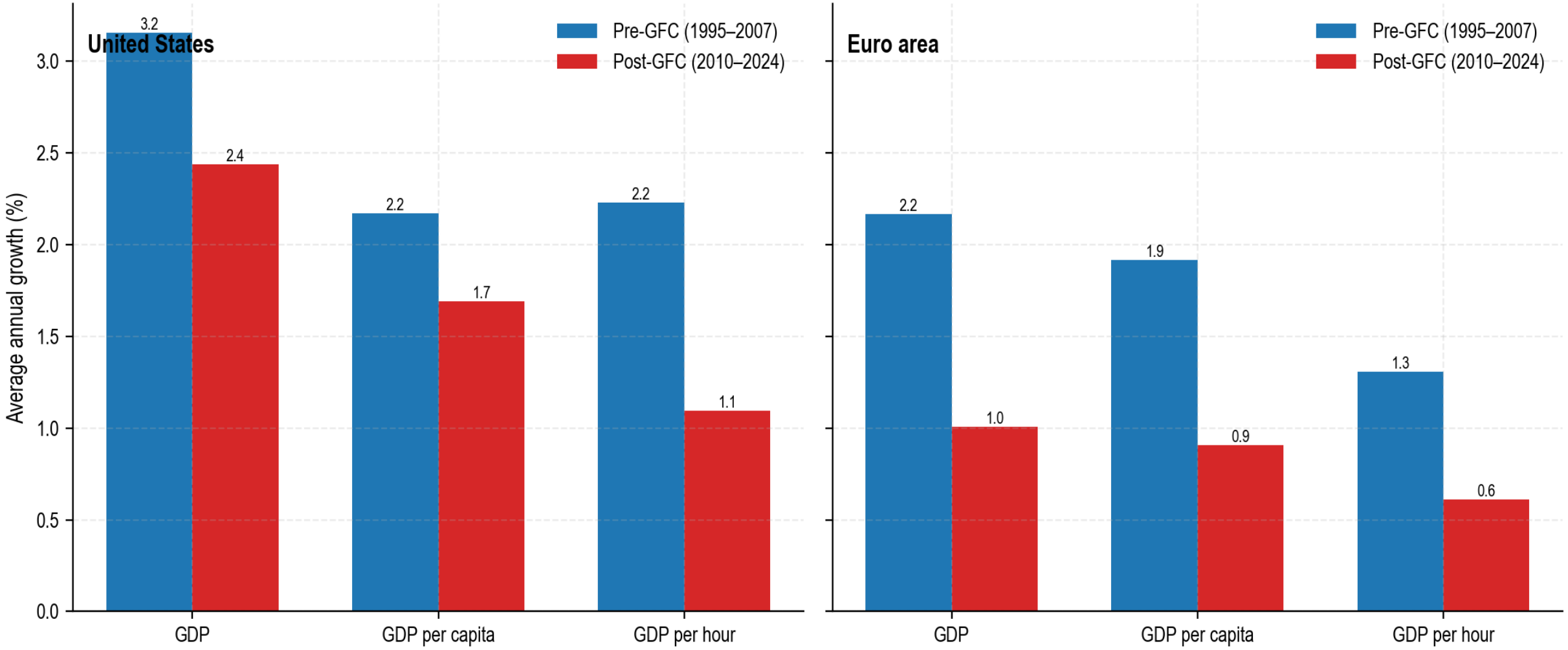
Likelihood of highest turnover occurring

5 %

Benefits of NPR

- Subjective expectations exist in at least 8 datasets (e.g. UK MES, US MOPS)
- Can control for endogeneity bias & selection in the **cross section**. Other methods need at least 2 years of panel
  - adding expectations questions to standard firm surveys
- Monte Carlo and empirical implementation on UK firm level data in 2010s. NPR performs well compared to ACF, etc. when firms face turbulent times & find it hard to choose optimal inputs (e.g. restaurants in COVID years)
- An estimator for turbulent times
- Better dynamic moments
  - Initial TFP and subsequent survival and growth

Growth slowdown in US and Europe since Financial Crisis



Source: Bergeaud (2026)