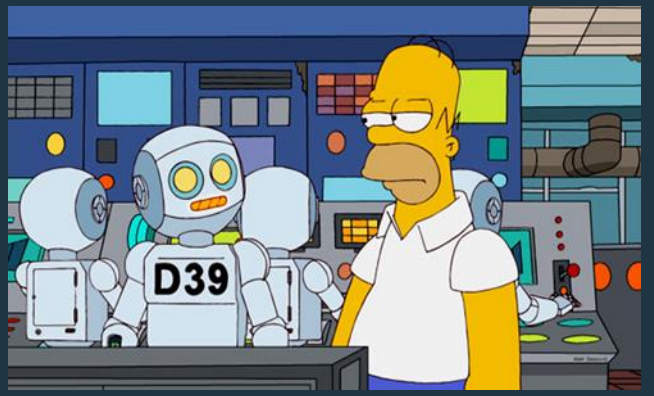
poid Programme on Innovation and Diffusion

Technology, Labour Markets and Firms

John Van Reenen (LSE and POID)

British Academy, March 24th 2022

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE



Five Facts on Technology & What Is to be Done?

- What are the most important facts that we have learned on technological progress and its impact on labour?
  - Focus on last 40 years in UK (and US)

- What does this mean for policy?
  - Skills, Innovation, Diffusion & Labour market institutions

Five facts on technology & what this means for policy

The Facts

1. **Productivity growth** drives living standards, and **technology** drives productivity

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OUTLINE OF TALK

Some Technology Facts

Policy

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Productivity growth drives living standards

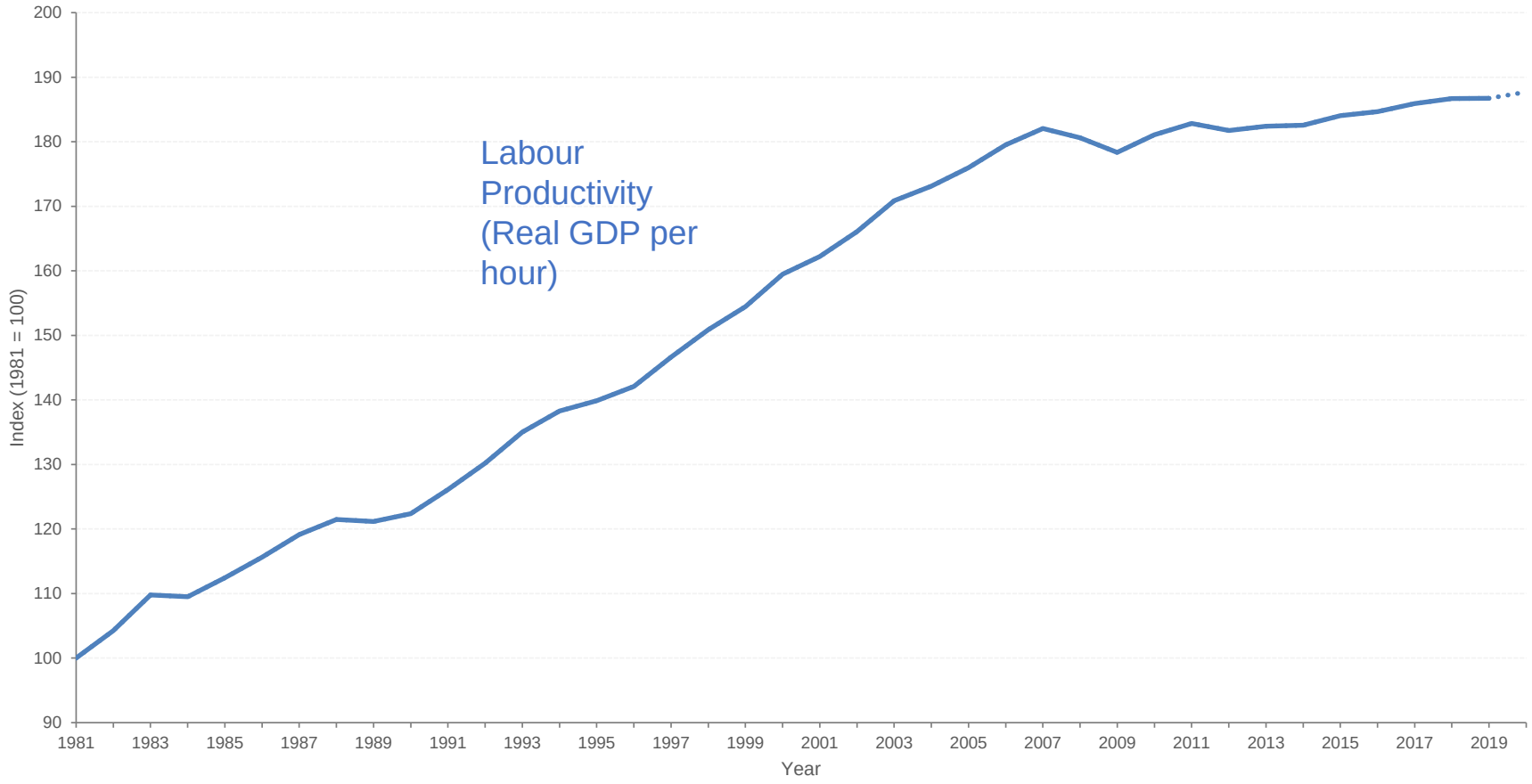
- Size/output of the economy (GDP) is not important *per se* for the wellbeing of our citizens

- Productivity (output per input, e.g. GDP per hour) *does* matter
  - Increasing output by increasing population or hours worked or the fraction of population in work is not something intrinsically desirable, and has clear limits

- In the long-run, wage growth follows productivity growth

- Therefore, to sustainably lift people and countries out of poverty requires lifting their productivity

The UK Challenge: Productivity growth dismal since Global Financial Crisis; Output per hour 1981-2020



Source: Teichgräber and Van Reenen (2021), ONS and OECD data

The UK Challenge: Productivity growth dismal since Global Financial Crisis; Output per hour 1981-2020

Global Financial Crisis

Labour Productivity (Real GDP per hour)

Before 2007:
Av. growth = **2.40%**

Since 2007:
Av. growth = **0.21%**

Index (1981 = 100)

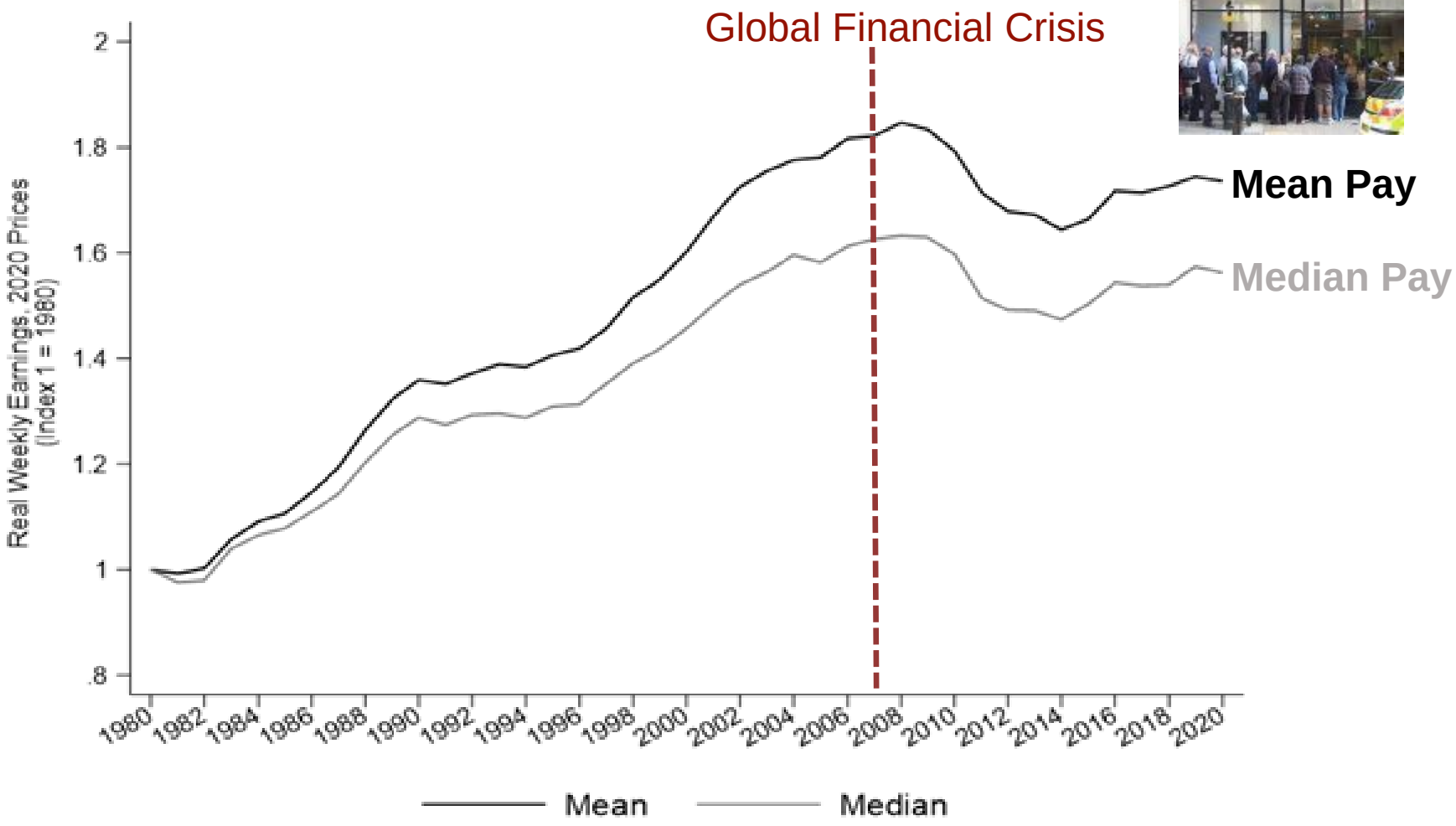
200
190
180
170
160
150
140
130
120
110
100
90

1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017 2019

Year

Source: Teichgräber and Van Reenen (2021), ONS and OECD data

Mean and Median worker Wages have also both stagnated since Financial Crisis



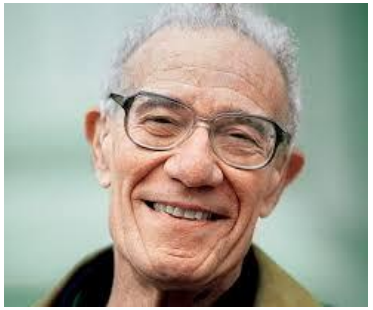
Notes: ASHE data

Technology as fundamental driver of Growth

- Growth is a story of technical change not accumulation of more people or capital

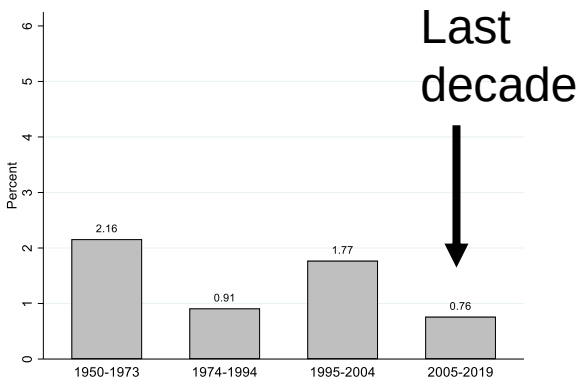
- **Output per hour grows 2.5% per annum since WW2**
  - 0.1% from capital deepening
  - 0.4% from labour composition
  - 2.0% from technical change (TFP “Solow Residual”)

Nobel Laureate Bob Solow, MIT

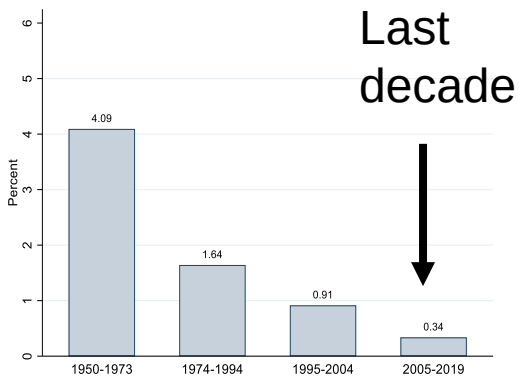


The recent slowdown in productivity is driven by slowdown in TFP (technical progress)

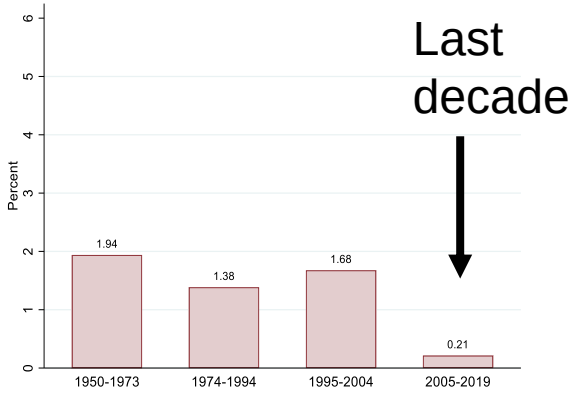
A. United States



B. Euro Area



C. United Kingdom



Source: Data updated from Bergeaud, Cette, and Lecat (2016). Data 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.

Technology and Growth

- Micro-econometric studies show that technology however measured (e.g. R&D, patents, TFP, IT, direct measures, etc.) is a fundamental driver of productivity growth
  - Causal evidence using policy changes as quasi-experiments that increases technology. **Examples:**
    - R&D tax policies create variation across firms in incentives to perform research
    - Broadband roll-out that increases usage of ICT/Internet

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- Although Ideas are Getting Harder to Find, this implies we need greater – not less - investment in innovation to achieve good productivity growth rates

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Will robots take all of our jobs?

Techno optimist

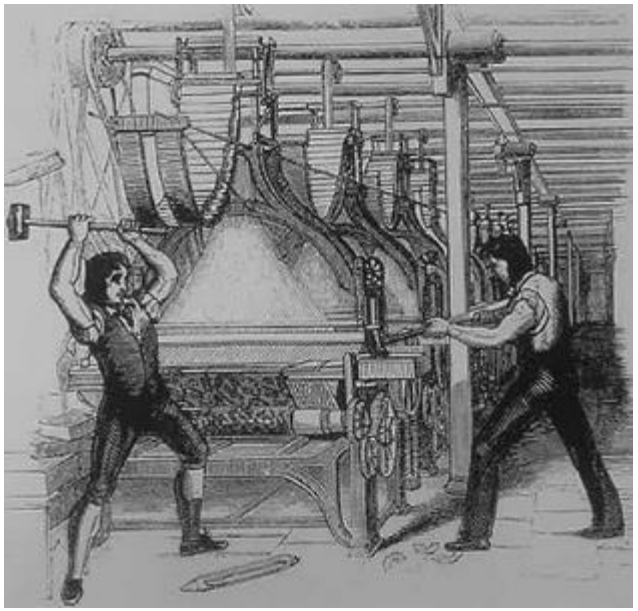
Will robots take all of our jobs?

Or….

The fear of technological unemployment is not new – in fact, Déjà vu all over again…

AUTOMATION IN BRITAIN STIRS UNREST IN LABOR

Workers See 'Robot Revolution' Depriving Them of Jobs



THE NEW YORK TIMES. SUNDAY. FEBRUARY 26, 1928. XX 3

MARCH OF THE MACHINE MAKES IDLE HANDS

Prevalence of Unemployment With Greatly Increased Industrial Output Points to the Influence of Labor-Saving Devices as an Underlying Cause

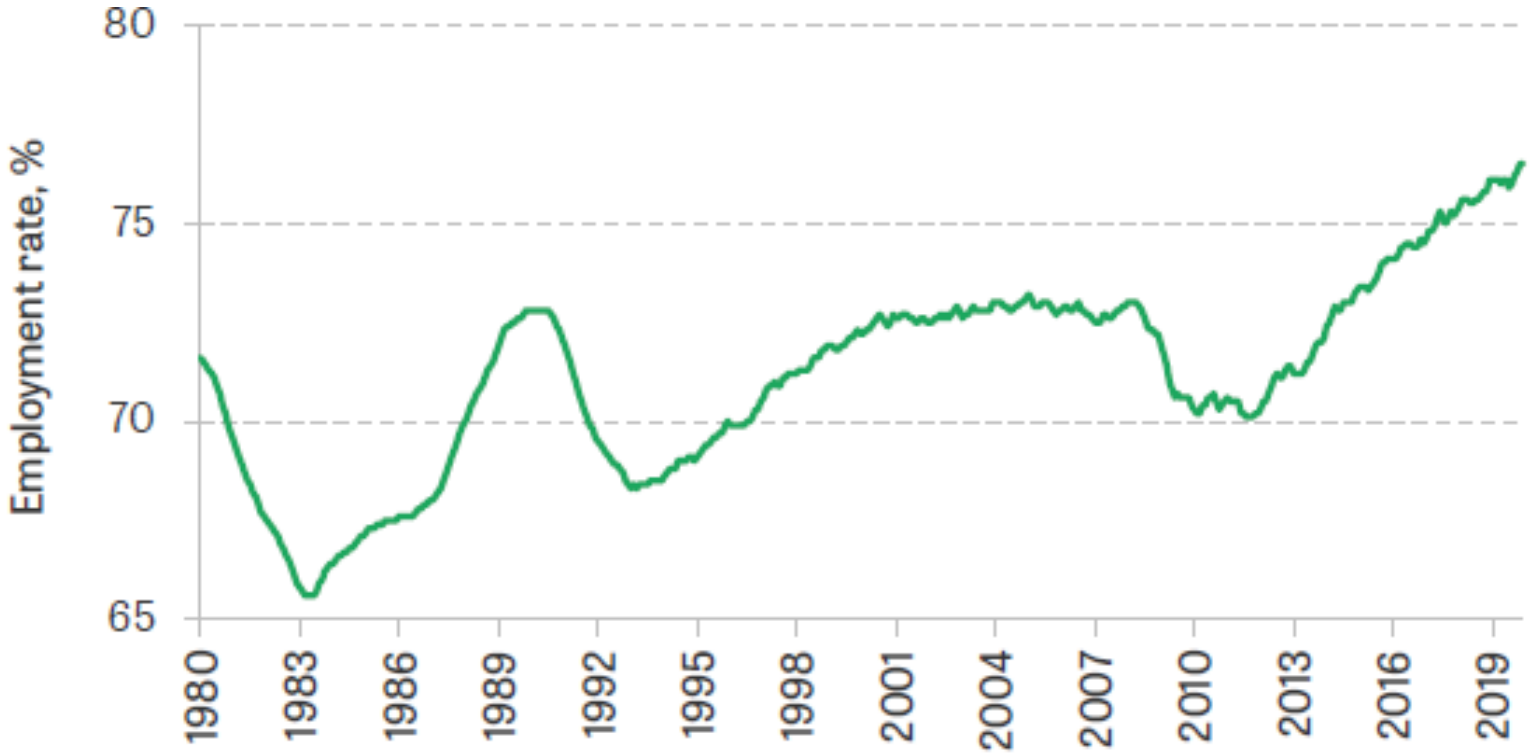
By EVANS CLARK.

A FEW days ago the General Motors Corporation reported the largest peace-time earnings ever made by a single concern in the history of America. Three days later Governor Smith made public a report from the New York Industrial Commissioner which called public attention to serious unemployment throughout the State; not since the depression of 1921, it was disclosed, have conditions been as bad.

The people of the United States—in the shadow of a Presidential elec-tion—are presented with a social

Fraction of people in work is rising, not falling.

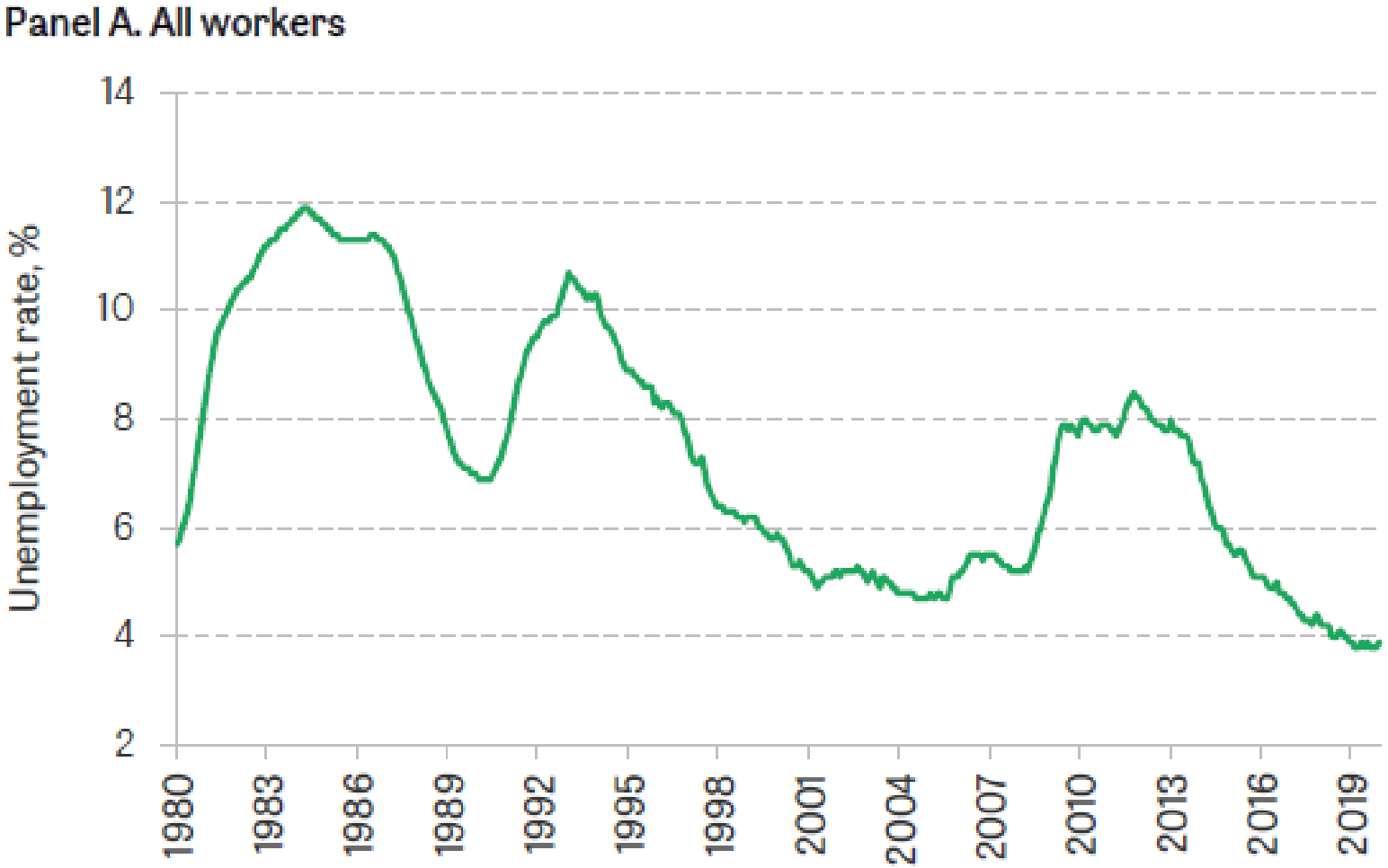
Proportion of working age population in jobs, UK, 1980-2022



Source: Giupponi and Machin (2022), https://ifs.org.uk/inequality/labour-market-inequality/

Unemployment is not trending upwards.

UK Unemployment rates, 1980-2020



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Micro-economic studies on jobs and technology

- As many papers showing positive effects as negative effects (see Aghion er al, 2021, for recent survey)

- Which is unsurprising:
  - Some innovations create new products rather than automating away labor through new processes
  - Even with labor saving automation, scale effect can outweigh substitution effect
    - For a given output automation implies substituting away from labour
    - But since automation reduces costs, prices fall/quality rises and this boosts demand/firm scale. This will increase jobs

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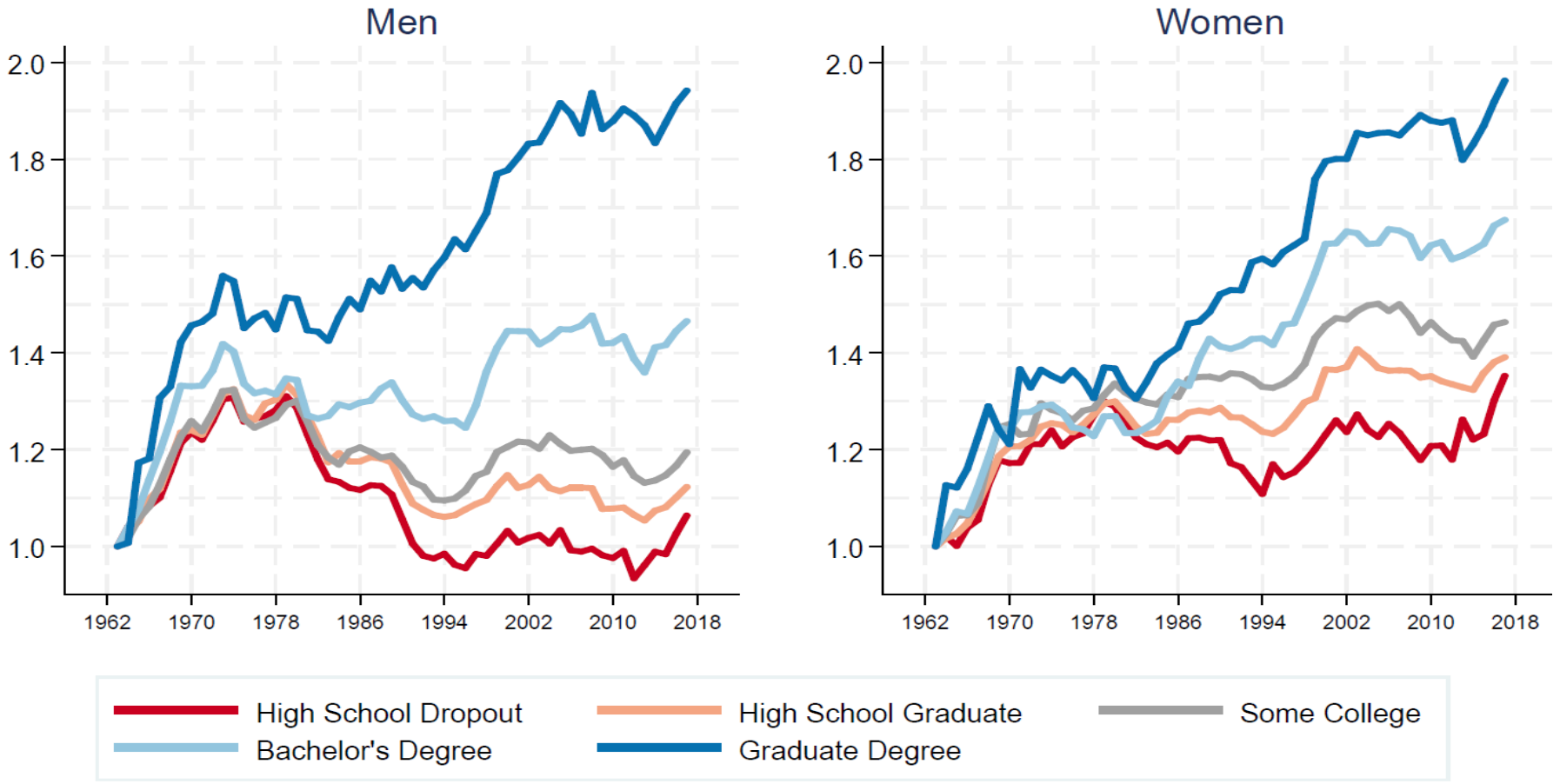
Technology affects the type of jobs people do

- Key fact is that for the last century technology has tended to increase the relative demand for more educated workers: **“Skill Biased Technical Change” (SBTC)**
- **Macro:** Despite big increase in years of schooling (skill supply up), relative wages of more educated workers has not fallen

Wage trends; Big increase in US college wage premium from mid 1970s; 1963-2017



Source: Autor (2019); Working Age Adults, Ages 18-64; Cumulative Change in Real Weekly Earnings

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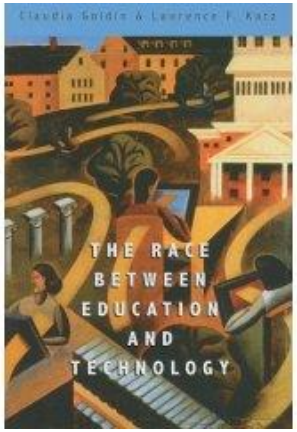
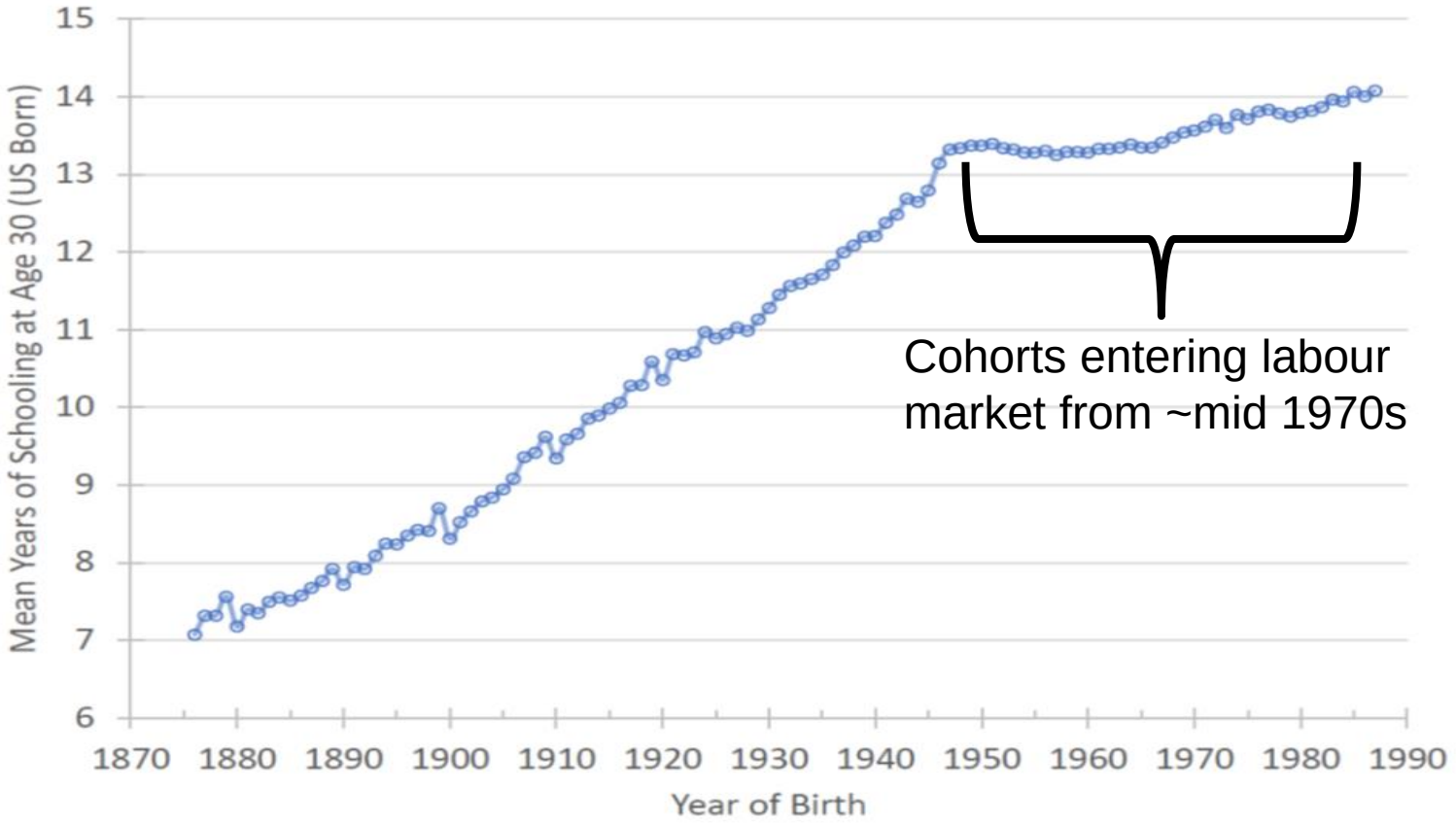
- **Micro:** Hundreds of studies suggesting technology tends to increase demand for skills (e.g. Machin & Van Reenen, 1998)
- Jan Tinbergen: "Race between Education and Technology": if education growth slows, inequality rises



Goldin & Katz

MEAN YEARS OF SCHOOLING SLOWS IN US

Figure 2: Mean Years of Schooling at Age 30 for the U.S. Born, 1876 to 1987 Birth Cohorts



Sources and Notes: US Census IPUMS data from 1940 to 2000 and CPS MORG data from 2005 to 2018. The figure updates Goldin and Katz (2007, figure 7). See on-line appendix.

Source: Autor, Goldin & Katz (2021), IPUMs, MORG

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- Jan Tinbergen (Goldin & Katz): "Race between Education and Technology": if education growth slows, inequality rises
- **Nuance**: ICT replaces routine tasks. First blue collar production workers in lower part of pay hierarchy, then white collar (e.g. clerical) in middle of distribution
  - leads to "polarization"/"hollowing out"

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The importance of sharing innovation rents for wage determination

- Labour markets are imperfectly competitive: wages are not only driven by productivity filtered through demand and supply
- Firm you work for has big effect on your wellbeing & pay

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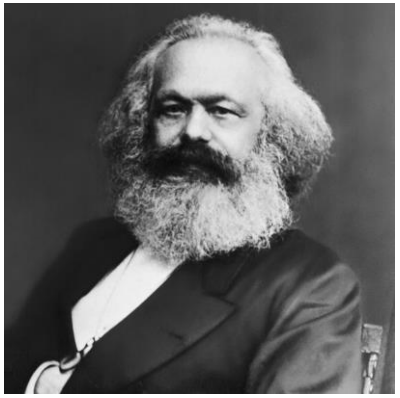
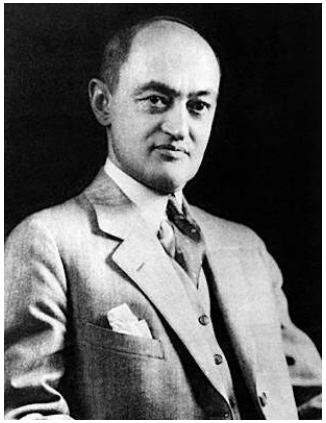
- Firm you work for has big effect on your wellbeing & pay
- Technological innovation increases firm performance and these “rents” often get shared with workers. Why?
  - Bargaining over the surplus individually or through unions

Marx



Schumpeter



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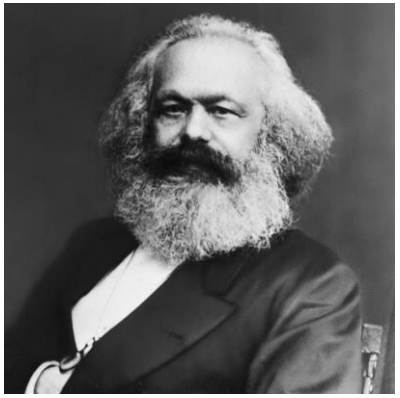
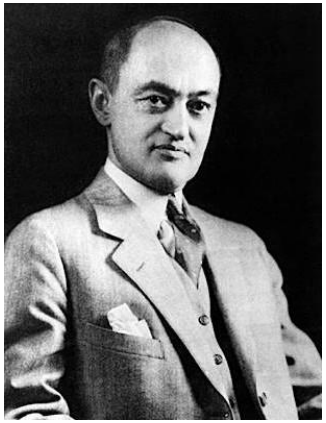


Robinson



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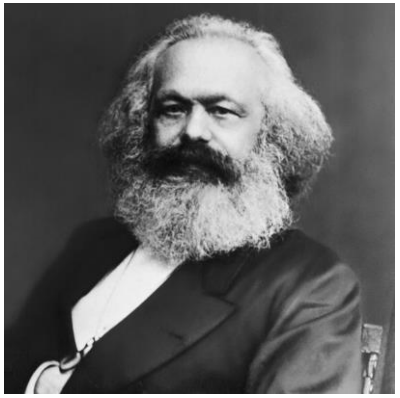
  - Bargaining over the surplus individually or through unions
  - To grow, firm raises wages to attract workers (monopsony)
- Van Reenen (1996) & Kline et al (2019) find large role: 10% increase in rents from innovation increases wages by 3%



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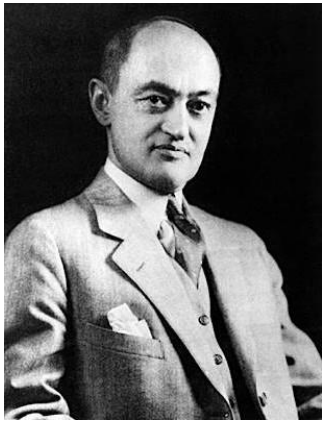

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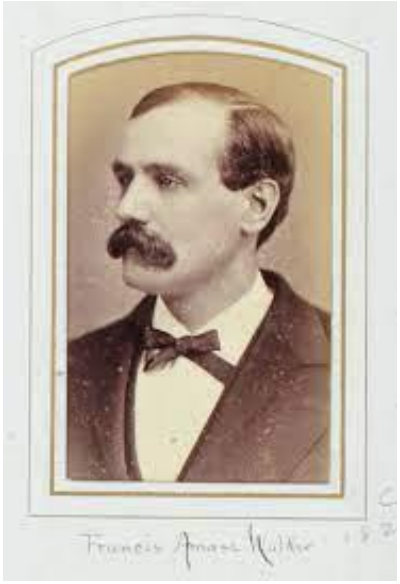
Firms are very different….

- It is well known that there are huge differences between firms
- In UK, top 0.1% of businesses account for 40% of jobs & 50% of all sales (de Loecker, Obermeier & Van Reenen, 2022)
- In US, 90-10 of productivity is 4:1 within average narrow SIC4 industry.

Francis Walker



Robert Gibrat

Firms vary a lot in size, productivity & management

Firm level average management scores, 1 (worst practice) to 5 (best practice)

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

And firms are becoming increasingly different

- Superstar firms pulling away from the rest (e.g. GAFAMs)

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Apple Becomes 1st Company Worth $3 Trillion—Greater Than The GDP Of The UK

Forbes, Jan 3rd 2022

https://www.forbes.com/sites/zacharysmith/2022/01/03/apple-becomes-1st-company-worth-3-trillion-greater-than-the-gdp-of-the-uk/?sh=2468cc8d5603

Market Valuation at start of 2022 (GAFAMs)

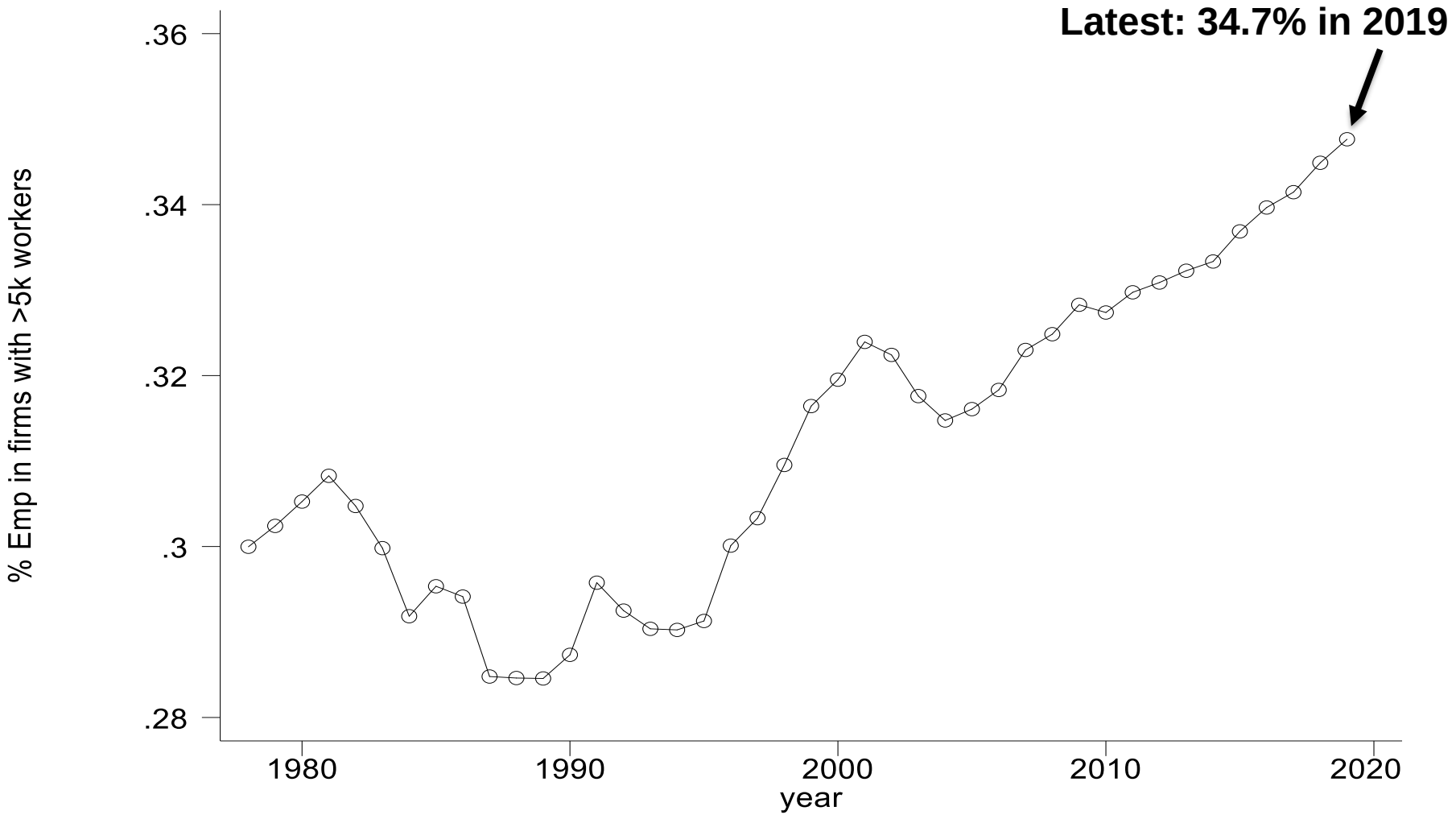
- ***Apple*** $3 Trillion
- ***Microsoft*** $2.53 Trillion
- ***Google/Alphabet*** $1.92 Trillion
- ***Amazon*** $1.69 Trillion
- ***Facebook/Meta*** $0.93 Trillion
- Growth has been supercharged by COVID's push to online, but has been going on long before the Pandemic

Firms becoming increasingly different

- Superstar firms pulling away from the rest (e.g. “GAFAMs”) but also outside digital economy.
- Many reasons suggested (antitrust; globalisation). Three technological reasons:
  - Network effects (e.g. Google and Microsoft)
  - Increase in fixed costs of intangible capital (e.g. Walmart)
  - Slowdown in diffusion between leaders & laggards

- Growth of superstar firms means increased industrial concentration, wider productivity dispersion, higher aggregate price-cost markups

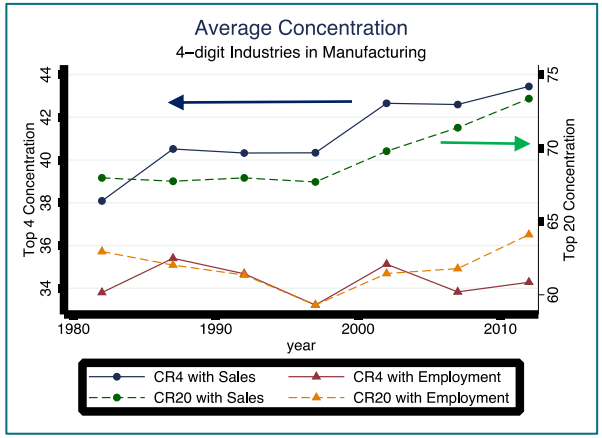
Since mid '80s Big Firms in US get bigger: % jobs in firms with 5,000+ workers rose from ~28% in 1987 to ~35% in 2019



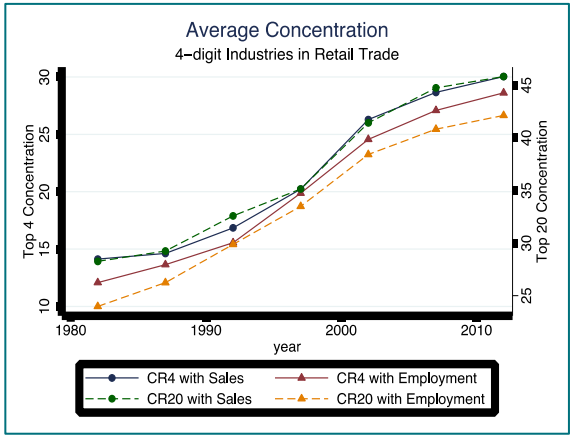
Source: US Business Dynamics Statistics (2021), https://www.census.gov/data/datasets/time-series/econ/bds/bds-datasets.html

Rising Concentration in within all sectors in US

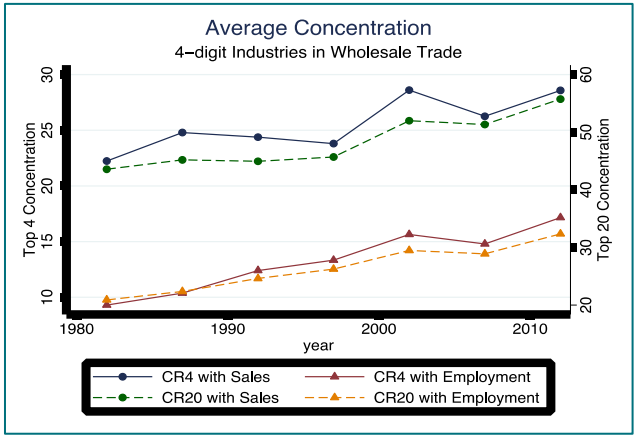
Manufacturing



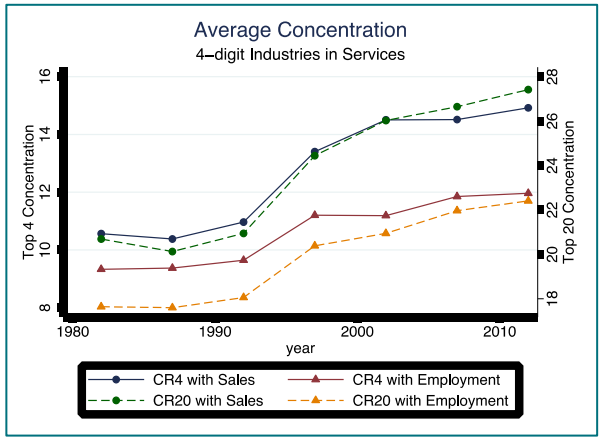
Retail Trade



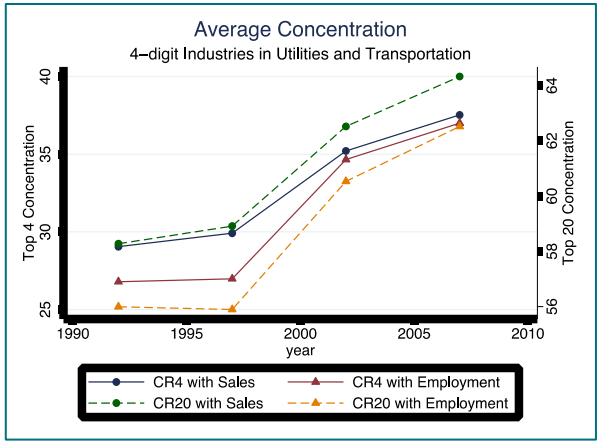
Wholesale Trade



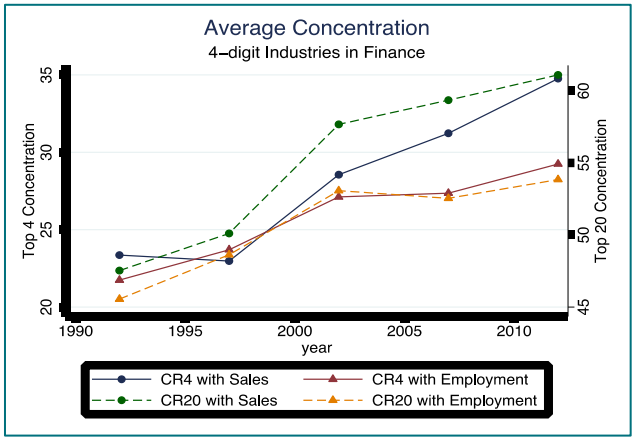
Services



Utilities + Transportation

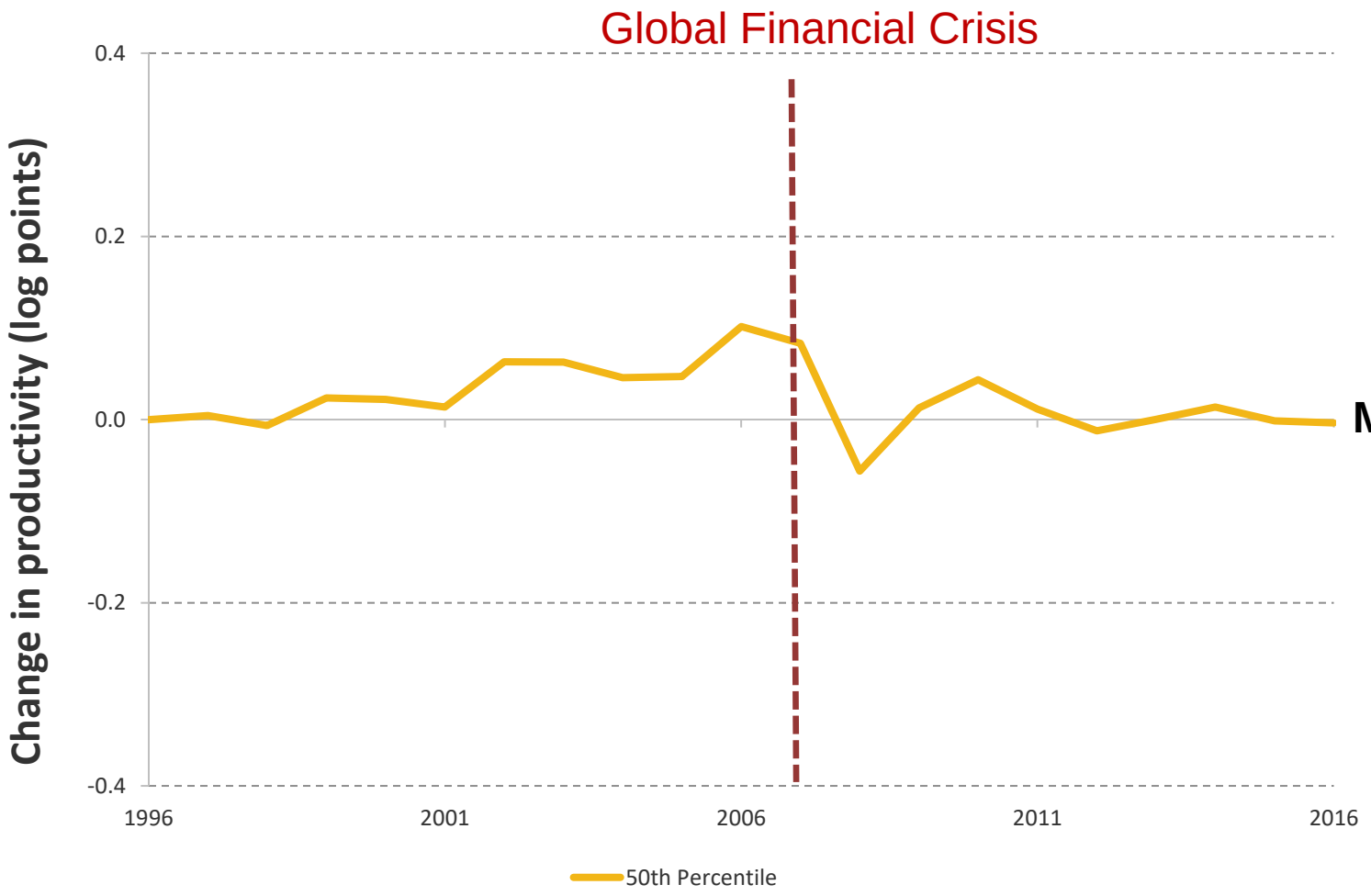


Finance



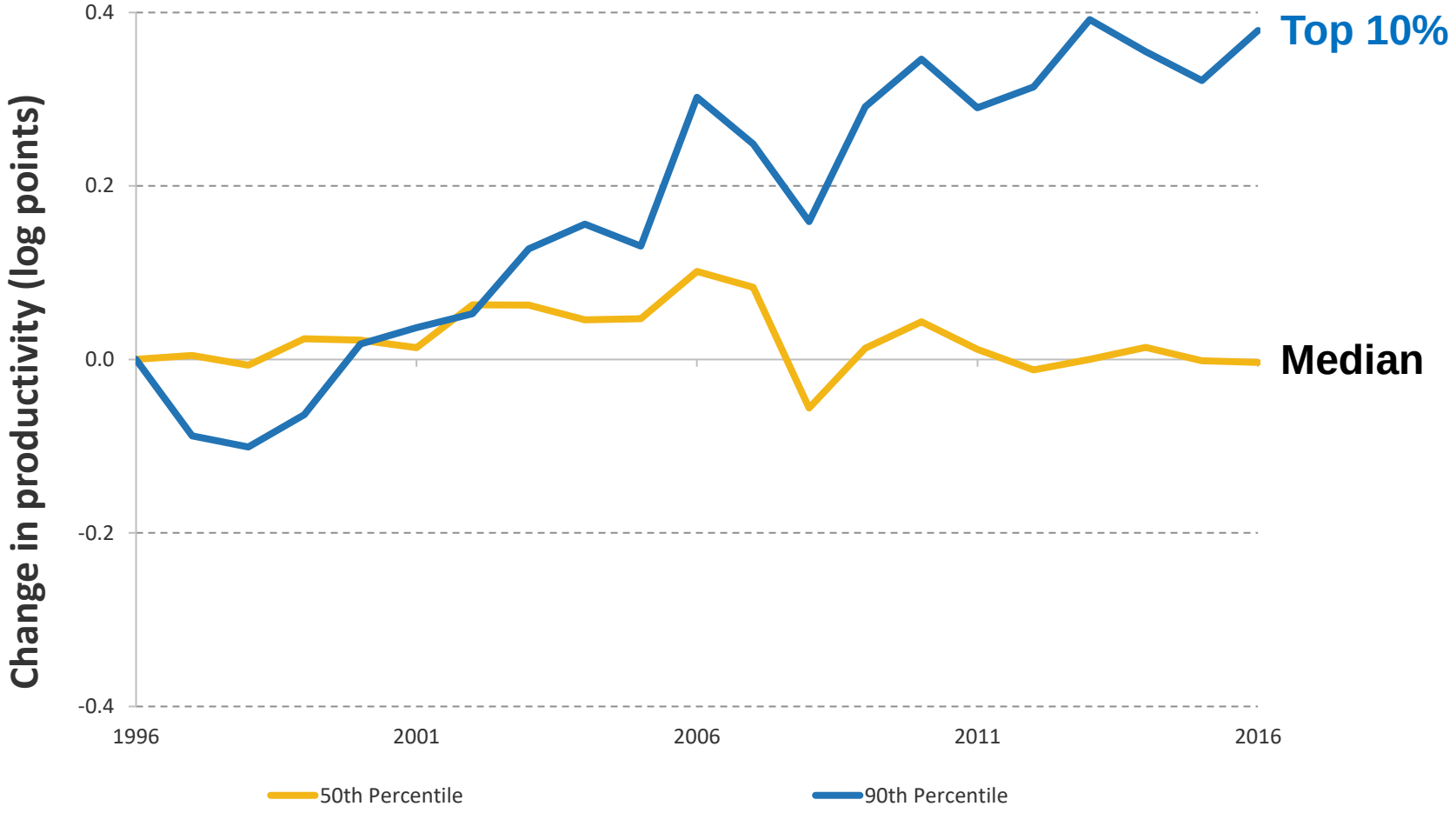
Notes: Weighted av. of concentration across the SIC-4's within each sector. 676 SIC4 industries (Manufacturing: 388 inds; Retail: 58; Wholesale: 56; Finance: 31; Services: 95; Utilities & Transport: 48)

In UK, increased dispersion across firm-level productivity. Median firm looks like macro picture



Notes: Historical ORBIS, ln(value added/employee), quantiles weighted by firm employment; values indexed to zero in 1996; Changes in log points, so 0.05 = about 5% growth; 0.4 = $(e^{0.04} - 1)*100 = 50\%$
Source: de Loecker, Obermeier and Van Reenen (2022)

“The Best pull away from the Rest”: Superstar Firms have strong productivity growth



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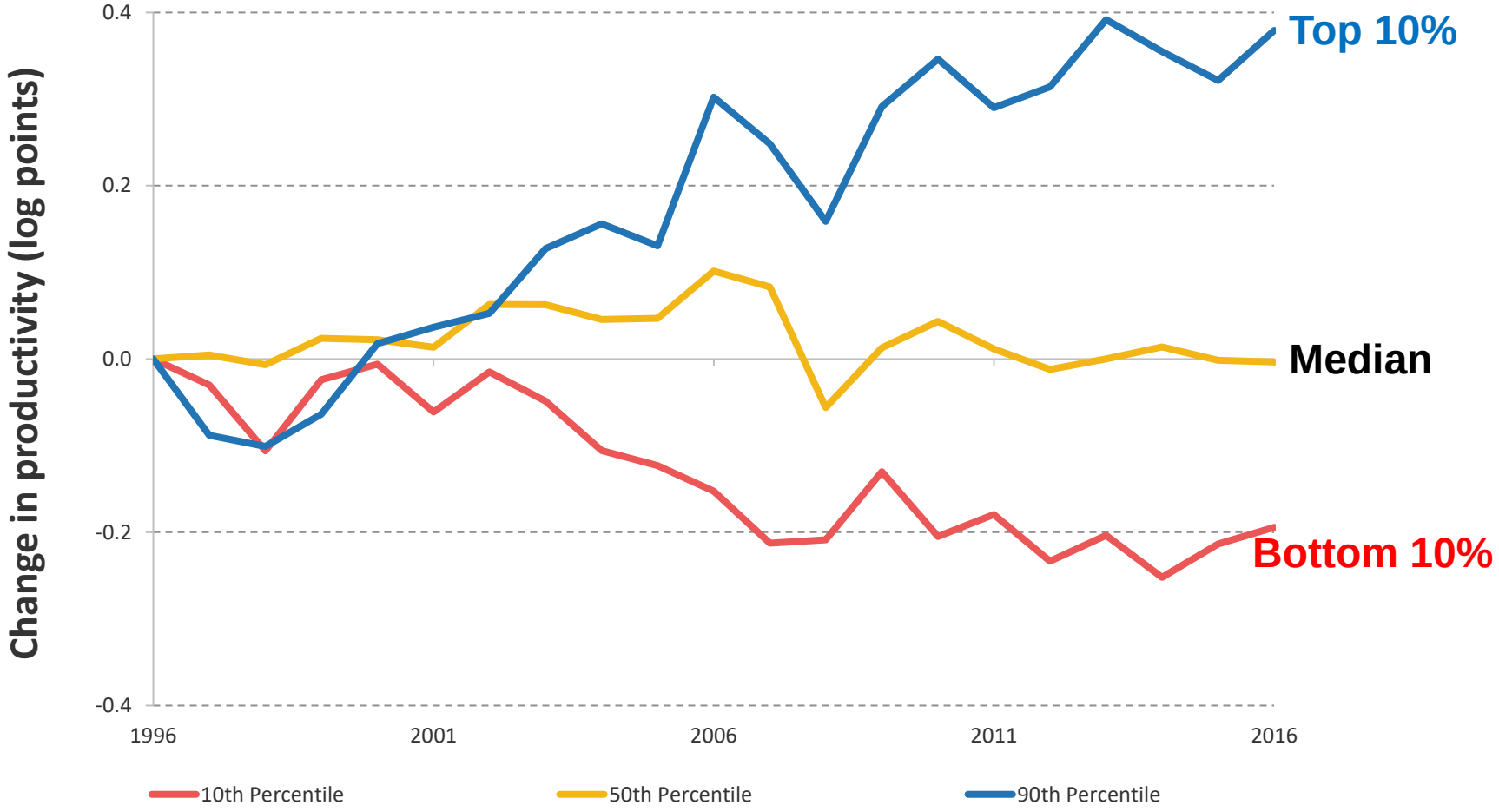
Source: de Loecker, Obermeier and Van Reenen (2022)

And poor productivity performance at the bottom of the distribution



Notes: Historical ORBIS, ln(value added/employee), quantiles weighted by firm employment; values indexed to zero in 1996; Changes in log points, so 0.05 = about 5% growth; 0.4 = $(e^{0.04} - 1)*100 = 50\%$
Source: de Loecker, Obermeier and Van Reenen (2022)

Firms becoming increasingly different

- Superstar firms pulling away from the rest (e.g. GAFAMs, but also outside digital economy). Why?
  - Network effects (e.g. Google and Microsoft)
  - Increase in fixed costs of intangible capital
  - Slowdown in diffusion between leaders & laggards
- Means increased industrial concentration, wider productivity dispersion
- A force for increasing income inequality:
  - Superstar firms sharing rents with workers
  - Most skilled workers sorting into these top firms
- Tends to lower labor share of GDP as superstars have high profits and low labor share of sales (even though wages high)
- Important implications for competition policy

OUTLINE OF TALK

The Technology Facts

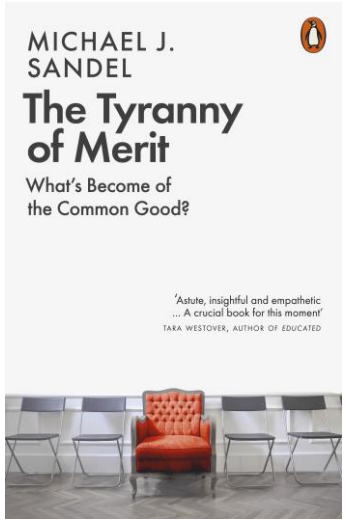
Policy

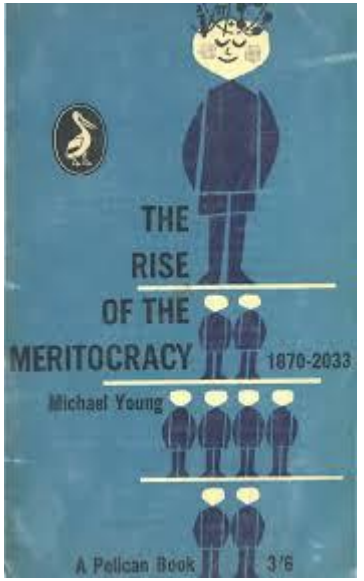
What should we do?

- Human Capital Policies
- Innovation Policies
- Diffusion Policies
- Labour Market Policies
  - Case study of UK National Minimum Wage

Human Capital Policy

- Building human capital key to raising productivity & wages as well as reducing inequality
- **Counter:** “Meritocratic” push for college education is wasteful and creates disrespect for non-graduates (e.g. Sandel, 2021)
  - UK government restricting access to universities through more minimum eligibility requirements for student loans





Human Capital Policy

- **Good points of critique**
  - In UK (& US) we have weak provision of career paths for non-graduates (FE, Apprenticeships, re-training)
  - There are significant barriers to equality of opportunity (we do not live in anything like a meritocracy)

Human Capital Policy

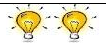
- **Good points of critique**
  - In UK (& US) we have weak provision of career paths for non-graduates (FE, Apprenticeships, re-training)
  - There are significant barriers to equality of opportunity (we do not live in anything like a meritocracy)
- **But** economists' emphasis on human capital is fundamentally right
  - Increasing schooling causes higher individual wages & this effect is no weaker/stronger for the disadvantaged (e.g. because of financial constraints)
  - Problem has been **slowdown**, not speed-up of education attainment in US causing inequality growth (Goldin-Katz)
  - UK achieved faster growth of university education than US, and this faster supply has helped mitigate inequality

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	↑

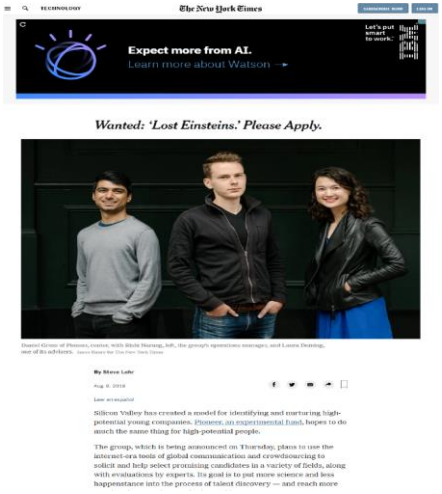
"Demand"

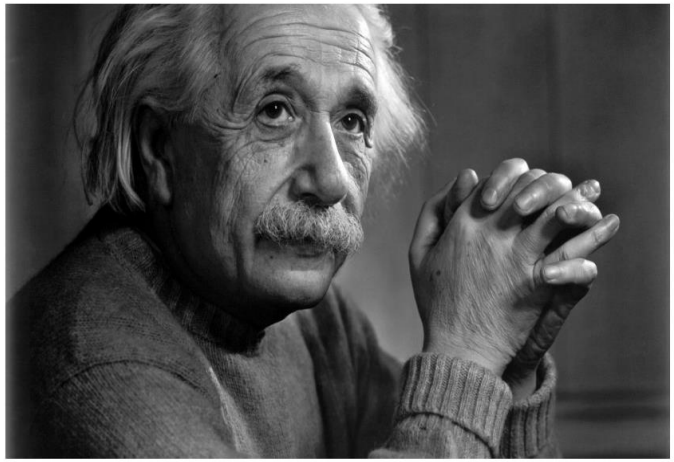
"Supply"

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

Finding the “Lost Einsteins” and “Marie Curies” (Bell, Chetty, Jaravel, Petkova & Van Reenen (2019)

- 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)





Diffusion: 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
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)

Labour Market Institutions

- Declining union power has been a force for wage inequality in UK and US
- Minimum wages as a counter-balance to increasing employer power?

Labour Market Institutions

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- By contrast, **UK** National Minimum Wage introduced in 1999 & subsequently strongly uprated by all parties:
  - Reduced wage inequality in bottom of pay distribution
  - No obvious negative effects on jobs
  - Helped offset pressures from higher employer product market power to keep up labour share of GDP ? (Draca, Machin and Van Reenen, 2011)

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- Need to properly regulate Gig Economy – massive growth of solo self-employed in UK

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

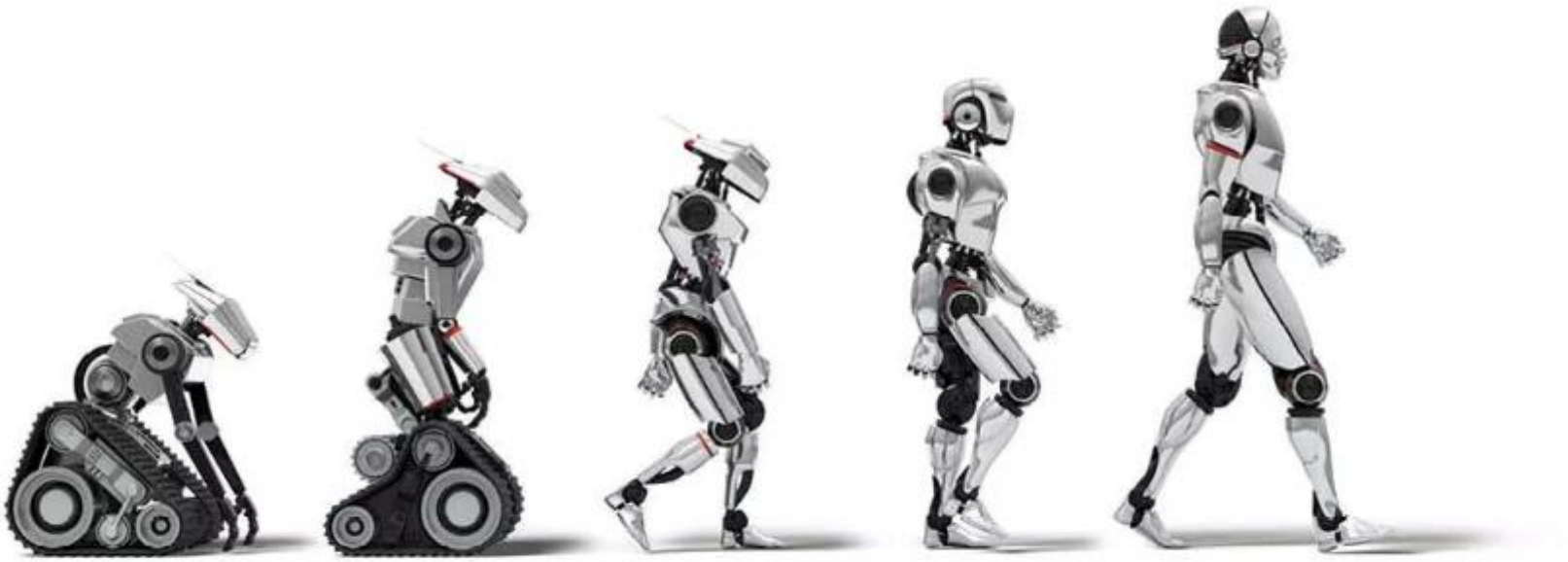
Conclusions

- Rather than fearing technical change, the problem is that we do not have enough of it. Needed to restore strong productivity and therefore wage growth

- Technology does tend to push up inequality: both through traditional skills bias & more recent superstar firm effects
  - So important to have policies fostering growth and equity.
  - Expanding human capital, especially at bottom end is key to this (e.g. “Lost Einsteins and Marie Curies”)

- And need to modernize labour market institutions to help protect workers

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

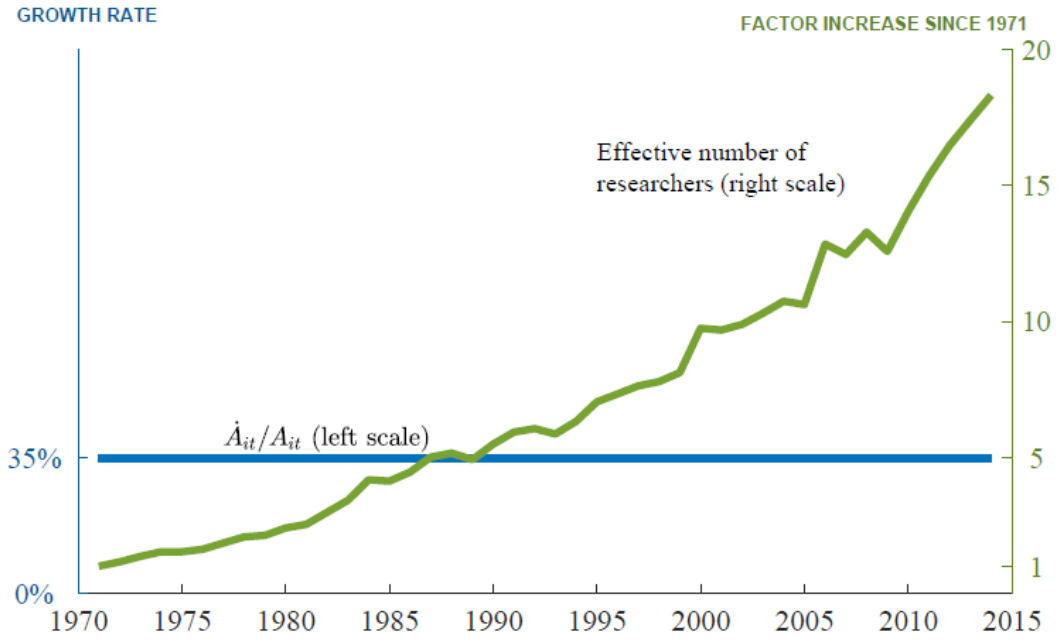
- "Do Fiscal Incentives increase innovation? An RD Design for R&D" (Antoine Dechezlepretre, Elias Einio, Ralf Martin, Kieu-Trang Nguyen and John Van Reenen), CEP Discussion Paper 1413 Vox, http://cep.lse.ac.uk/pubs/download/dp1413.pdf

Technology and growth

- Micro-econometric studies show that technology however measured (e.g. R&D, IP/patents, diffusion of ICT, TFP, etc.) is a fundamental driver of productivity growth
  - Causal evidence using policy changes as quasi-experiments (e.g. R&D tax policies that create exogenous variation across firms in incentives to perform research)

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

Figure 4: Data on Moore's Law

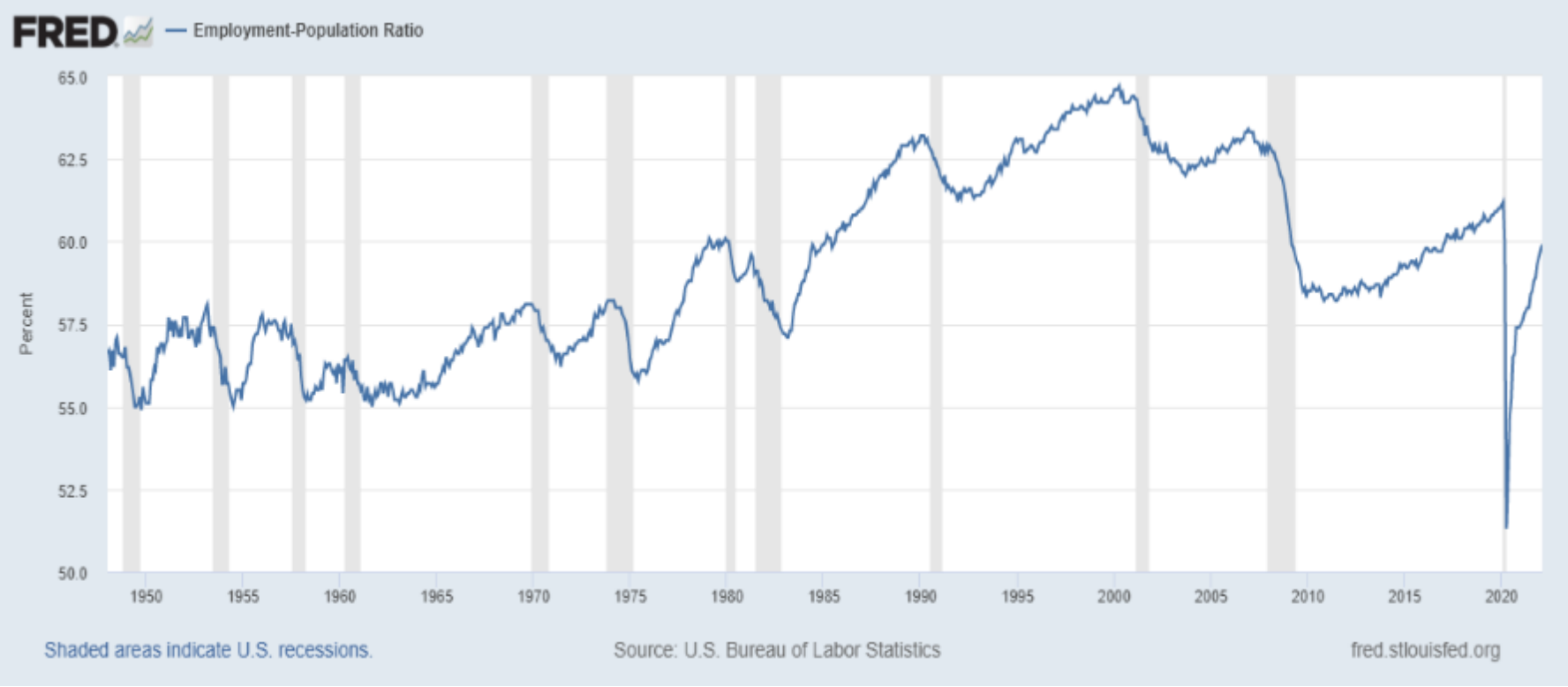


Note: The effective number of researchers is measured by deflating the nominal semiconductor R&D expenditures of key firms by the average wage of high-skilled workers. The R&D data includes research by Intel, Fairchild, National Semiconductor, Texas Instruments, Motorola, and more than two dozen other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

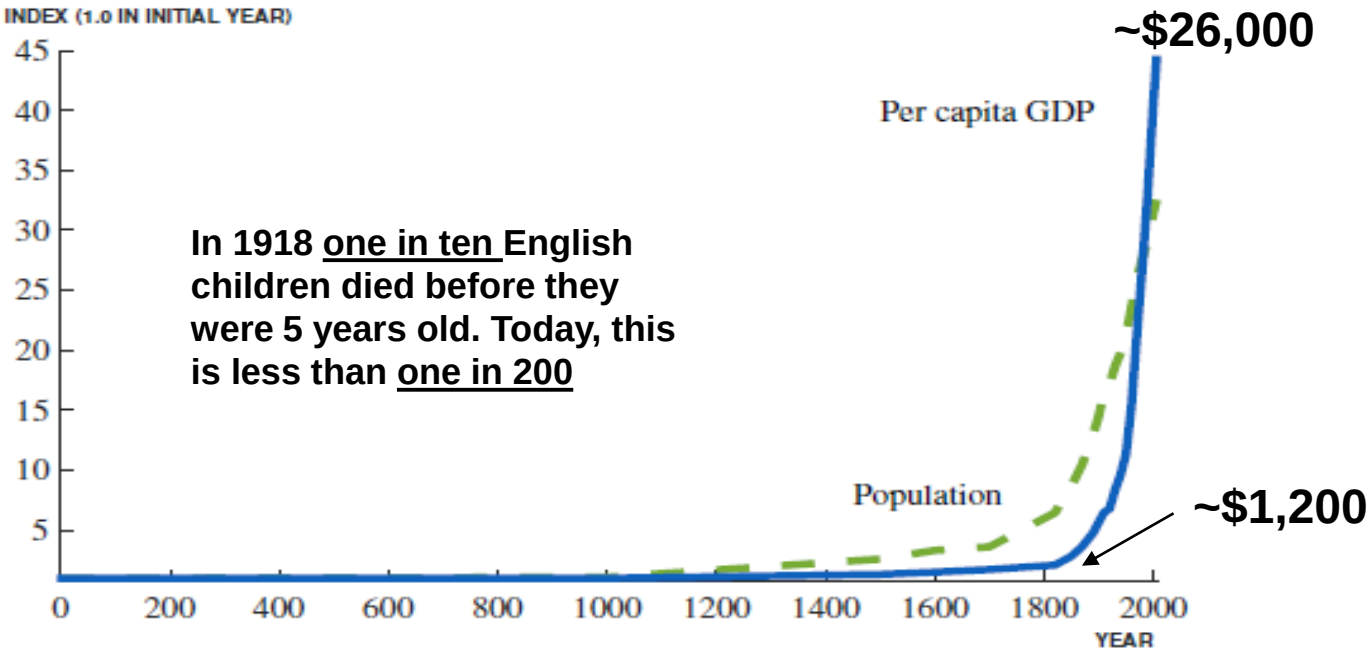
Source: Bloom, Jones, Van Reenen and Webb (2020, AER)

Fraction of people in work is rising in US, not falling. Unemployment is not trending upwards

Example: Fraction of working age population in employment in US, 1945-2022

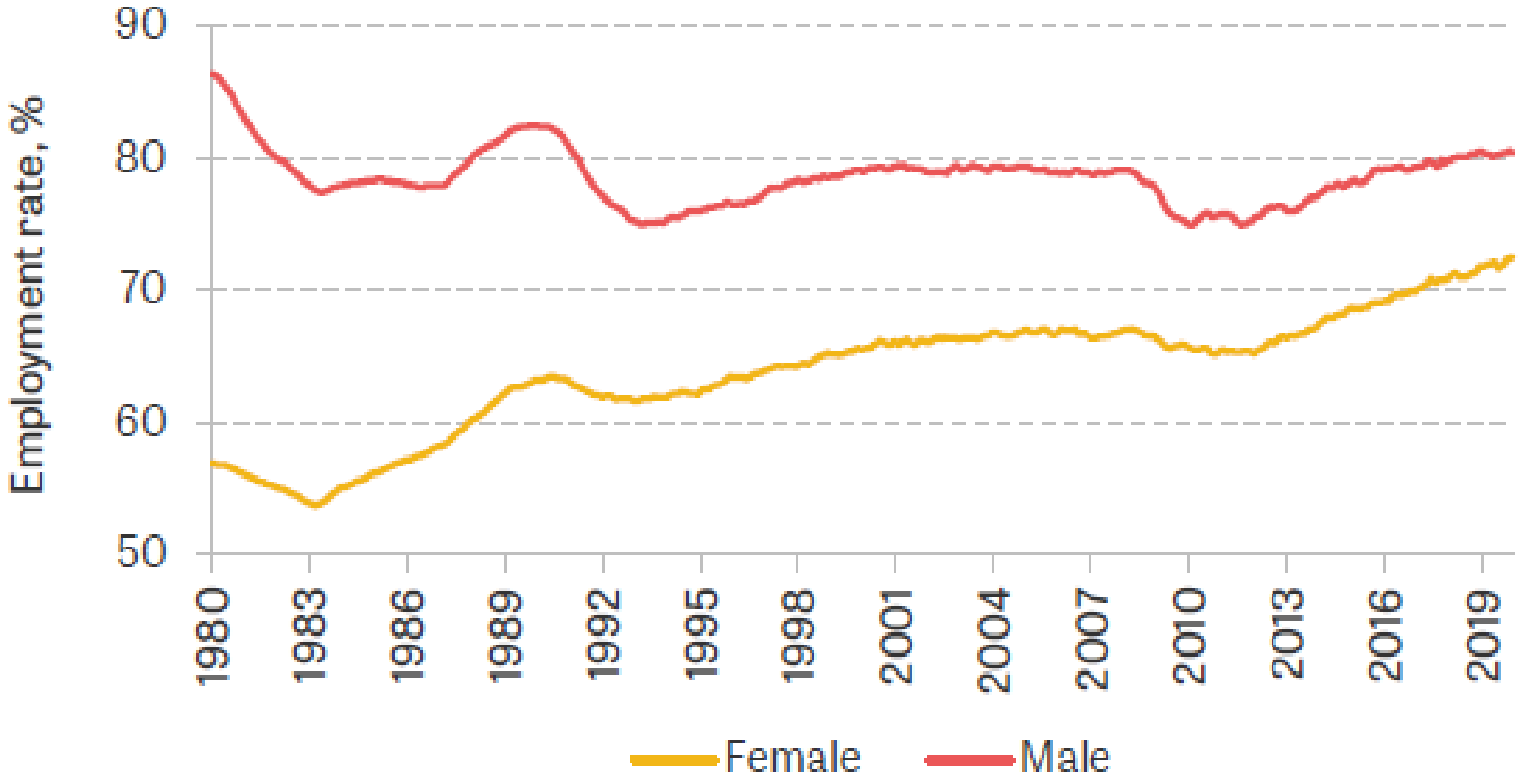


The "Hockey Stick": Two millennia of Western Growth



Note: Data are from Maddison (2008) for the "West," i.e. Western Europe plus the United States. A similar pattern holds using the "world" numbers from Maddison.

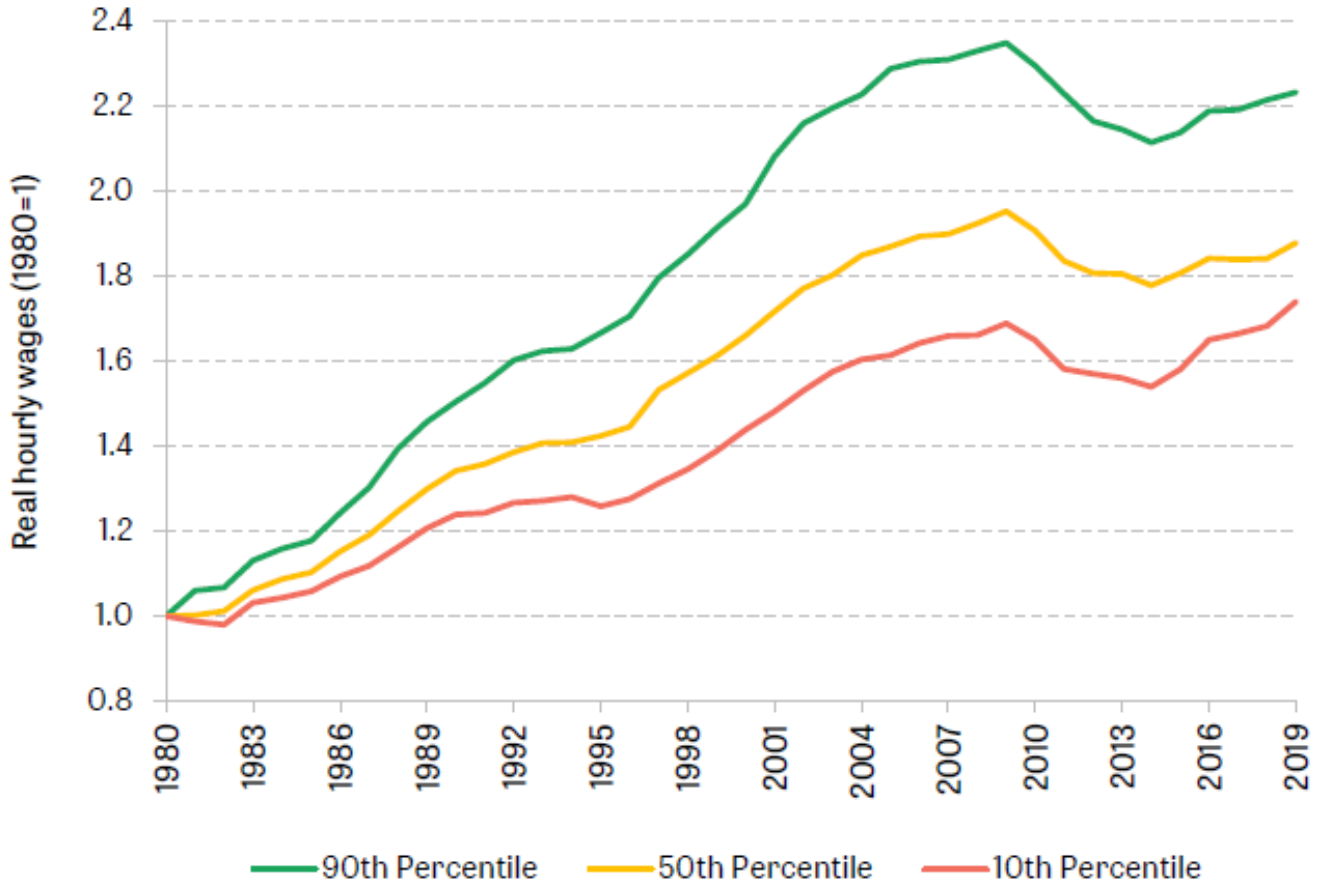
Fraction of working age population in employment in UK, 1980-2020, by gender



Source: Giupponi and Machin (2022),

https://ifs.org.uk/inequality/labour-market-inequality/

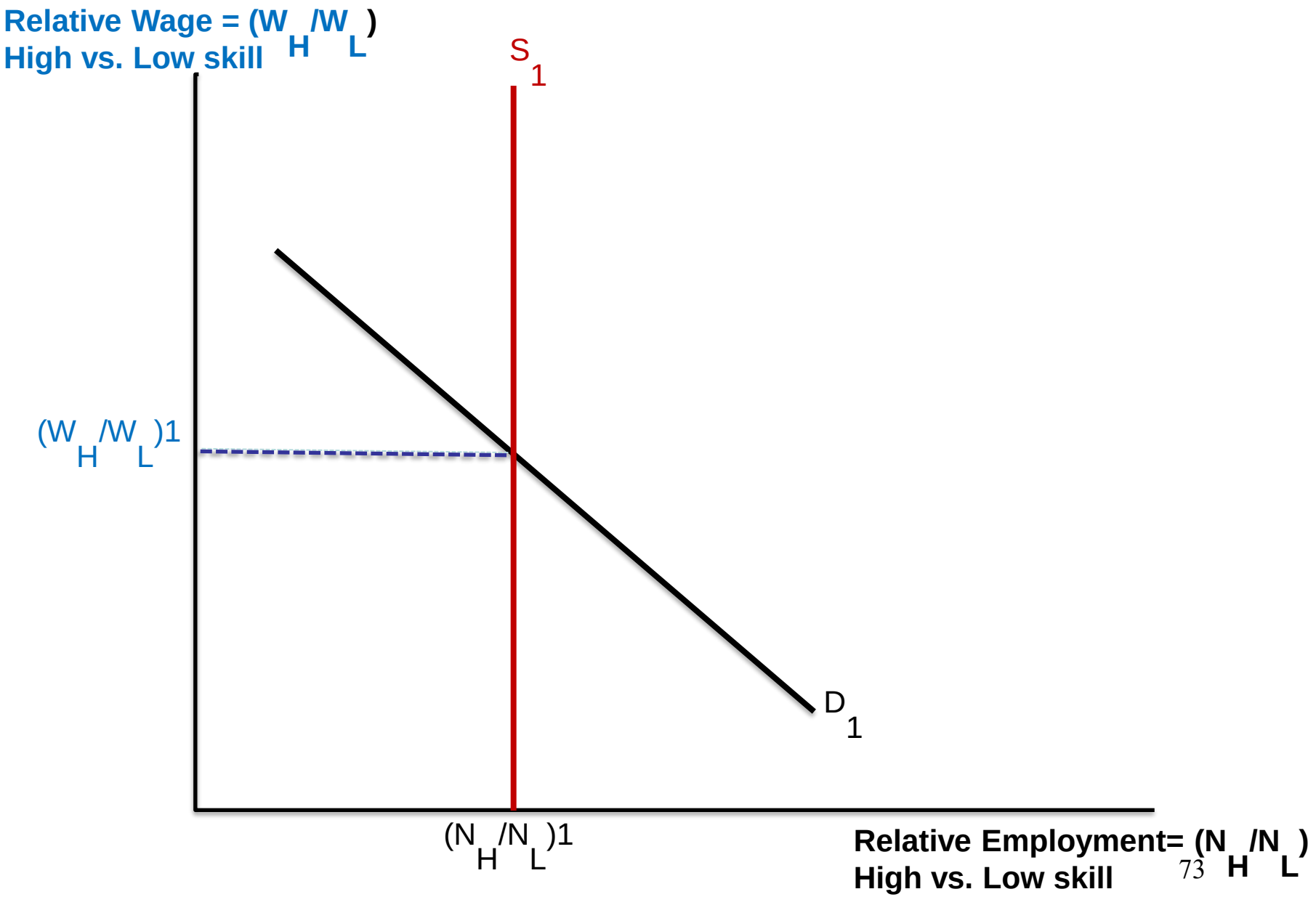
UK Wage trends; Cumulative Change in Real Hourly Wages 1980-2019, Full Time Workers



Note: Panel A shows the evolution of CPI-deflated weekly earnings at different percentiles relative to 1980 for both full-time and part-time workers. Panel B restricts the sample to full-time workers. Panel C shows the evolution of CPI-deflated hourly wages at different percentiles relative to 1980 for full-time workers. Full-time workers are defined as those who work more than 30 paid hours per week or those in teaching professions working 25 paid hours or more per week.

Source: Annual Survey of Hours & Earnings.

THE CANONICAL MODEL: SHIFT IN RELATIVE SUPPLY.....



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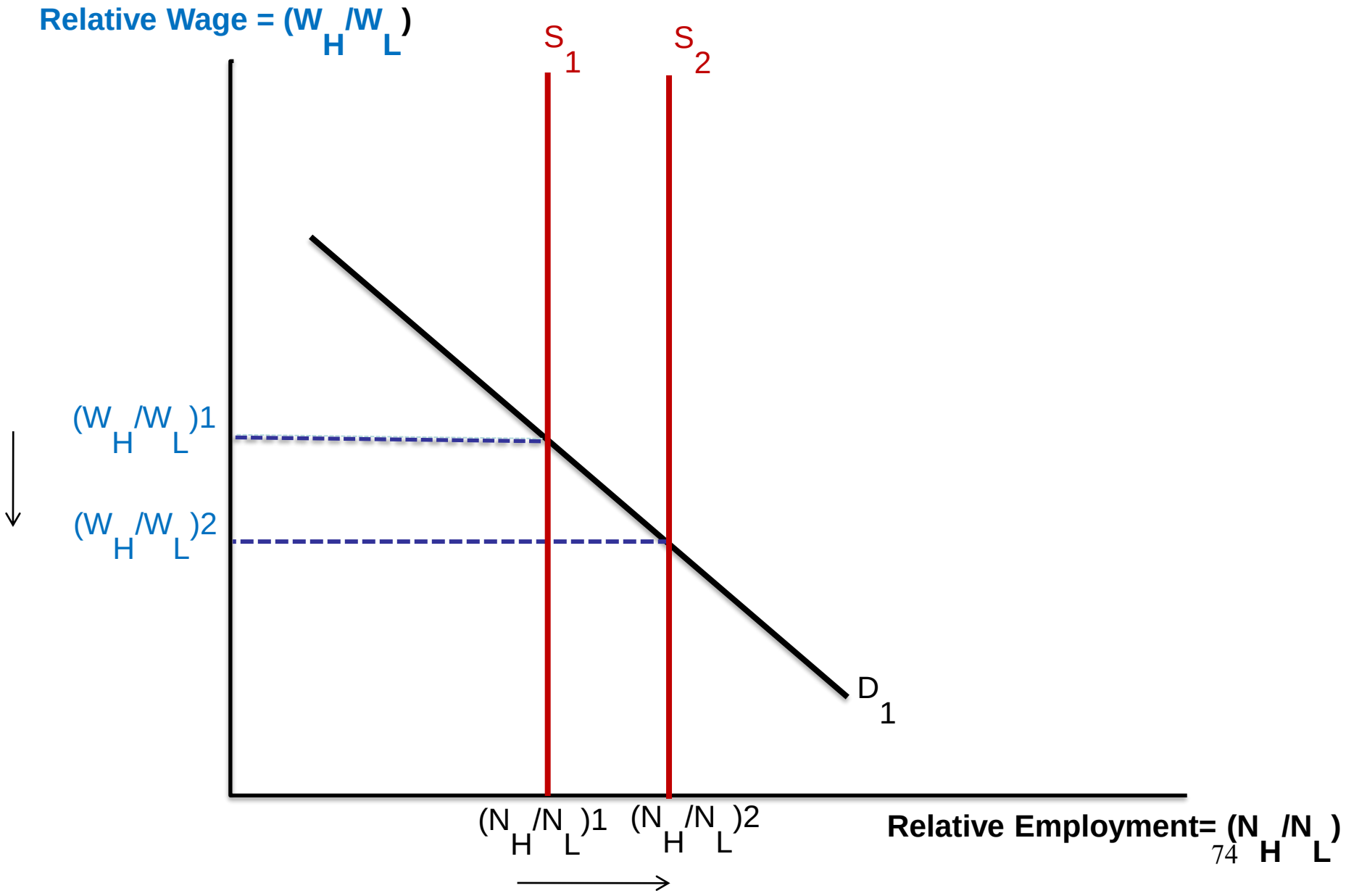
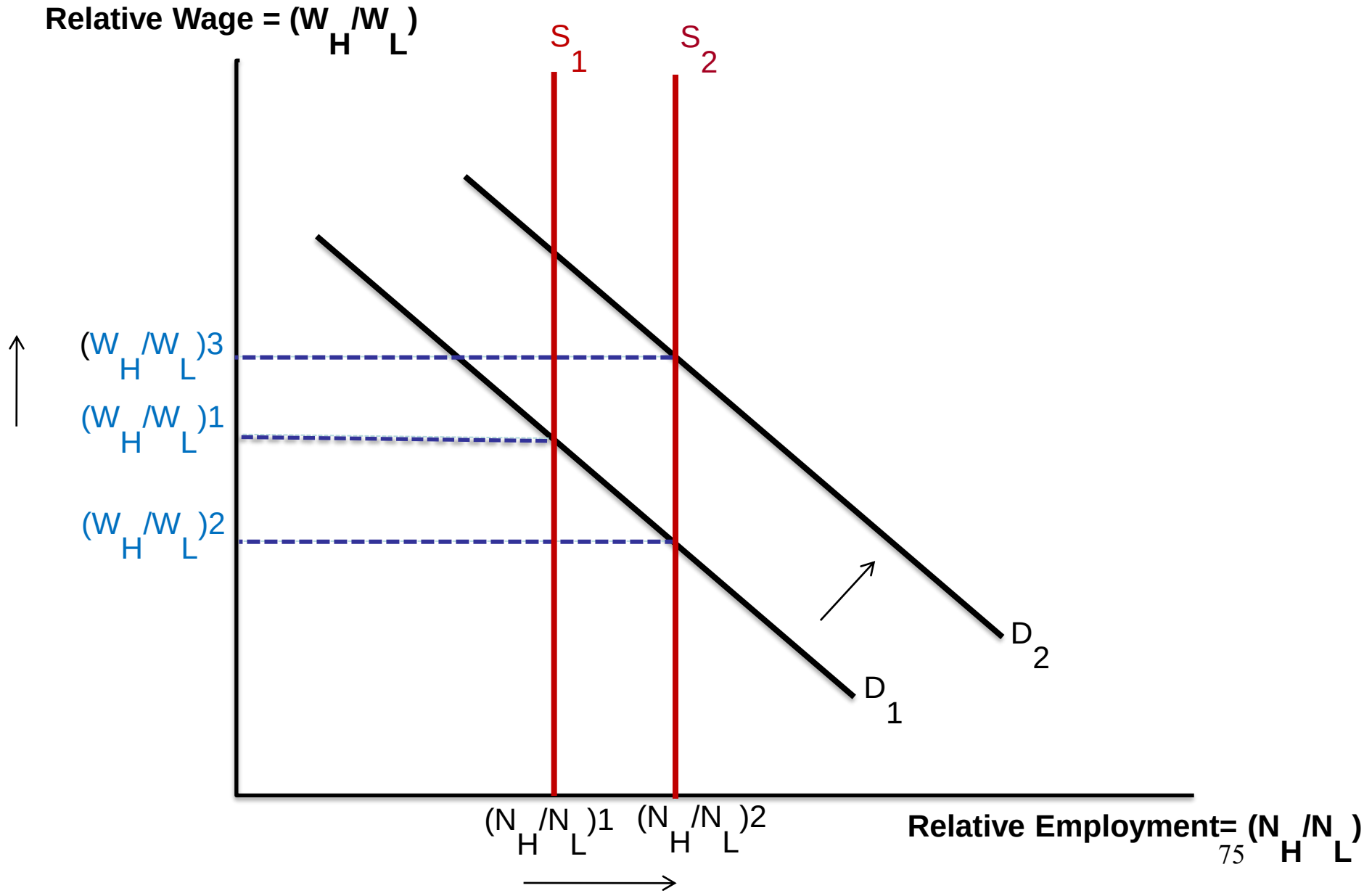
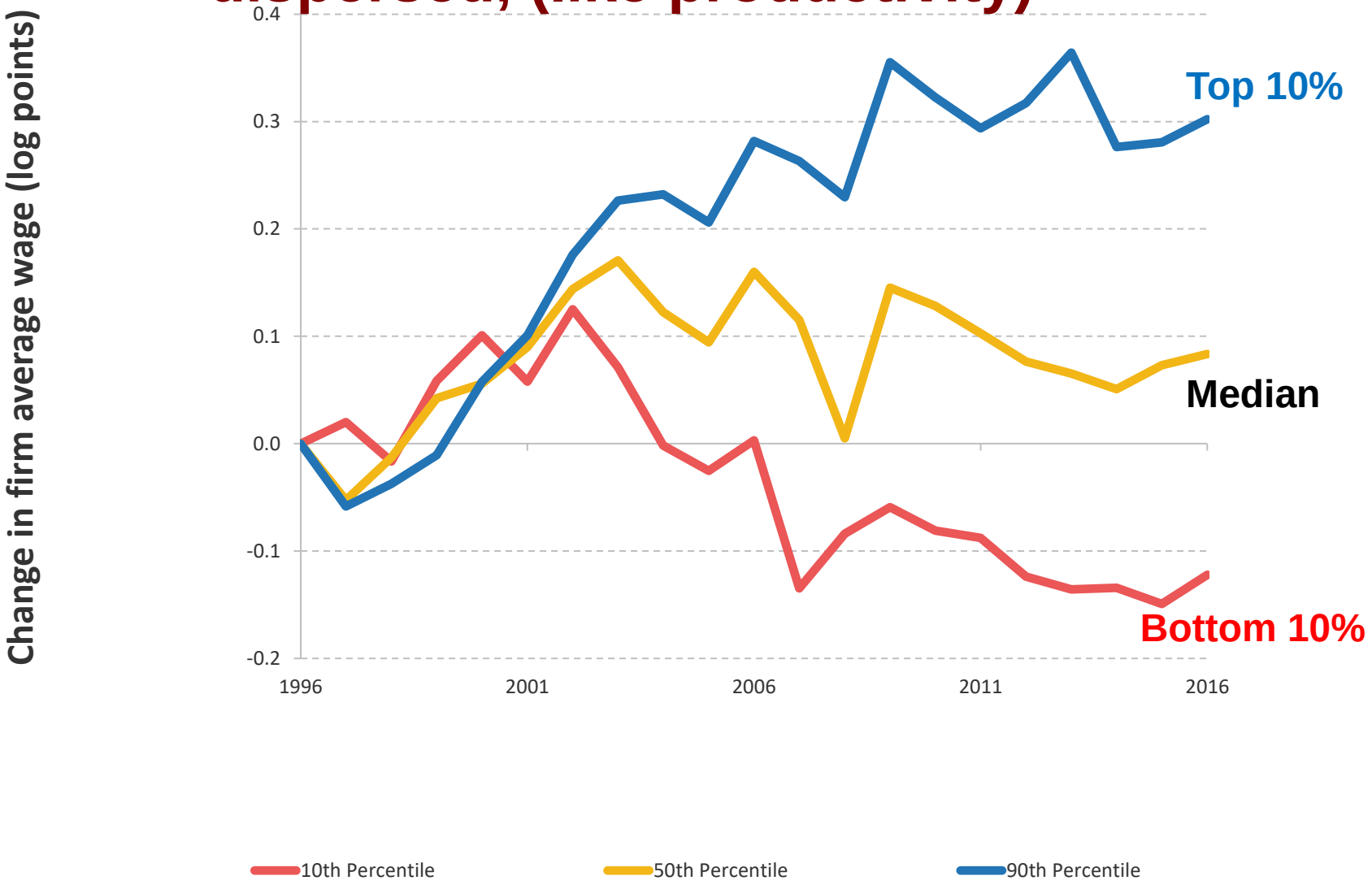


THE CANONICAL MODEL: SHIFT IN RELATIVE SUPPLY NEEDS SHIFT IN RELATIVE DEMAND TO RATIONALIZE INEQUALITY

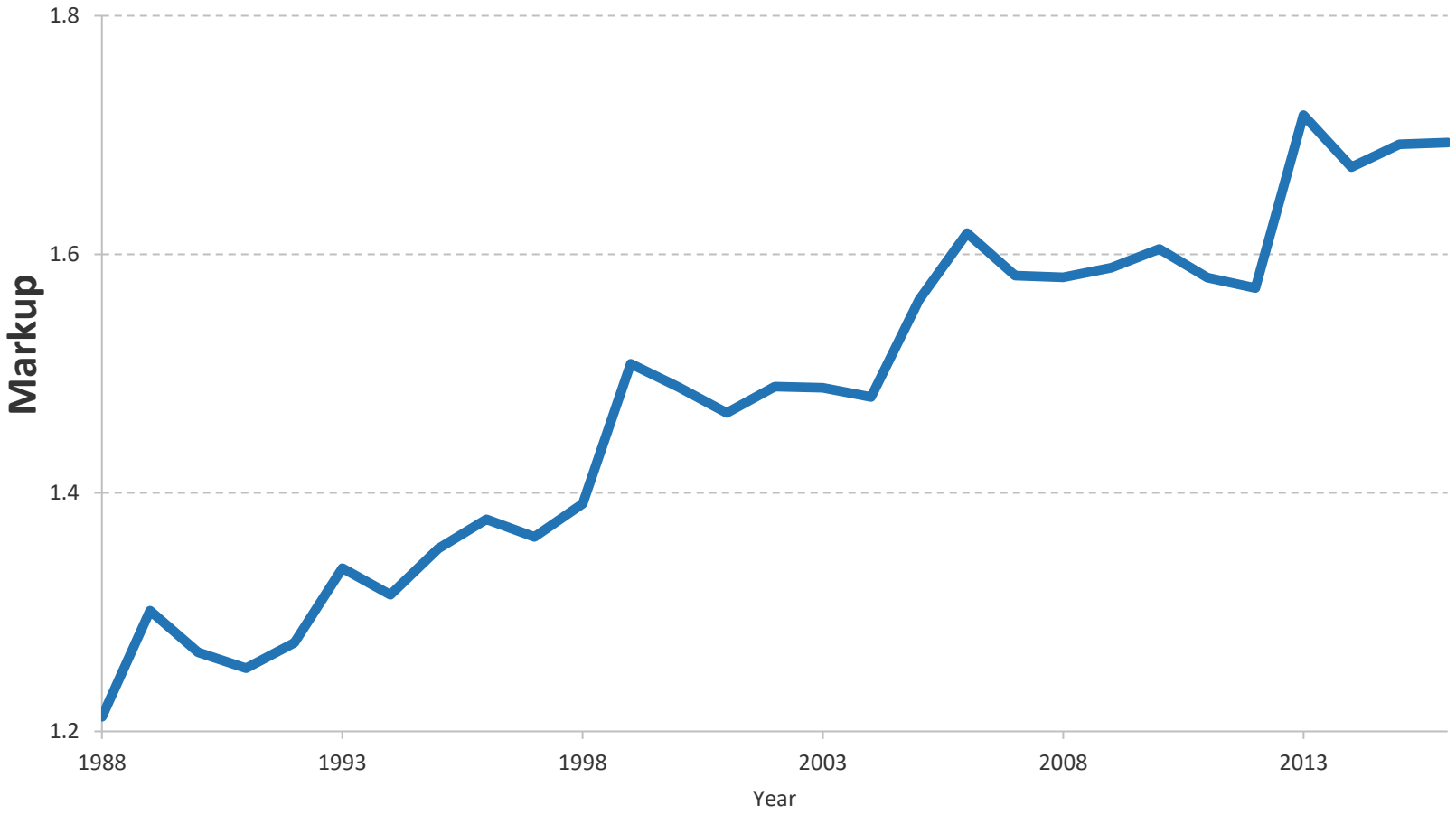


Average Wages by firm have become increasingly dispersed, (like productivity)



Notes: Historical ORBIS, ln(wage bill/employment), quantiles weighted by firm employment; values indexed to zero in 1996; Changes in log points, so 0.05 = about 5% growth; 0.4 = $(e^{0.40} - 1)*100 = 50\%$

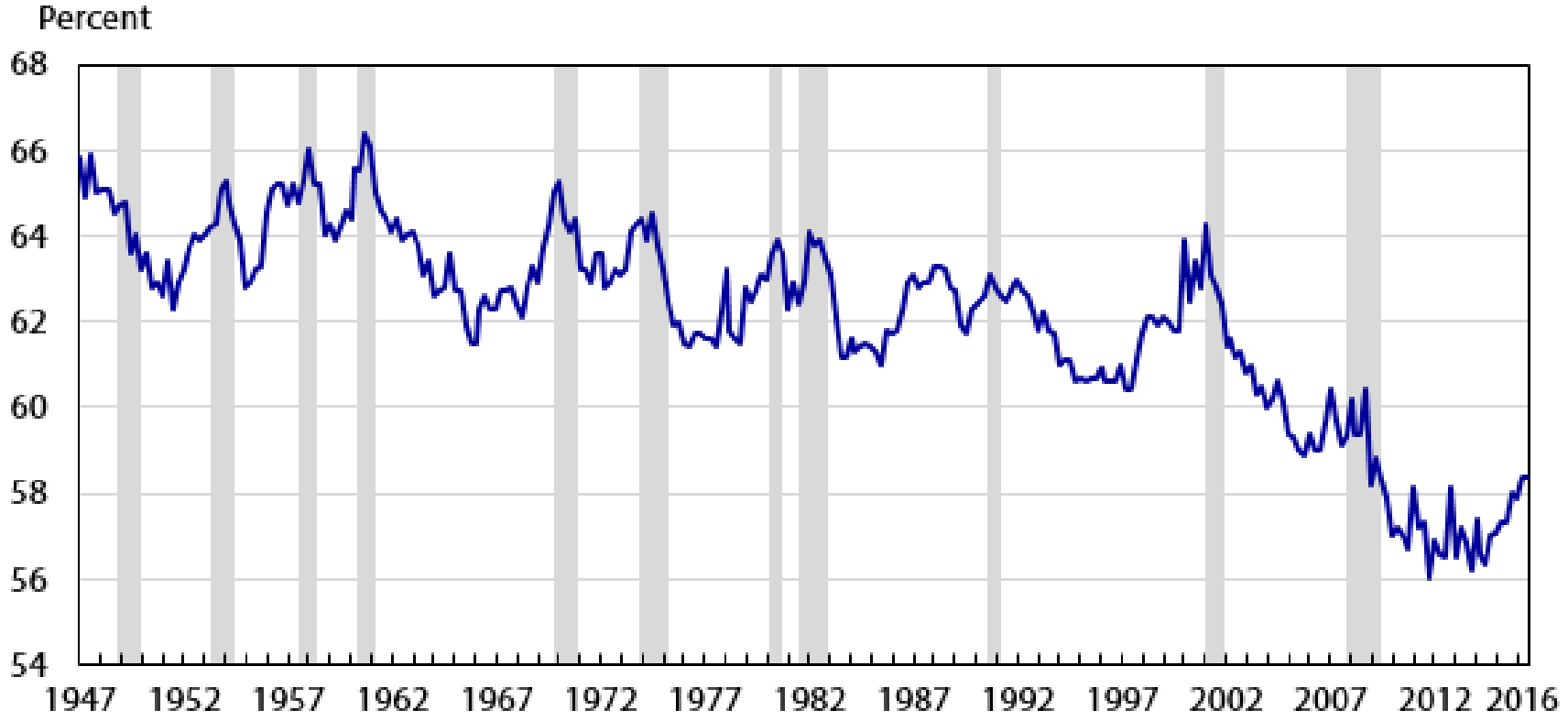
Aggregate markups (Prices/marginal cost) have also been increasing, 1988-2016



Notes: Worldscope (publicly listed firms), estimate of price/marginal costs using COGS/Sales and calibrated elasticity of output to variable costs of 0.85

US Labor Share 1947-2016

Figure 1. Labor's share of output in the nonfarm business sector, first quarter 1947 through third quarter 2016

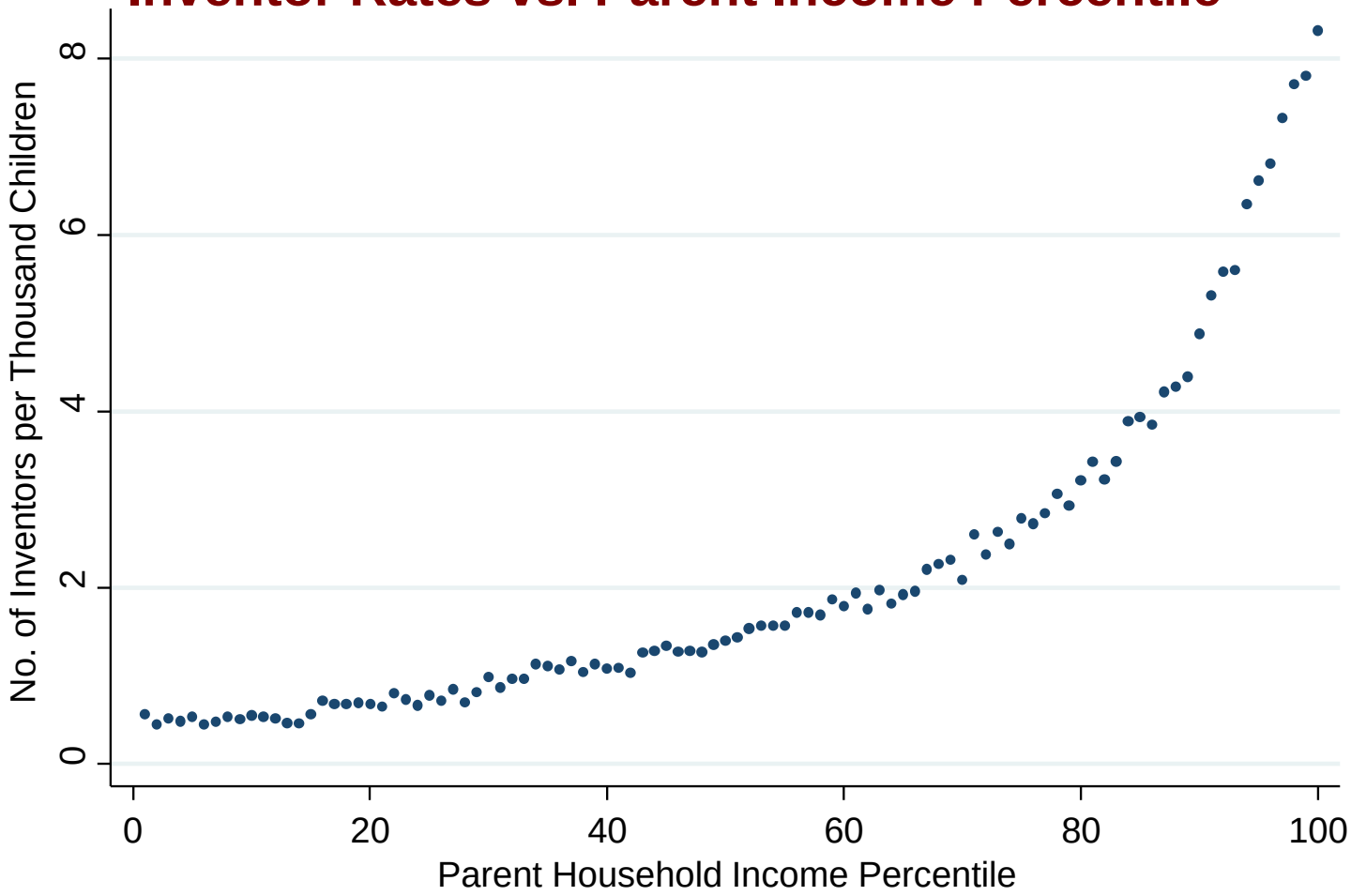


Note: Shaded areas indicate recessions, as determined by the National Bureau of Economic Research.

Source: U.S. Bureau of Labor Statistics.

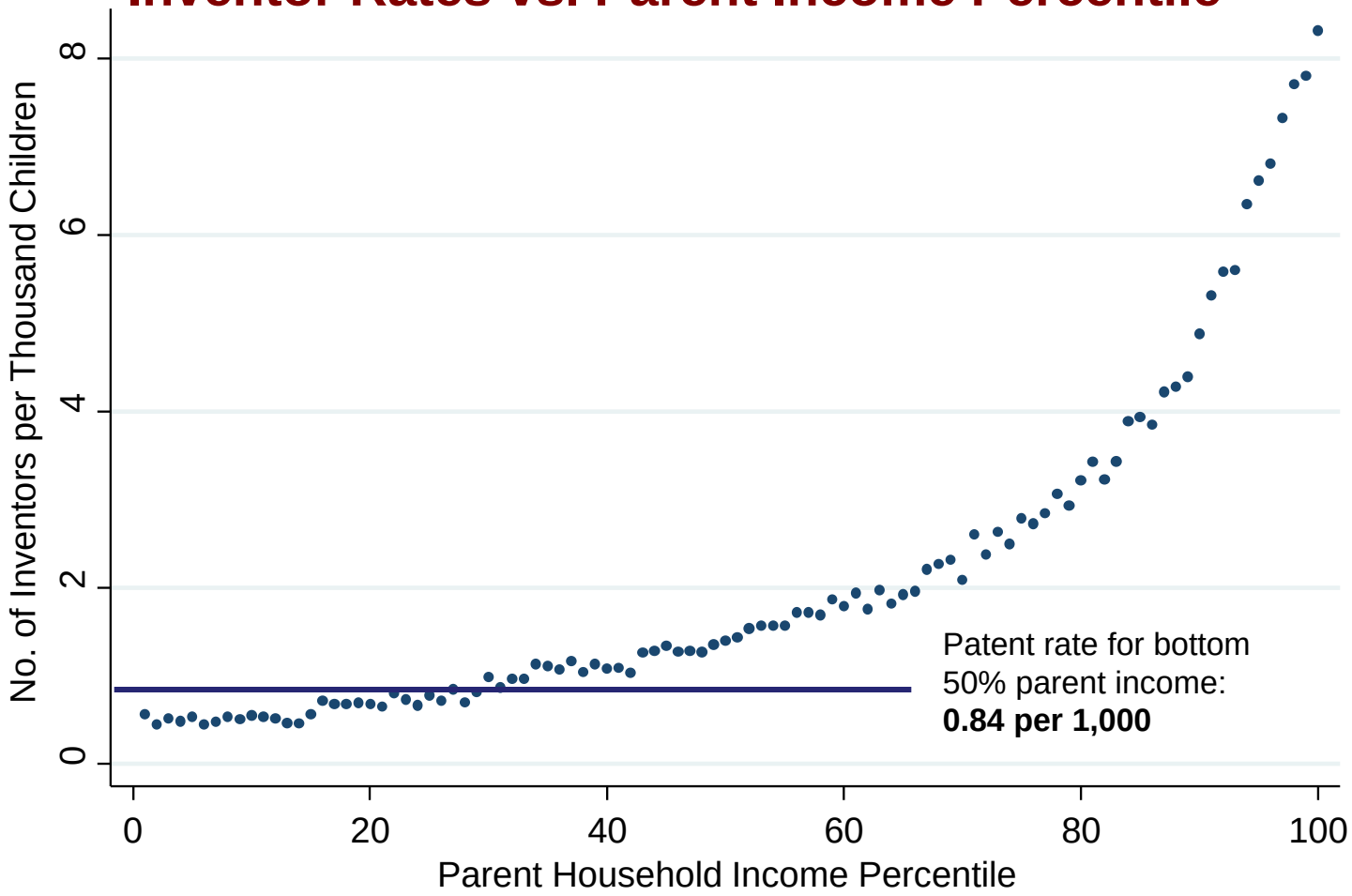
Source: BLS https://www.bls.gov/opub/mlr/2017/article/estimating-the-us-labor-share.htm

Inventor Rates vs. Parent Income Percentile



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

Inventor Rates vs. Parent Income Percentile



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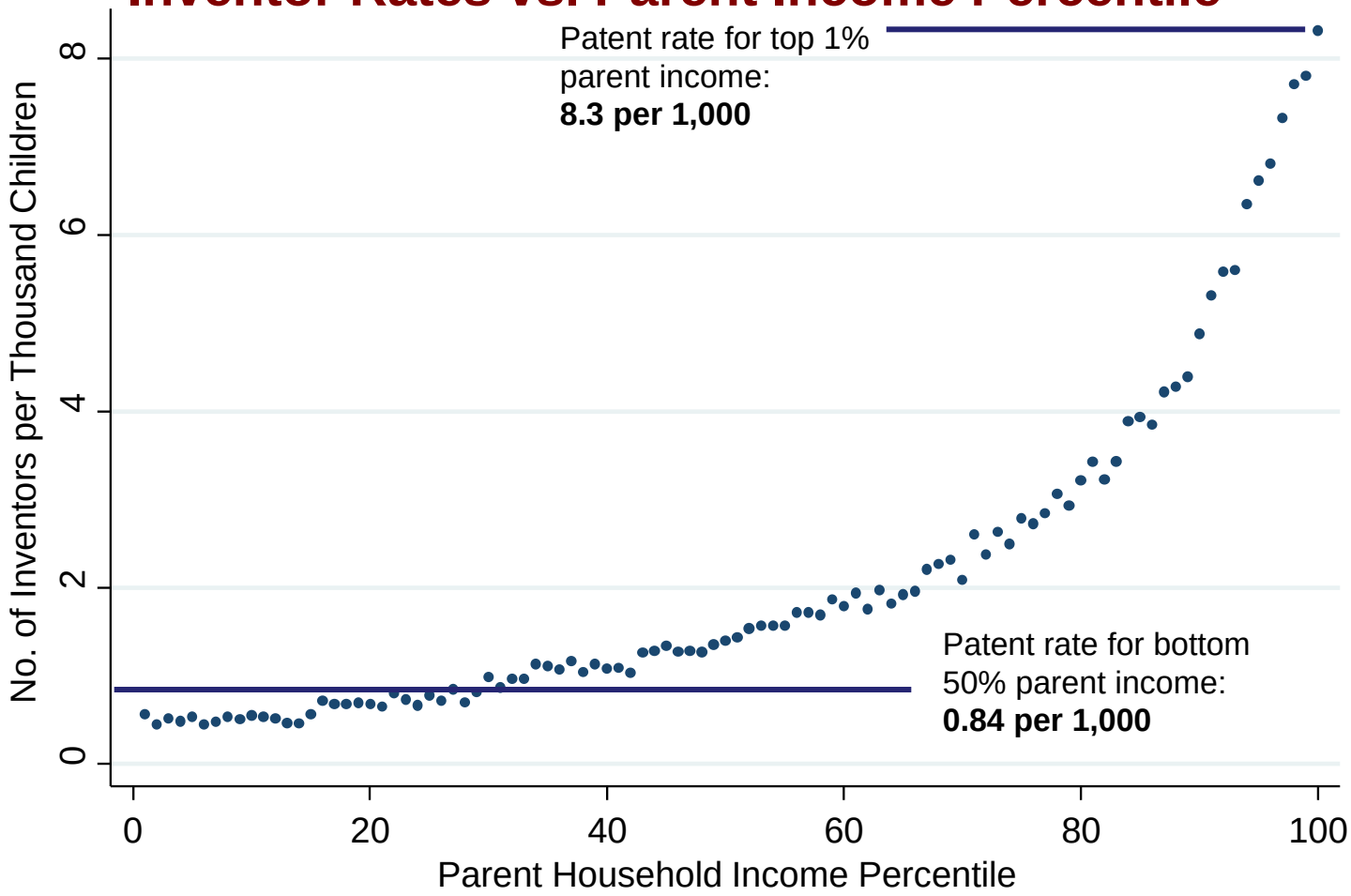
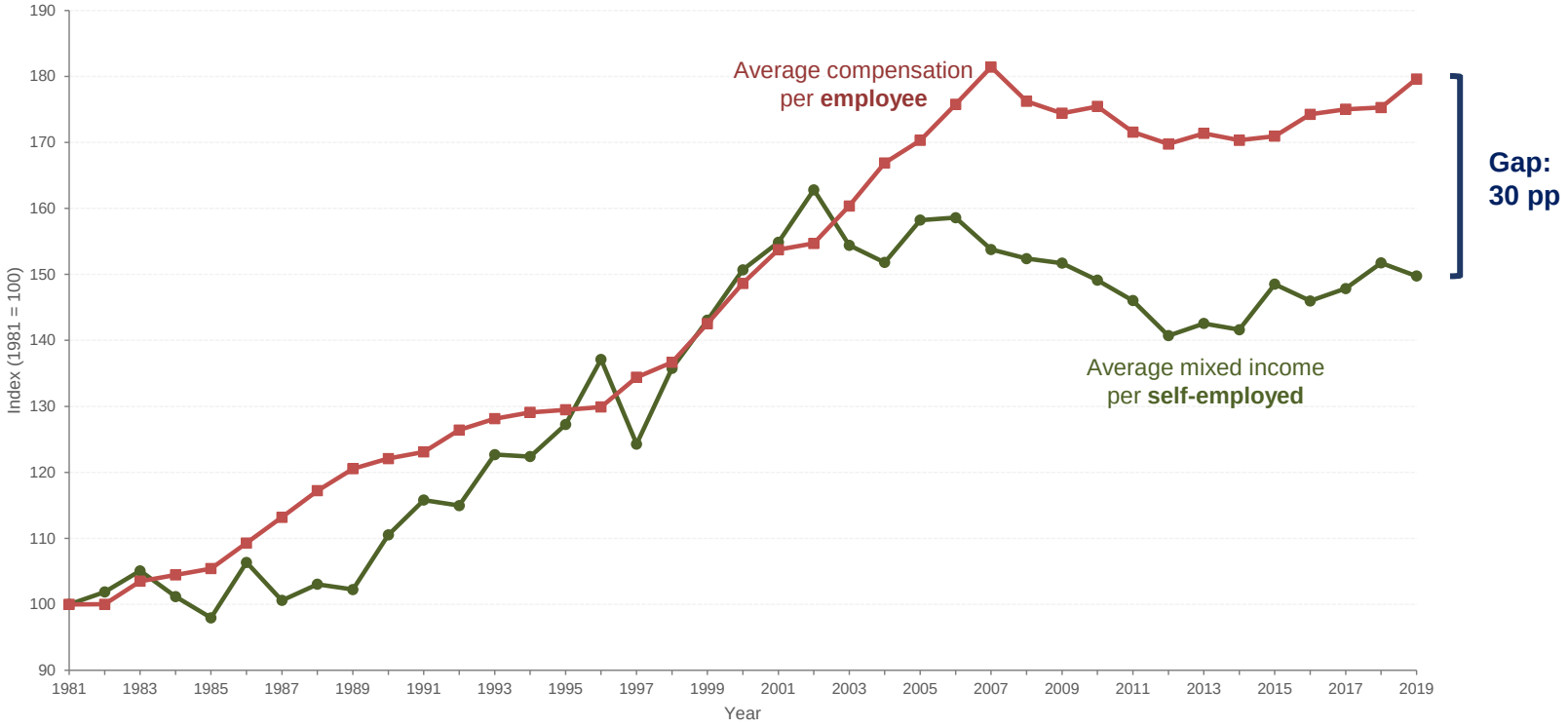


Note: Sample of children is 1980-84 birth cohorts. **Source:** Bell et al (2019)

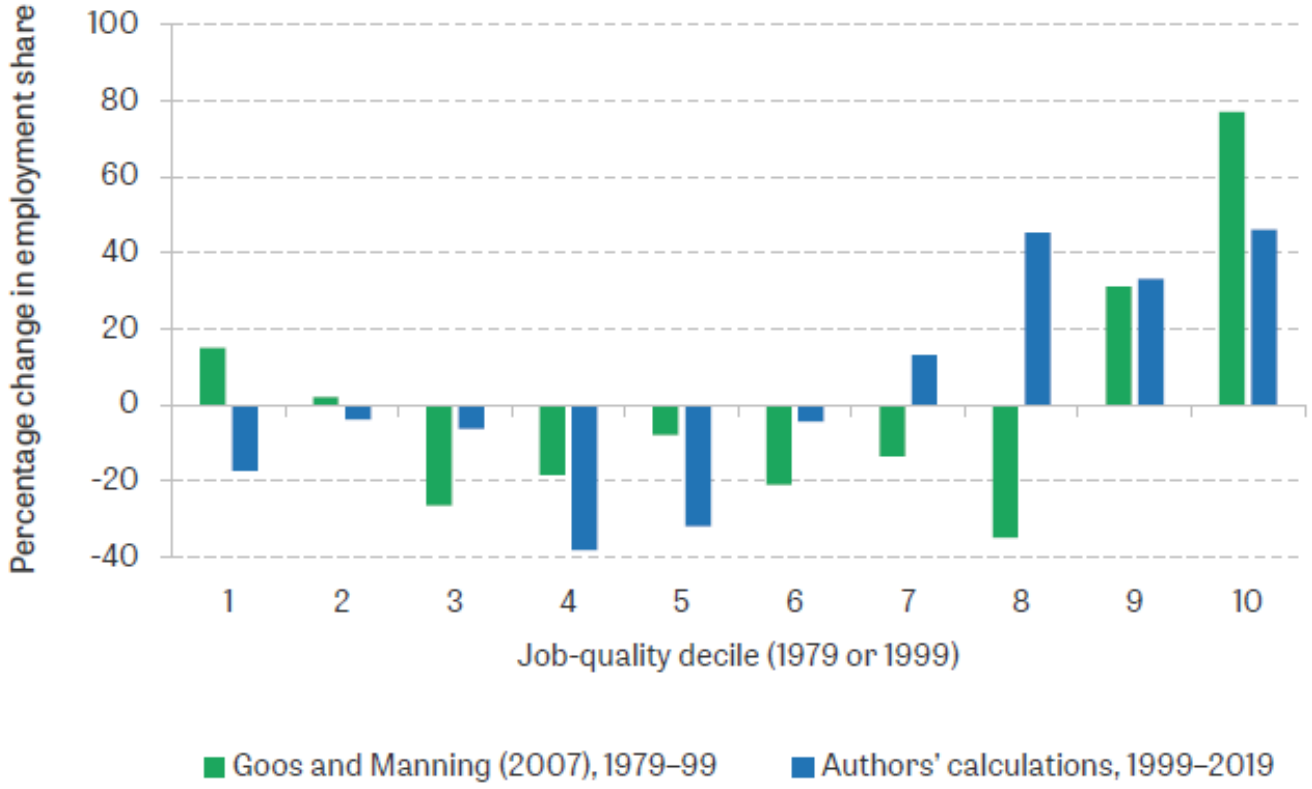
But Self-Employed income has grown much slower than that of employees



Source: ONS and OECD
Notes: Average compensation is total employee compensation divided by number of employees. Average mixed income is total mixed income divided by number of self-employed. Both series are deflated with the CPI.

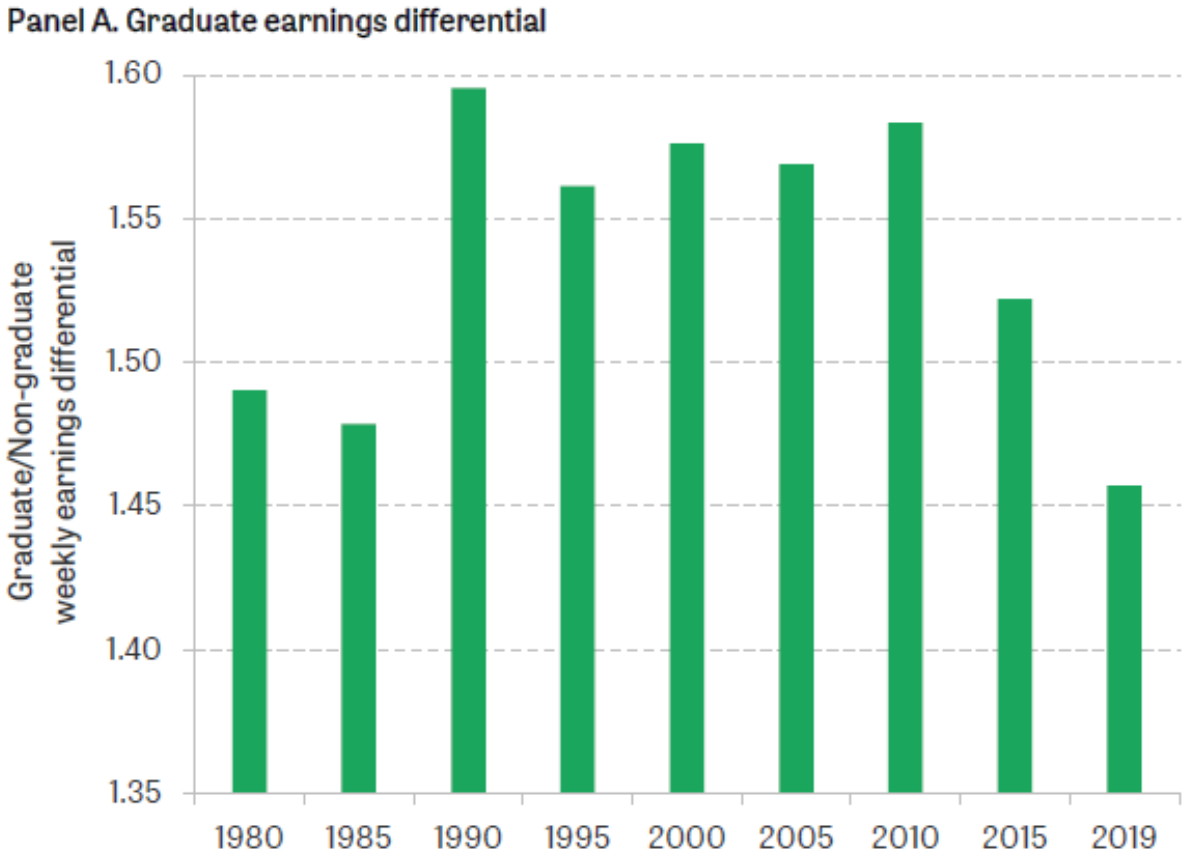
Figure 20. Polarisation

Panel A. All workers, 1979–99 and 1999–2019



Source: Giupponi and Machin (2022), https://ifs.org.uk/inequality/labour-market-inequality/

RISING GRADUATE WAGE DIFFERENTIALS IN UK: DEGREE PREMIUM



Source: Giupponi and Machin (2022), https://ifs.org.uk/inequality/labour-market-inequality/

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

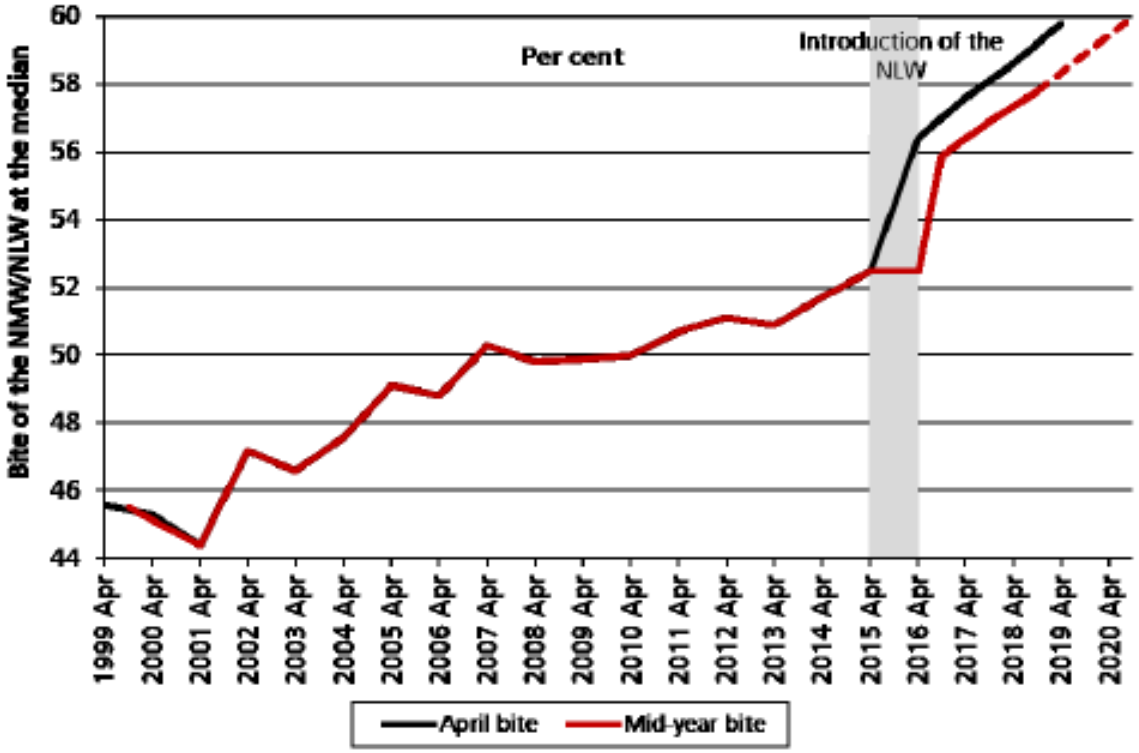
Medium sized manufacturing firms(50-5,000 workers, median≈250)

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

UK Minimum Wage

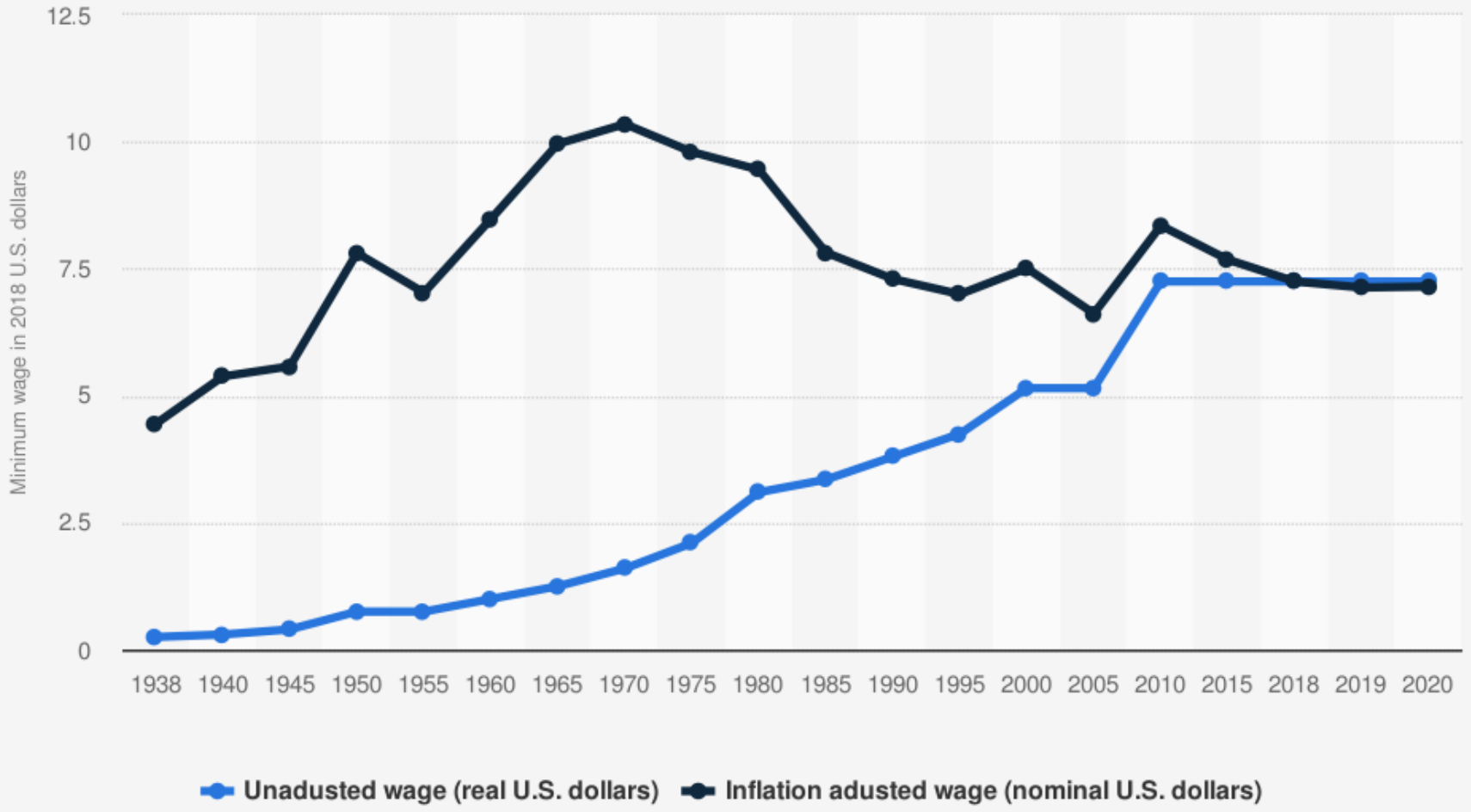
- **Fall in monopsony power** (smaller markdowns), $\psi < 0$?
  - UK introduced first National Minimum Wage in 1999. "Bite" of this has become increasingly strong over time

Chart 1.B: The 'bite' of the NMW/NLW for workers aged 25 and over (1999-2020)



Source: Dube (2019)

Real and nominal value of the federal minimum wage in the United States from 1938 to 2020 (in 2018 U.S. dollars)



Sources
CNN; Bureau of Labor Statistics; US Department of Labor

Additional Information:
United States; 1938 to 2020