Why is productivity slowing down?

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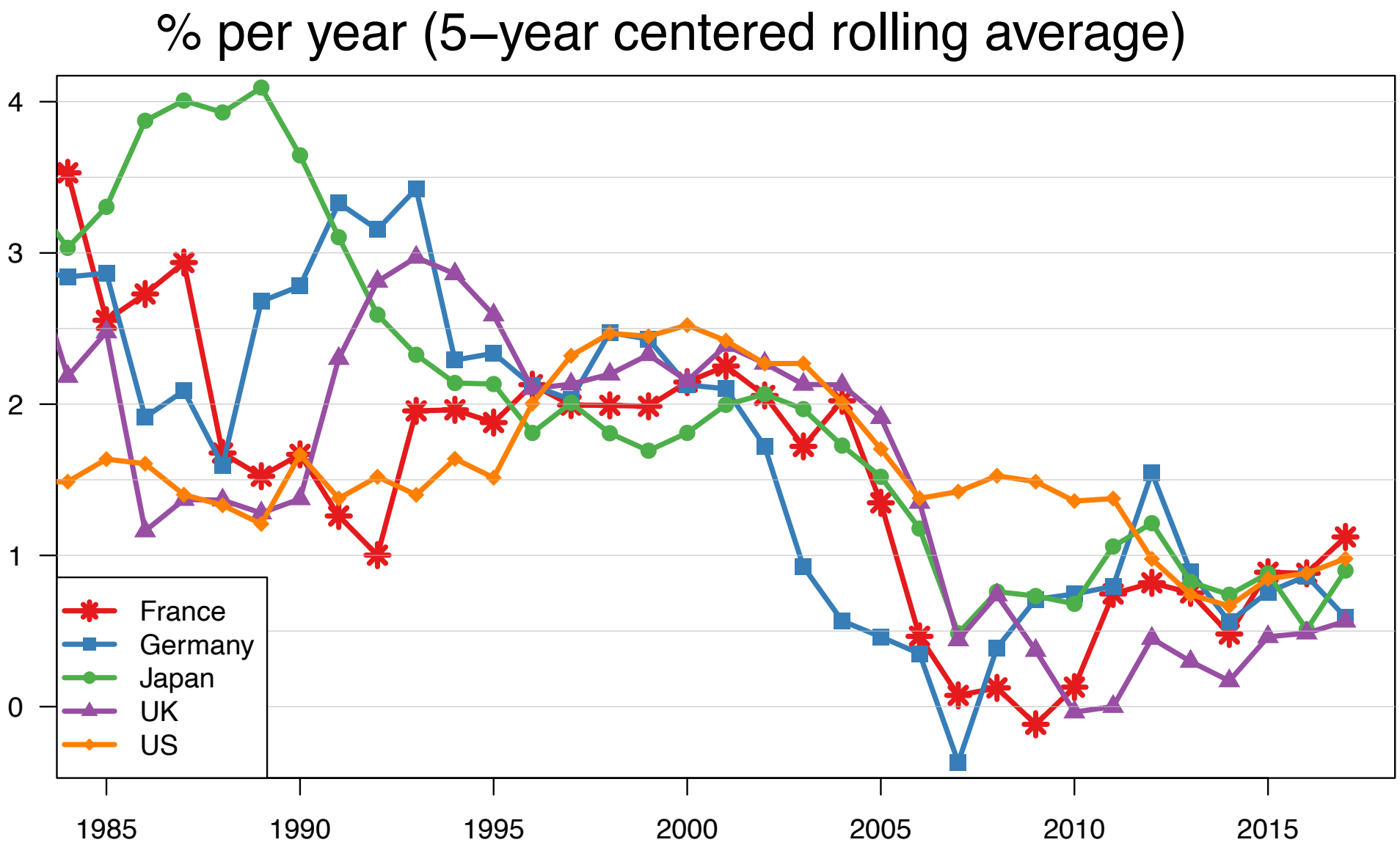
Is productivity really slowing down?

	LP growth 1996-2005	LP growth 2006-2017	Slowdown	GDP per capita 2017	"Missing" GDP per capita
France	1.65	0.66	0.99	€30,512	€3,836
Germany	1.85	0.91	0.94	€35,217	€4,203
Japan	1.68	0.85	0.82	¥4,155,243	¥356,944
United Kingdom	2.21	0.45	1.75	£27,487	£6,443
United States	2.62	1	1.61	$59,015	$12,610

Table 1: Labor Productivity (LP) slowdown and per capita GDP gap. Growth of labor productivity is per hour worked, and GDP per capita is in 2017 national currency units, using data from EU-KLEMS 2019 (Stehrer et al. 2019) and the Conference Board. The periods for Japan (1995-2015) and the US (1998-2017) are slightly different due to data coverage, see Appendix A.1 for details.

Is productivity really slowing down?



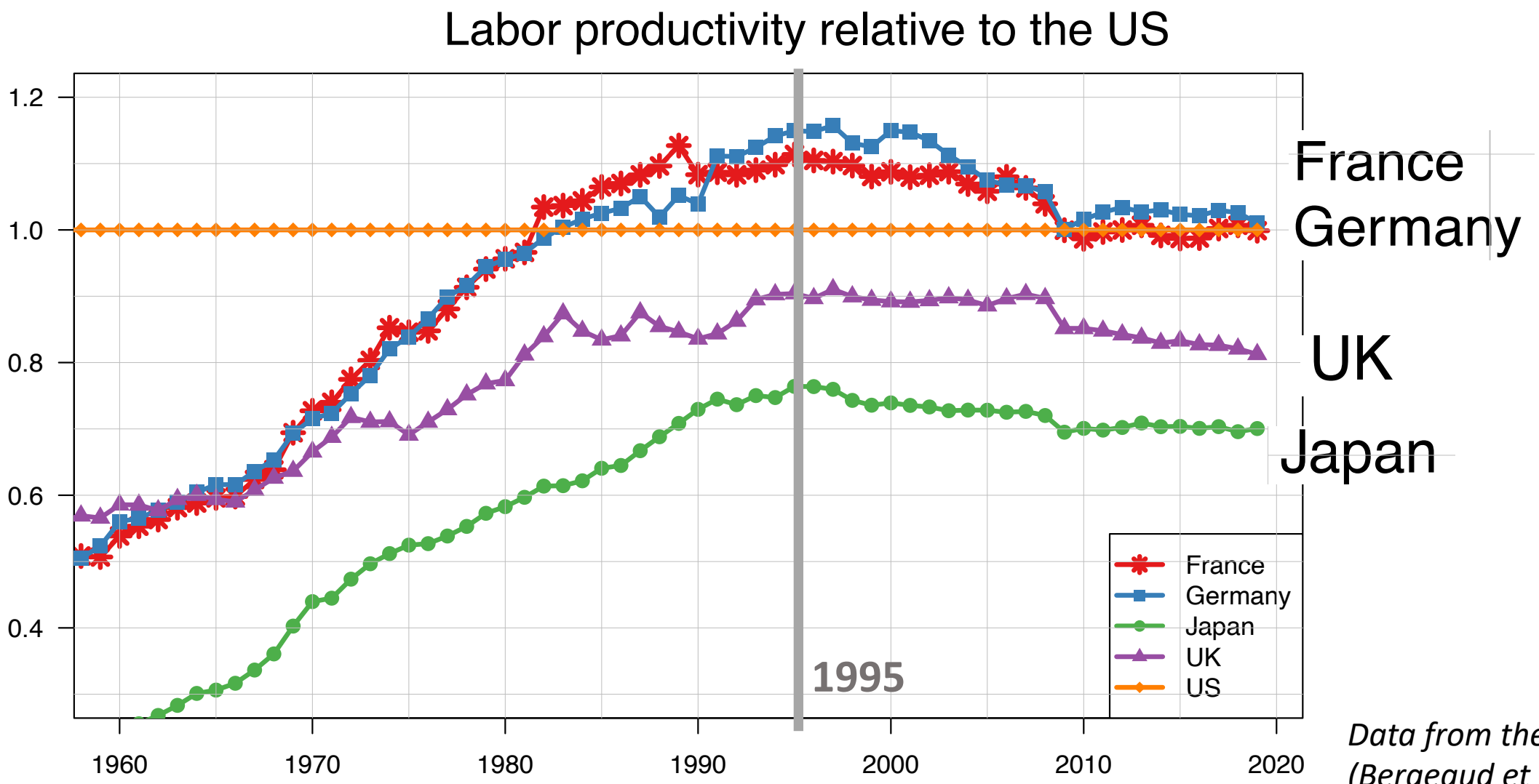
Data from the LTPD (Bergeaud et al)

Is this a new phenomenon? Yes.

	1891-1910	1911-1930	1931-1950	1951-1970	1971-1990	1991-2005	2006-2018
France	1.21	3.39	0.78	5.36	3.33	1.89	0.68
Germany	1.75	0.73	0.02	5.82	3.21	2.27	0.70
Japan	2.16	2.69	1.07	7.32	3.87	2.03	0.71
UK	0.74	1.46	1.16	3.46	2.48	2.43	0.47
US	1.43	2.78	3.22	2.48	1.34	2.05	1.06

Table 13: Average growth rates of labor productivity ($US 2010 PPP per hour worked), for several long periods. Data from the Long-Term Productivity Database (Bergeaud et al. 2016).

For non-US countries, is this just due to the end of convergence? No.



Data from the LTPD (Bergeaud et al)

Growth accounting

y = Y/L : Real output per hour

A : TFP

k = K/L : Capital (services) per hour

h : Index of composition of the labor force

		$\Delta \log y_t$	$\Delta \log A_t$	$(1-\alpha_t)\Delta \log k_t$	$\alpha_t \Delta \log h_t$
France	1996-2005	1.65	1.18	0.16	0.30
	2006-2017	0.66	0.17	0.09	0.40
	Slowdown	0.99	1.01	0.07	-0.09
	Share	1.00	1.02	0.07	-0.10
Germany	1996-2005	1.85	1.10	0.61	0.15
	2006-2017	0.91	0.87	0.07	-0.03
	Slowdown	0.94	0.23	0.54	0.17
	Share	1.00	0.24	0.57	0.18
Japan	1995-2005	1.68	0.29	1.07	0.33
	2006-2015	0.85	0.31	0.26	0.28
	Slowdown	0.82	-0.02	0.80	0.04
	Share	1.00	-0.03	0.98	0.05
United Kingdom	1996-2005	2.21	1.14	0.70	0.37
	2006-2017	0.45	0.30	0.18	-0.02
	Slowdown	1.75	0.84	0.53	0.39
	Share	1.00	0.48	0.30	0.22
United States	1998-2005	2.62	1.37	1.09	0.16
	2006-2017	1.00	0.46	0.38	0.17
	Slowdown	1.61	0.91	0.71	-0.01
	Share	1.00	0.57	0.44	-0.00

Growth accounting

United Kingdom	Total	Manufacturing	Wholesale, Retail and Repair	Financial and Insurance Activities	Information and Communication	Other	Reallocation
1996-2005	2.24	0.51	0.16	0.37	0.32	0.64	0.25
2006-2016	0.42	0.12	0.20	0.01	0.07	-0.28	0.29
Slowdown	1.82	0.38	-0.04	0.35	0.25	0.92	-0.05
Share	1.00	0.21	-0.02	0.19	0.14	0.51	-0.02
United States							
1998-2005	2.54	0.96	0.55	0.29	0.50	0.40	-0.16
2006-2017	0.92	0.20	0.11	0.04	0.45	0.31	-0.19
Slowdown	1.61	0.76	0.43	0.26	0.05	0.09	0.02
Share	1.00	0.47	0.27	0.16	0.03	0.06	0.01

Table 3: Industry decomposition for the slowdown in labor productivity growth pre- and post-2005. Data from the EU-KLEMS 2019.

What makes a good explanation?

- *Sequencing*: Candidate cause takes place ***before*** the slowdown
- *Scope*: Candidate cause takes in ***all places*** where there is a slowdown
- *Scale*: Cause should have a plausibly ***large effect***

$$\Delta \log y_t = \underbrace{-\mathcal{B}}_{\substack{\text{Mismeasurement} \\ \text{(Section 3)}}} + \underbrace{(1-\alpha_t)\Delta \log k_t}_{\substack{\text{Capital Deepening} \\ \text{(Section 4)}}} + \underbrace{\alpha_t \Delta \log h_t}_{\substack{\text{Human Capital} \\ \text{(Section 5)}}} + \underbrace{\Delta \log A_t^{\text{Alloc}}}_{\substack{\text{Trade and Allocative Efficiency} \\ \text{(Sections 6 \& 7)}}} + \underbrace{\Delta \log A_t^{\text{Tech}}}_{\substack{\text{Technology} \\ \text{(Section 8)}}}$$

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Mismeasurement

$$\Delta \log y = \underbrace{\Delta \log \bar{Y}}_{\text{Boundary issues}} - \underbrace{\Delta \log P}_{\text{Issues with deflators}} - \underbrace{\Delta \log L}_{\text{Mismeasured labor inputs}}$$

	Around 2000	Around 2010	Slowdown
	Deflators		
Consumption	22	42	20
Investment	23	16	-7
Imputation for new products	63	70	7
Offshoring bias	-5.0	-2.5	2.5
Total Deflators	103	125	22
	Boundaries		
Profit shifting	5	0	-5
Intangibles	-9	-5	4
Total Boundaries	-4	-5	-1
Total	99	120	21

Groshen et al. (2017)
Lebow & Rudd (2003)
Byrne & Corrado (2020),
Aghion et al. (2019)
Reinsdorf & Yuskavage (2018)

Guvenen et al. (2021)
Stehrer et al. (2019)

Free goods and services? Informal economy? Environment?

$$\Delta \log y_t = \underbrace{-\mathcal{B}}_{\substack{\text{Mismeasurement} \\ \text{(Section 3)}}} + \underbrace{(1-\alpha_t)\Delta \log k_t}_{\substack{\text{Capital Deepening} \\ \text{(Section 4)}}} + \underbrace{\alpha_t \Delta \log h_t}_{\substack{\text{Human Capital} \\ \text{(Section 5)}}} + \underbrace{\Delta \log A_t^{\text{Alloc}}}_{\substack{\text{Trade and Allocative Efficiency} \\ \text{(Sections 6 \& 7)}}} + \underbrace{\Delta \log A_t^{\text{Tech}}}_{\substack{\text{Technology} \\ \text{(Section 8)}}}$$

Capital Deepening

Physical ICT
Computing equipment
Communications equipment

Included Intangible
Research and Development
Computer software and databases
ther Intellectual Property Products

		$(1-\alpha_t)\Delta \log k_t$	Non-ICT	ICT	Intangible
France	1996-2005	0.16	0.08	0.03	0.06
	2006-2017	0.09	0.00	0.02	0.07
	Slowdown	0.07	0.08	0.01	-0.02
	Share	1.00	1.14	0.13	-0.27
Germany	1996-2005	0.61	0.49	0.03	0.08
	2006-2017	0.07	0.02	-0.01	0.07
	Slowdown	0.54	0.48	0.05	0.02
	Share	1.00	0.88	0.08	0.04
Japan	1995-2005	1.07	0.44	0.34	0.29
	2006-2015	0.26	0.06	0.07	0.13
	Slowdown	0.80	0.38	0.27	0.16
	Share	1.00	0.47	0.33	0.20
United Kingdom	1996-2005	0.70	0.55	0.12	0.03
	2006-2017	0.18	0.17	0.03	-0.02
	Slowdown	0.53	0.38	0.09	0.05
	Share	1.00	0.73	0.18	0.10
United States	1998-2005	1.09	0.63	0.24	0.21
	2006-2017	0.38	0.18	0.07	0.12
	Slowdown	0.71	0.45	0.17	0.09
	Share	1.00	0.64	0.23	0.13

Structural or cycle effects?

Structural effects

- **Intangible capital** (more next slide)
- **Competition**: market power restricts output and investment
- **Corporate governance**: Common ownership; short-termism
- **Globalization**: investment shifts abroad

Business cycles and the financial crisis

- **Financial frictions**
- Depressed aggregate **demand** (through accelerator effect)
- Lower **government investment**

*We will **assume** that structural and business cycle effects contribute 50-50 each*

Spillovers from intangibles

Scale: Yes

Sequencing: Yes

	France	Germany	Japan	UK	US
1996-2005	2.53	2.62	3.30	1.83	4.27
2006-2017	2.88	2.31	0.90	1.85	2.89
Slowdown	-0.36	0.31	2.40	-0.03	1.38
Slowdown ×0.2	-0.07	0.06	0.48	-0.01	0.28

Data from EUKLEMS

Scope: No

$$\Delta \log y_t = \underbrace{-\mathcal{B}}_{\substack{\text{Mismeasurement} \\ \text{(Section 3)}}} + \underbrace{(1-\alpha_t)\Delta \log k}_{\substack{\text{Capital Deepenin} \\ \text{(Section 4)}}} + \underbrace{\alpha_t \Delta \log h_t}_{\substack{\text{Human Capital} \\ \text{(Section 5)}}} + \underbrace{\Delta \log A_t^{\text{Alloc}}}_{\substack{\text{Trade and Allocative Efficiency} \\ \text{(Sections 6 \& 7)}}} + \underbrace{\Delta \log A_t^{\text{Tech}}}_{\substack{\text{Technology} \\ \text{(Section 8)}}}$$

Human Capital

- **Education and skills**: no strong evidence of a slowdown
- **Aging**: no clear evidence of *direct* effect on productivity ; sequencing?
- **Migration**: difficult to quantify, heterogenous effects; scope?
- **Leisure technology**: difficult to quantify; but good sequencing.
- **Labor market institutions**:
  - No-poaching and non-compete agreements
  - Low wages make investment less attractive
  - Gig economy
  - Slower rate of reduction in discrimination

Conclusion: **Mix of secular trends and recent changes have probably affected TFP, but we are unable to quantify this further**

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Global trade:
Lower gains in world allocative efficiency?

Why would trade be good for productivity?

- Specialization (level effect)
- Firm-level selection (level effect)
- Innovation (growth effect)

Has Trade integration slowed down and why?

- Business cycle effect: Slowdown in global trade post financial crisis
- Structural effects: Large trade gains from GVC organization already reaped?

Global Trade

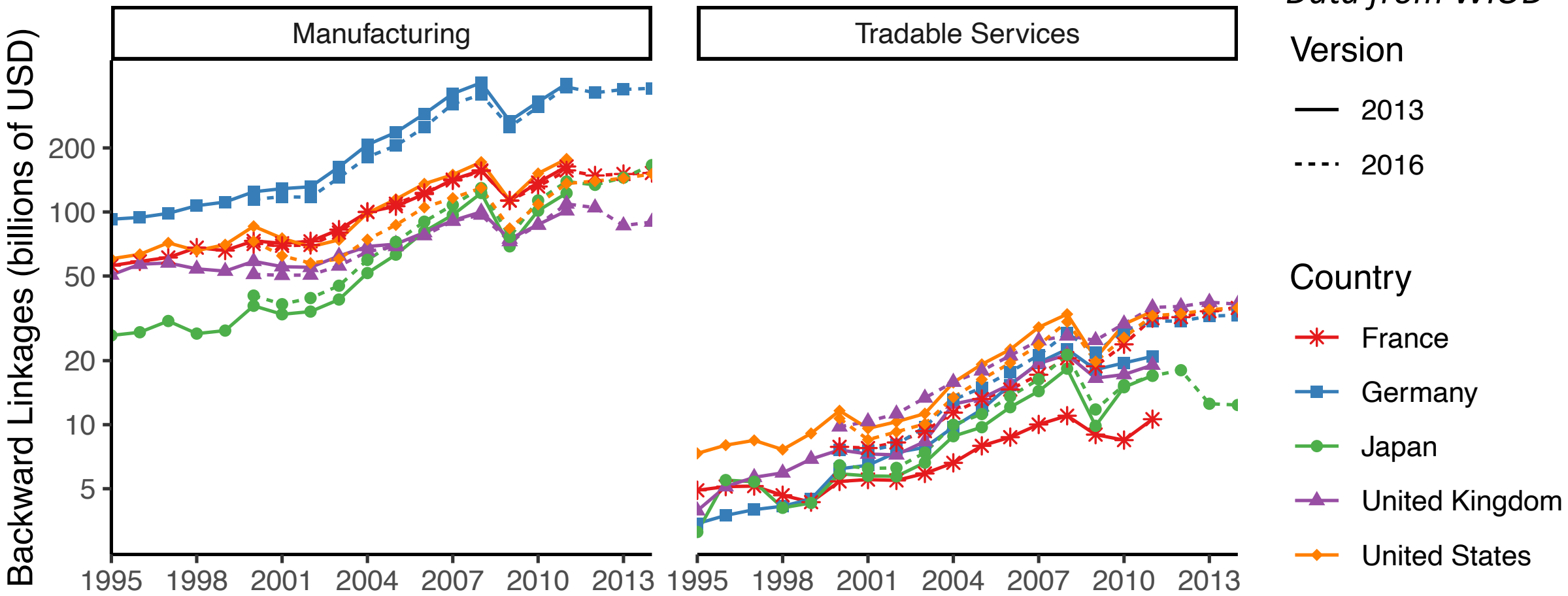
VA embodied in exports

VA/GO Exports

$$Z = V(I - A)^{-1}E,$$

Leontief inverse

Foreign VA embodied in exports
~ vertical specialization



Global Trade

$$\Delta \log y^{E}_{i,j,t} = \beta^{\mathrm{GVC}} \Delta \log B_{i,j,t}.$$

Constantinescu et al (2017):
Foreign VA embodied in exports is correlated to output/worker at the industry-level

	Indus.	Backward linkages		Elasticity	Productivity effect		Slowdown
		1996-05	2006-14	β^{GVC}	1996-05	2006-14	
France	M	0.89	0.72	0.03	0.03	0.02	0.01
	M&S	3.87	3.90	0.24	0.95	0.96	-0.01
Germany	M	2.15	1.58	0.03	0.07	0.05	0.02
	M&S	7.39	5.00	0.24	1.81	1.23	0.58
Japan	M	1.53	1.76	0.03	0.05	0.06	-0.01
	M&S	6.50	2.24	0.24	1.59	0.55	1.04
United Kingdom	M	0.48	0.29	0.03	0.02	0.01	0.01
	M&S	7.85	4.09	0.24	1.92	1.00	0.92
United States	M	0.77	0.78	0.03	0.03	0.03	-0.00
	M&S	5.32	4.25	0.24	1.30	1.04	0.26

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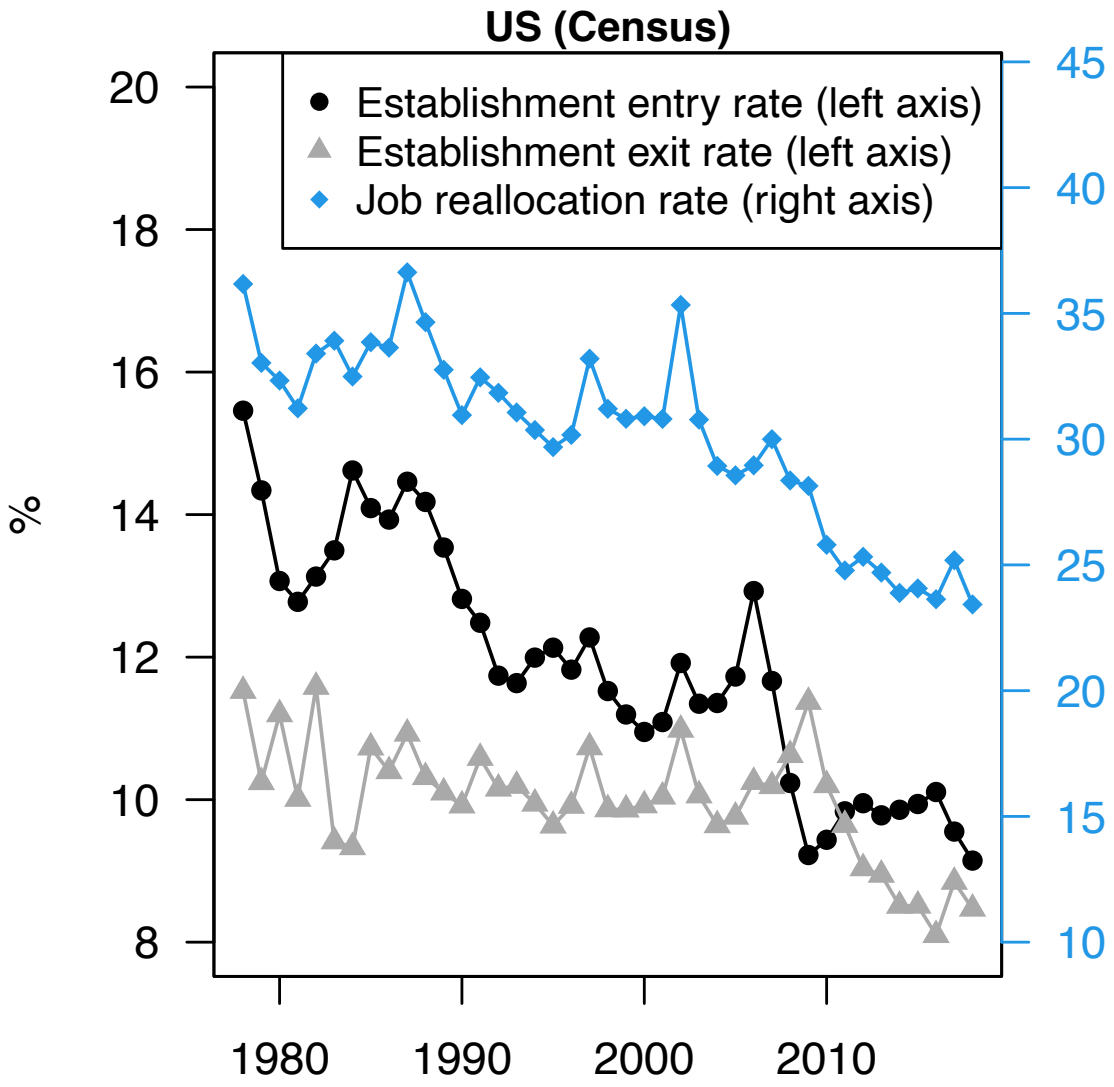
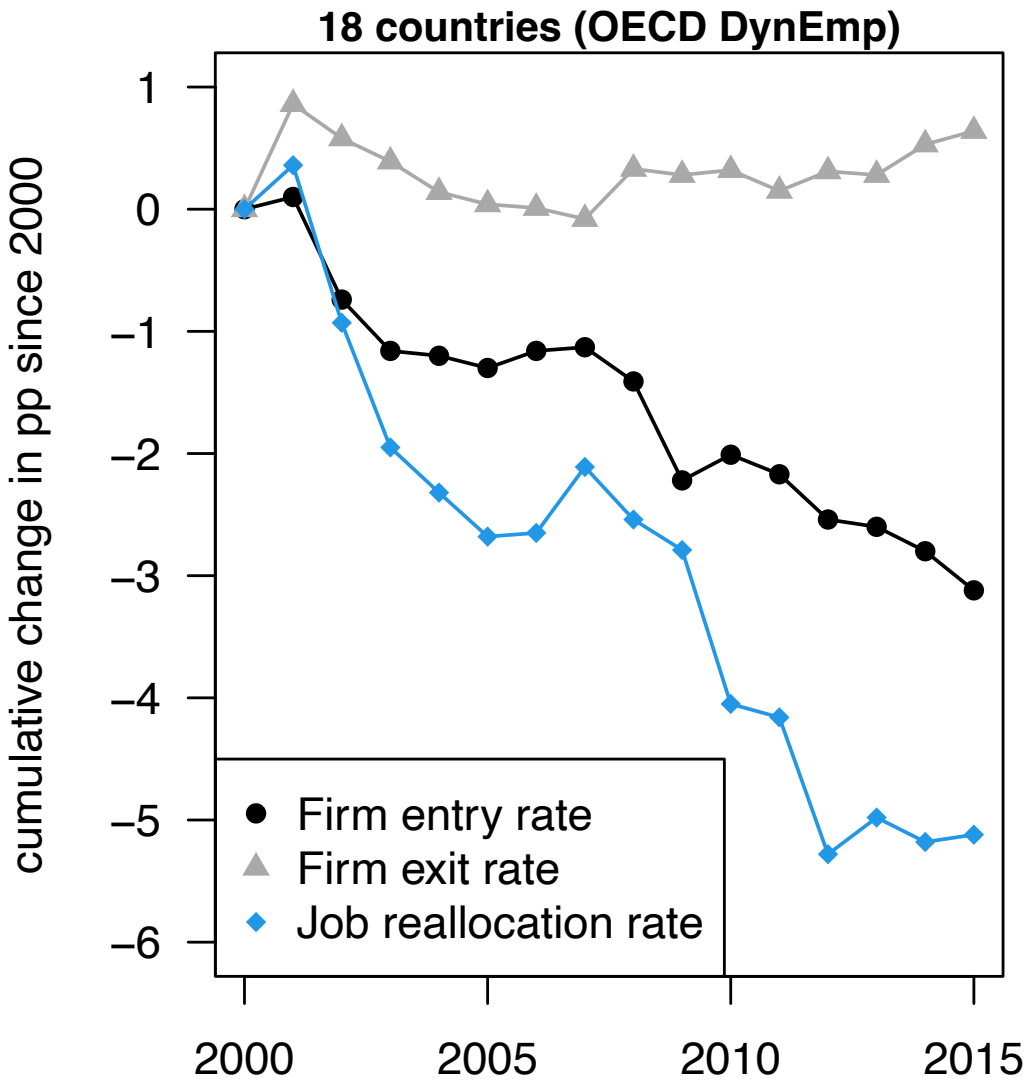
- Business dynamism and job reallocation
- Market power: Concentration, profits and markups
- Productivity dispersion

Business dynamism and job reallocation

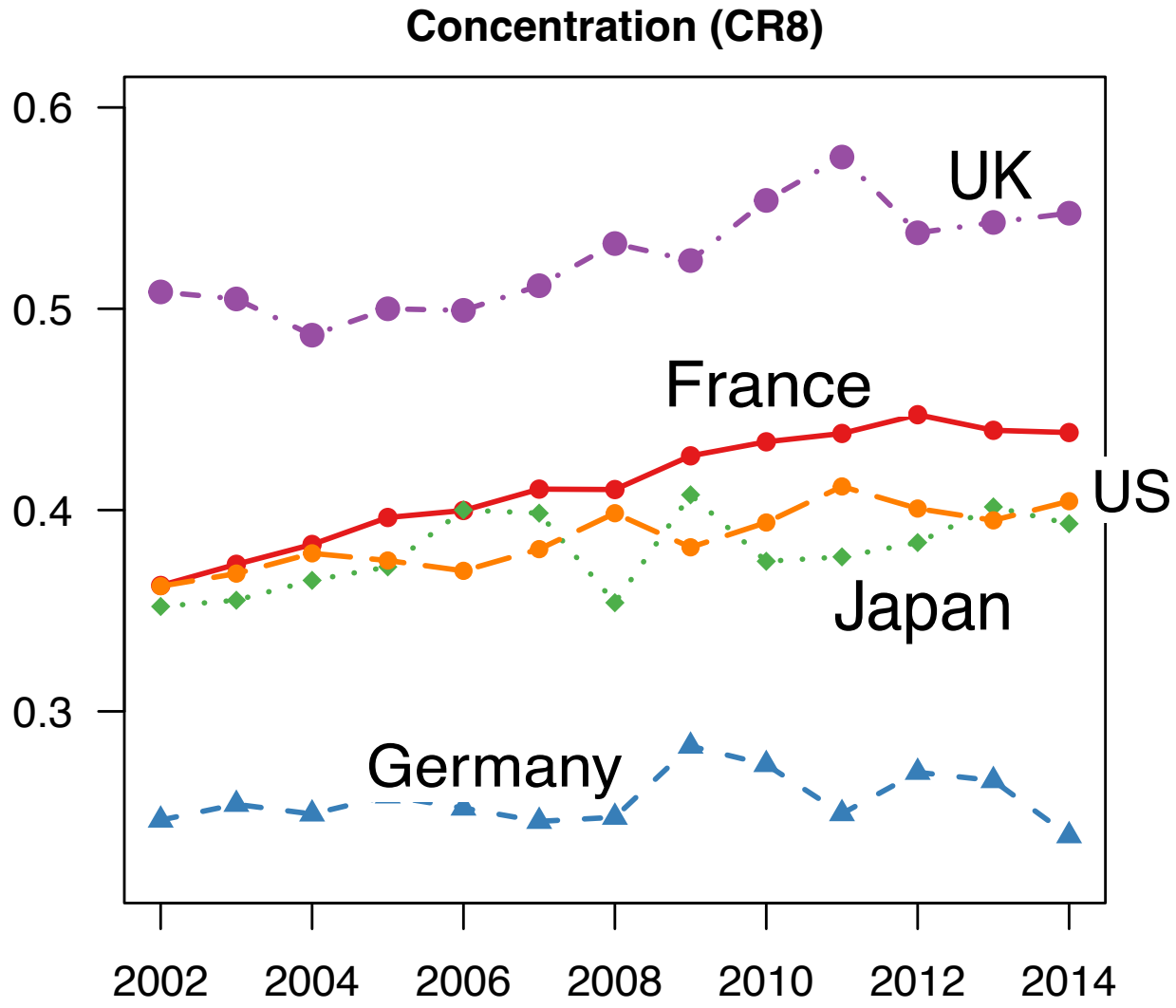




Market power 1: Concentration

- Issues in ***measuring***
  - Market definition
  - (especially geographic)
  - Denominator when using firm-level datasets

- Issues in ***interpreting***: Good or bad?
  - Natural monopolies
  - Barriers to entry



Orbis data, computations from the OECD

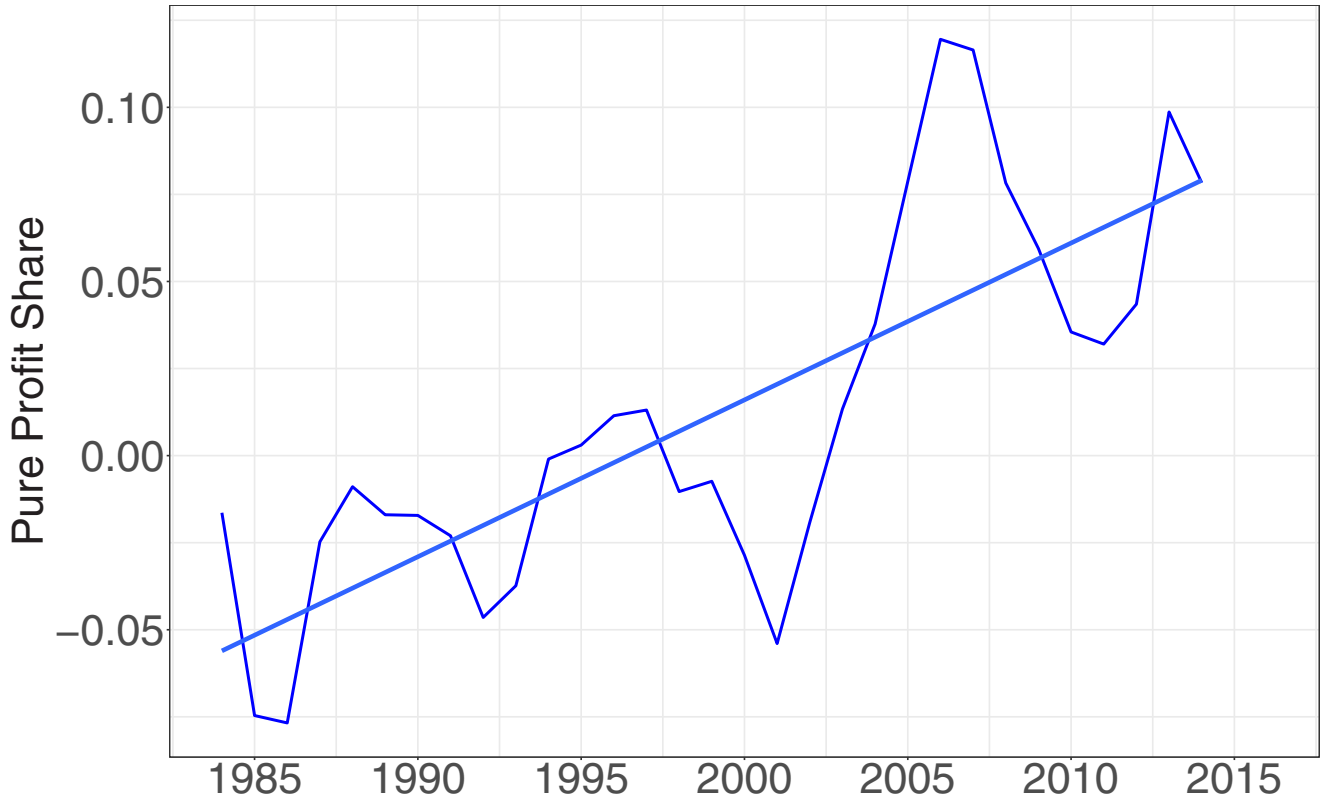
Market power 2: Profits

$$\text{Factorless income} =$$

$$Y - wL - rK$$

$$rK = \sum_j r_j K_j$$

- Missing capitals?
- Wrong rates of return?
- (Treatment of mixed income after R&D capitalization)



Barkai (2020), Declining Capital and Labor shares, Journal of Finance

Market power 3: Markups

profit rate

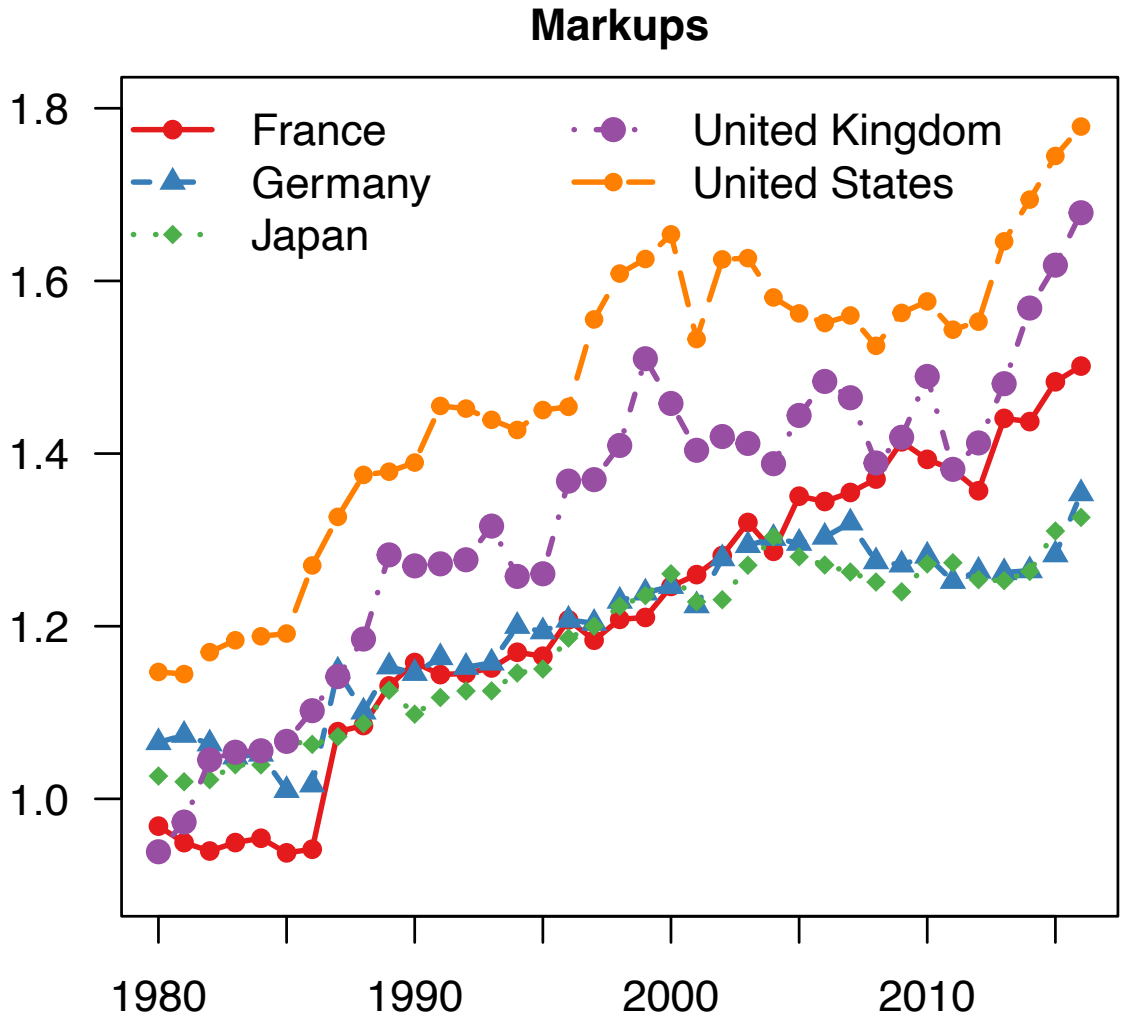
$$\mu(1-\pi)=\gamma$$

markups *economies of scale*

What costs are fixed vs variable?

Aggregate markups have increased because:

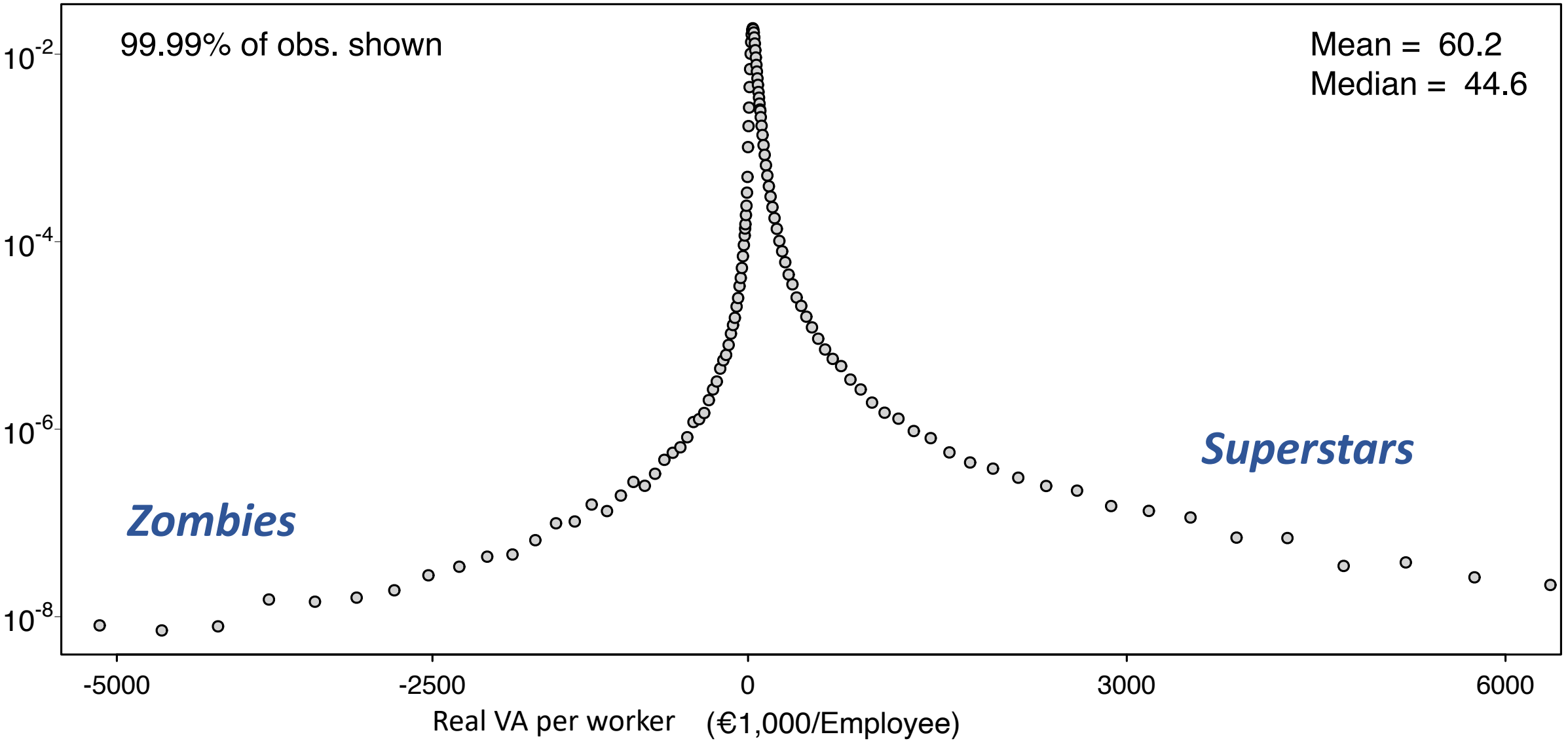
- High markups firms are getting bigger
- High markups firms are increasing their markups



Data from DeLoecker & Eekhout (2022)

Productivity dispersion

French firms from Orbis, pooled across years. From Yang et al (2022), Measuring productivity dispersion using the Lévy stable distribution



Contribution to the slowdown

Baqaee & Fahri (2020): Allocative Efficiency contributed about half of TFP growth.
So, did it contribute half of the *slowdown*? Almost.

$$\underbrace{\Delta \log Y_t - \tilde{\Lambda}'_{t-1} \Delta \log \mathcal{L}_t}_{\Delta\text{Markup-corrected Solow residual}}$$

$$\approx \underbrace{\tilde{\lambda}'_{t-1} \Delta \log \mathcal{A}_t}_{\Delta\text{ Technology}}$$

$$\underbrace{-\tilde{\lambda}'_{t-1} \Delta \log \mu_t - \tilde{\Lambda}'_{t-1} \Delta \log \Lambda_t}_{\Delta\text{ Allocative Efficiency}}$$

	Distorted TFP	Allocative Efficiency	Technology
		User cost of capital	
1997-2005	1.44	0.75	0.69
2006-2014	0.33	0.09	0.24
Slowdown	1.11	0.66	0.44
Share of slowdown	100 %	60 %	40 %
		Production Function	
1997-2005	2.14	0.63	1.51
2006-2014	0.58	0.22	0.37
Slowdown	1.56	0.41	1.15
Share of slowdown	100 %	26 %	74 %
		Accounting profits	
1997-2005	1.74	0.37	1.37
2006-2014	0.44	0.32	0.12
Slowdown	1.30	0.06	1.24
Share of slowdown	100 %	4 %	96 %

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- Business dynamism and job reallocation
- Market power: Concentration, profits and markups
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Technology: pessimists vs optimists

Overall R&D effort does not appear to have slowed down massively,

- But it is more focused on **medical sciences**
- And originates more from the **corporate sector**

Research productivity:

- Theory: **Fishing out** from higher shoulders vs **combinatorial explosion**
- Data: **Increasing number of scientists** to achieve constant rate of progress

Lags in diffusion of the new GPT

- Theory based on history is compelling: **Complementary investment** (from firms and government) take time
- But data shows differences with previous periods: **Business dynamism and investment rates are low**

Conclusion 1: US

	US (pp)	US, % of slowdown	Range, % of slowdown
Total slowdown	1.61	100	
Capital: Financial crisis	0.35	22	[11,33][1]
Capital: Secular trends	0.35	22	[11,33][1]
Labor composition	-0.01	0	[-10,22][2]
TFP: Mismeasurement	0.21	13	[0,25][3]
TFP: Spillovers from intangibles	0.28	17	[0,25][4]
TFP: Trade	0.13	8	[0,16][5]
TFP: Allocative efficiency	0.38	23	[3,41][6]
Total 'explained'	1.7	105	[15,195][7]

Conclusion 2: All countries

	France	Germany	Japan	UK	US
Capital: Financial crisis[1]	0.04	0.27	0.40	0.26	0.35
Capital: Secular trends[1]	0.04	0.27	0.40	0.26	0.35
Labor composition[1]	-0.09	0.17	0.04	0.39	-0.01
TFP: Mismeasurement[2]	0.21	0.21	0.21	0.21	0.21
TFP: Spillovers from intangibles[3]	-0.07	0.06	0.48	-0.01	0.28
TFP: Trade[4]	-0.00	0.30	0.52	0.46	0.13
TFP: Allocative efficiency[5]	0.42	0.09	-0.01	0.35	0.38
TFP, to explain[1]	1.01	0.23	-0.02	0.84	0.91
TFP 'explained'	0.56	0.67	1.20	1.02	1.00
Total slowdown	0.99	0.94	0.82	1.75	1.61
Total 'explained'	0.54	1.38	2.05	1.93	1.70

Thanks

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