The rise in the supervisory wage gap in Western Europe

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- Wage inequality is a central concern in labour markets
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  - Almost no evidence on how it has *evolved over time*
- Why it matters: hierarchies capture authority and bargaining power inside firms, not only skill

This artcile

- Q1: How has the supervisory wage gap (SWG) changed in Western Europe, 2003–2022?
- Q2: What explains the change?
- Three datasets:
  - EU-SILC – 15 Western European countries, >1m worker-years
  - BHPS/USoc – UK individual longitudinal panel
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Main findings: SWG rose by 6–7 pp; mostly *not* explained by ability or job content; linked to *employment relations*

Three channels for the supervisory wage gap

- Human capital – supervisors have higher ability/skills (Mincer; Calvo & Wellisz)
  - *Prediction:* SWG ↑ if higher-ability workers increasingly sort into supervisory roles
- Job content – supervisory tasks differ (complexity, responsibility, span)
  - Efficiency wages: cost of supervisory shirking is high (Shapiro–Stiglitz)
  - *Prediction:* SWG ↑ when firms grow, span widens, or technology raises supervisory task complexity
- Employment relations (often overlooked) – relative *bargaining power*
  - Monitoring tech, outsourcing, offshoring, labour market institutions
  - *Prediction:* SWG ↑ when non-supervisory workers lose bargaining power

Data

EU-SILC
(repeated cross-section)

- 15 W. European countries
- 2003–2022
- >1m worker-years
- Supervisory question: "perform supervisory tasks?"
- 28% supervisors

BHPS/USoc
(individual panel)

- UK, 2003–2022
- Track individuals over time
- Used to control for *unobserved* ability

WERS
(matched employer–employee)

- UK, 2004 & 2011
- Firms followed over time
- Used to control for *firm* fixed effects
- 569 firms, ∼10k workers

Hourly wages; ages 20–65; employees only; cross-country specs weight countries equally.

Empirical strategy – Baseline (EU-SILC)

Baseline (EU-SILC): estimate change in SWG year-by-year relative to 2003

- Controls for education, age, gender, industry, occupation, country
- Supervisor-industry-country and industry-country-year fixed effects

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$$y_{it} = \beta_t S_{it} + \gamma_H' H_{it} + \gamma_D' D_{it} + \gamma_Z' Z_{it} + \varepsilon_{it}$$

y_{it}: log hourly wage; S_{it}: supervisory indicator; β_t: change in SWG in year t vs. 2003.

Empirical strategy – Human capital channel (BHPS/USoc)

Channel 1 (BHPS/USoc): add *supervisor-spell* fixed effects

- $\rightarrow$ uses only *within-individual* variation
- Removes time-invariant ability sorting

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γ_i^S / γ_i^{NS}: individual FE while supervising / not supervising. $\beta_t - \alpha_t$: share of rise due to ability sorting.

Empirical strategy – Job content channel (WERS)

Channel 2 (WERS): add *firm* and *firm-year* fixed effects

- employer-employee linked data to control for firm-level factors (size, span, technology) that may drive job content changes
- $\rightarrow$ uses only *within-firm* variation over time

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λ_{sj}: supervisor-firm FE; ζ_{jt}: firm-year FE.

Empirical strategy – Employment relations channel (EU-SILC + industry/country)

Channel 3 (EU-SILC + industry/country data): long-difference interaction with monitoring, outsourcing, offshoring, wage coordination

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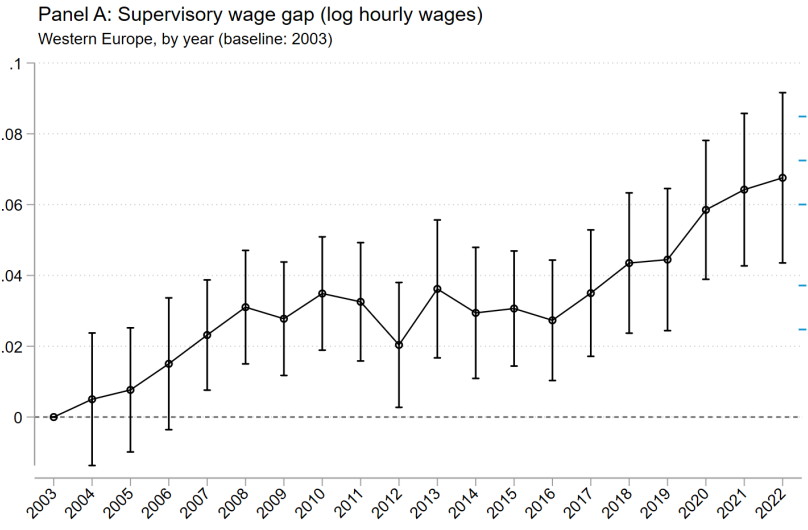
$$y_{it} = \gamma_1(S_i \times t) + \gamma_2(S_i \times t \times \Delta X_k) + \gamma_H' H_{it} + \gamma_D' D_{it} + \gamma_Z' Z_{it} + \varepsilon_{it}$$

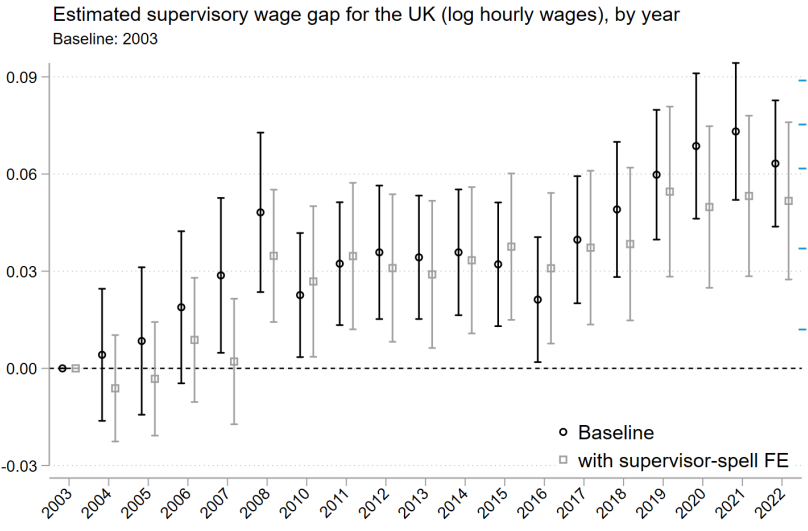
t: linear time trend; ΔX_k: long-difference of an industry/country determinant. γ_2: extra SWG growth where X rises.

Finding 1: The supervisory wage gap rose by ∼7pp



- 15 W. European countries
- SWG ↑ by 6.8 pp, 2003–2022
- Conditional gap in 2003: ∼15%
- Implies ∼40% rise in the gap
- Robust to job and firm-size controls (Appendix)

Channel 1: Ability sorting explains ∼20% of the rise



- UK panel (BHPS/USoc)
- Cross-section: SWG ↑ 6.3 pp
- Add supervisor-spell FE: ↑ 5.2 pp
- ⇒ ability sorting explains ∼20%
- ∼80% remains unexplained by sorting

Channel 2: WERS – rise persists within firms

	(1) Baseline	(2) Firm FE	(3) Within-firm	(4) × Firm growing	(5) × Span growing
SWG × 2011	0.036*	0.047***	0.048**	0.040*	0.037*
	(0.020)	(0.018)	(0.019)	(0.023)	(0.021)
× Firm growing				0.028	
				(0.039)	
× Span growing					0.059
					(0.044)
Controls	Yes	Yes	Yes	Yes	Yes
Supervisor-industry FE	Yes	Yes			
Industry-year FE	Yes	Yes			
Firm FE		Yes			
Supervisor-firm FE			Yes	Yes	Yes
Firm-year FE			Yes	Yes	Yes
Observations	10,337	10,335	10,215	10,215	10,215

SE clustered at firm level; * p<0.1, ** p<0.05, *** p<0.01.

Channel 2: Not driven by firm structure or technology

- WERS (UK): rise is a *within-firm* phenomenon
  - SWG ↑ 3.6 pp, 2004–2011; persists with firm & firm-year FE
  - Not concentrated in firms that grow in size
  - Not concentrated in firms that expand supervisory span

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- EU-SILC: no systematic association between SWG growth and
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  - task complexity (relative to non-supervisors)
  - ICT capital intensity

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⇒ Standard job-content / skill-biased technology stories cannot explain the rise

Channel 3: Employment relations

	(1)	(2)	(3)	(4)	(5)
SWG annual trend	-0.058	0.182***	0.169***	0.213***	0.108**
	(0.097)	(0.037)	(0.041)	(0.037)	(0.042)
× Monitoring	0.921***				
	(0.310)				
× Outsourcing		0.796*			
		(0.419)			
× Offshoring			0.452**		
			(0.204)		
× Union density				0.096	
				(0.472)	
× Wage coordination					-0.171***
					(0.036)
Controls + FE	Yes	Yes	Yes	Yes	Yes
Observations	838,962	850,595	998,904	998,904	868,173

Bottom line

Empirical facts

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- SWG rose by 6–7 pp in Western Europe and the UK (2003–2022) – a ∼40% rise

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- *Not* firm structure (size, span) – rise is within-firm
- *Not* broad technology / ICT intensity

The rise *is* associated with

- Digital worker monitoring ✓
- Outsourcing ✓
- Offshoring ✓
- Declining wage coordination ✓

Implications

Interpretation: supervisory wage gaps reflect *power relations*, not just productivity

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For research

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- Bridges labour economics and industrial relations

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For research

- Inequality across hierarchies is a missing dimension in the wage-structure literature
- Bridges labour economics and industrial relations

For policy

- Education/training alone will not close hierarchical gaps
- Regulate workplace monitoring technologies
- Strengthe wage coordination and collective bargaining
- Limit erosion of internal pay equity (outsourcing)

Get in touch

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Paper & supplementary material

Appendix

Wage-*level* gaps across job hierarchies

- Supervisory vs. non-supervisory wage gap: ∼15% (Leonida et al., 2023)
  - Highest in UK (∼23%), lower in CMEs like Germany
- Job levels capture authority in production (Bayer and Kuhn, 2022)
- Wage gaps across jobs with different hold-up power (Bloesch et al., 2022)
- Firm-size wage premium concentrated in supervisory roles (Green et al., 2021)

Existing work: *cross-sectional* differences only

Open questions: how have SWGs *evolved*? what *drives* them?

Hypotheses

- H1 (Human capital): SWG ↑ when higher-ability individuals sort into supervisory roles
- H2 (Job content): SWG ↑ as supervisory responsibilities expand
  - organisational change (firm growth, wider span) OR
  - technological change raising supervisory task complexity
- H3 (Employment relations): SWG ↑ when changes in employment relations weaken bargaining of non-supervisory workers
  - monitoring, outsourcing, offshoring, weaker LMIs

Why employment relations? – Mechanisms

- Monitoring – digital tools reduce reliance on efficiency wages for easy-to-monitor (non-supervisory) workers (Skott & Guy, 2007; Ball, 2021; Rabensteiner & Guschanski, 2025)

- Outsourcing – bypasses internal pay equity; supervisors retained in-house (Weil, 2014; Goldschmidt & Schmieder, 2017)

- Offshoring – credible relocation threat compresses non-supervisory wages; supervisory tasks harder to offshore

- LMIs – unions/coordination compress the distribution; benefit lower-paid workers most (Farber et al., 2021; Visser, 2006)

EU-SILC details

- 15 Western European countries; 2003–2022
- Hourly wage = annual gross wage / (months $\times$ 4.2 $\times$ usual weekly hours)
- Mean hourly wage: €14.9
- Supervisory indicator: "Are you performing supervisory tasks? Yes/No"
  - 28% of respondents classified as supervisors
- Sample: employees aged 20–65, >30 hrs/week, excl. self-employed and public administration
- Trim top/bottom 1% of wages within country-year
- 1-digit ISCO, 8 broad NACE industries

BHPS/USoc details

- UK individual-level panel; BHPS (1991–) linked to Understanding Society (2009–)
- Mean hourly wage: £12.2
- Supervisory question: "Do you have any managerial duties, or do you supervise any other employees?"
  - Manager / supervisor / neither
  - Supervisor = manager or supervisor
- Same sample restrictions as EU-SILC (20–65, >30 hrs, excl. self-employed)
- Waves indexed by survey year (Sep–Sep)

WERS details

- UK matched employer–employee survey (Van Wanrooy et al. 2013)
- 2004 and 2011 waves linked at firm level
- Up to 25 randomly selected employees per establishment
- Wages reported in 14 bands; midpoints assigned (Green et al., 2021)
- Mean hourly wage: £12.3
- Supervisory question: "Do you supervise any other employees?"
- 569 firms; >10,000 worker-years; WERS survey weights used

Industry-level data sources

Variable	Source	Notes
Supervisory span	EWCS	2005–2015
Task complexity	EWCS	supervisor vs. non-supervisor
ICT capital / value added	EU KLEMS	after Michaels et al. (2014)
Digital monitoring	ECS	data analytics on employees
Outsourcing / Offshoring	OECD ICIO	input–output tables
Union density	European Social Survey	
Wage coordination, CB cov.	ICTWSS	country level

Table A1 – EU-SILC summary statistics (selected)

Variable	Mean	SD
Log hourly wage	2.700	0.671
Supervisor	0.279	0.449
Age	42.5	11.1
Female	0.474	0.499
Tertiary education	0.461	0.498
Upper secondary education	0.341	0.474
Native born	0.879	0.326
Full-time, all year	0.736	0.441
Firm size: <10	0.393	0.488
Firm size: 50+	0.444	0.497
Manufacturing & mining	0.226	0.418
Other services	0.238	0.426

EU-SILC, 2003–2022; >1m worker-year observations across 15 W. European countries.

Table A2 – BHPS/USoc summary statistics (selected)

Variable	Mean	SD
Log hourly wage	2.502	0.563
Supervisor (incl. manager)	0.431	0.495
Age	40.6	11.6
Female	0.441	0.497
Degree	0.313	0.464
No qualification	0.053	0.224
Temporary employment	0.041	0.199
Married	0.538	0.498
Firm size: 1–9	0.135	–
Firm size: 1000+	0.151	0.358
Manufacturing	0.137	0.344
Health & social work	0.133	0.340

UK BHPS & Understanding Society, 2003–2022.

Table A3 – WERS summary statistics (selected)

Variable	Mean	SD
Log hourly wage	2.370	0.512
Supervisor	0.384	0.486
Age	42.2	11.0
Female	0.475	0.499
First degree	0.236	0.424
Higher degree	0.092	0.289
Temporary employment	0.050	0.219
Tenure: 10+ years	0.331	0.471
Firm size: 100–199	0.176	0.381
Firm size: 500–999	0.105	0.306
Supervisory span: $\leq$30%	0.338	0.473
Supervisory span: 30–75%	0.617	0.486

UK WERS 2004 & 2011, matched firms (Green et al., 2021 sample).

Table A4 – Industry- and country-level variables

Variable	Source	Mean	SD
Industry level			
Employee monitoring	European Company Survey	0.308	0.158
Outsourcing	OECD ICIO IOT	0.304	0.304
Offshoring	OECD ICIO IOT	0.246	0.244
ICT intensity (ICT/VA)	EU KLEMS	0.016	0.043
Log value added	EU KLEMS	11.86	2.85
Union density	European Social Survey	0.178	0.183
Task complexity (share)	EWCS	0.620	0.175
# supervisees (median)	EWCS	4.97	2.83
Share with >10 supervisees	EWCS	0.269	0.165
Country level			
Wage coordination (1–5)	ICTWSS	3.413	1.019
CB coverage	ICTWSS	0.764	0.219
Min. / median wage	OECD	0.499	0.114

(Eq. 1) Baseline – EU-SILC

$$y_{it} = \beta_t S_{it} + \gamma_H' H_{it} + \gamma_D' D_{it} + \gamma_Z' Z_{it} + \varepsilon_{it}$$

- y_{it}: log hourly wage of worker i at time t
- S_{it}: supervisory indicator
- β_t: change in SWG in year t relative to 2003
- H_{it}: education, age (experience proxy)
- D_{it}: gender, migrant status, marital status
- Z_{it}: occupation, supervisor-industry-country FE, industry-country-year FE; some specs add job controls and firm size
- OLS with EU-SILC weights; equal country weights; clustered SE at supervisor-industry-country level

(Eq. 2) Adding supervisor-spell FE – BHPS/USoc

$$y_{it} = \alpha_t S_{it} + \gamma_i^S S_{it} + \gamma_i^{NS}(1 - S_{it}) + \gamma_H' H_{it} + \gamma_D' D_{it} + \gamma_Z' Z_{it} + \varepsilon_{it}$$

- Supervisor-spell FE absorb time-invariant ability *within* supervisory and non-supervisory roles separately
- Identifies α_t from *within-individual* wage variation
- Follows Cortes (2016); Wang (2020); Rabensteiner & Guschanski (2025)
- SE clustered at individual level

(Eq. 3) Within-firm identification – WERS

$$y_{it} = \delta_t S_{it} + \gamma_H' H_{it} + \gamma_D' D_{it} + \gamma_Z' Z_{it} + \lambda_{sj} + \zeta_{jt} + \varepsilon_{it}$$

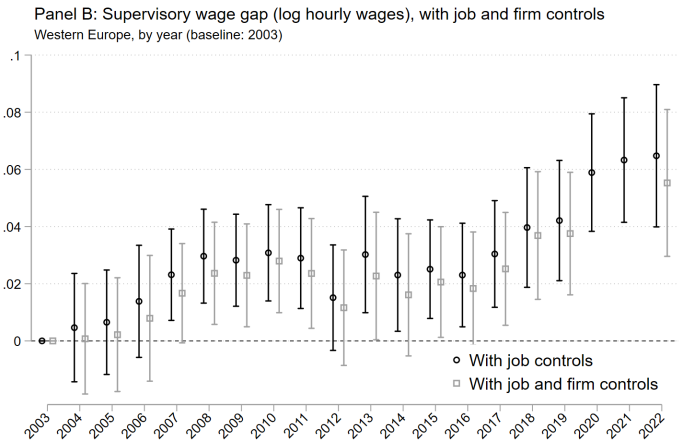
- λ_{sj}: supervisor-firm FE – firm-specific SWGs
- ζ_{jt}: firm-year FE – firm-specific wage shocks
- δ_t identified from *within-firm* change in SWG over 2004–2011
- Extensions interact S_{it} with firm employment growth and supervisory-span growth

(Eq. 4) Long-difference, industry-level interactions

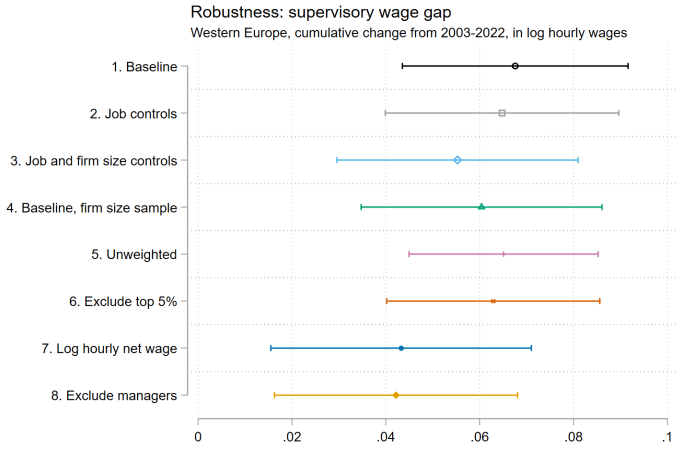
$$y_{it} = \gamma_1(S_i \times t) + \gamma_2(S_i \times t \times \Delta X_k) + \gamma'_H H_{it} + \gamma'_D D_{it} + \gamma'_Z Z_{it} + \varepsilon_{it}$$

- Linear time trend t; γ_1 = annual SWG growth in industries where X unchanged
- ΔX_k: long-difference of an industry- or country-level determinant
- $\gamma_1 + \gamma_2$: annual SWG growth where X increases by 1 unit
- Same controls and FE as baseline
- Reduces sensitivity to measurement error in slow-moving determinants (Michaels et al., 2014)

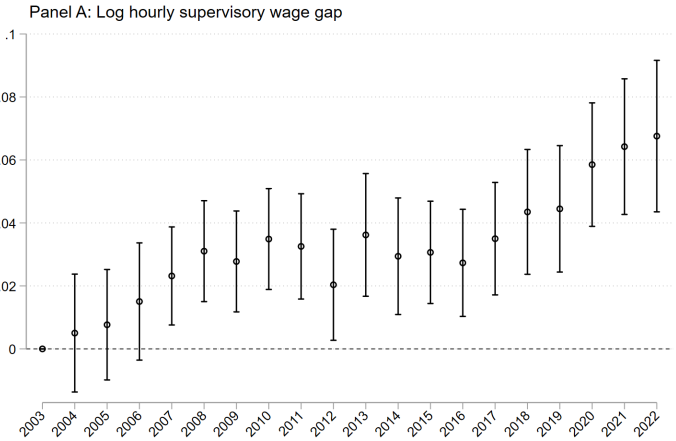
EU-SILC: adding controls



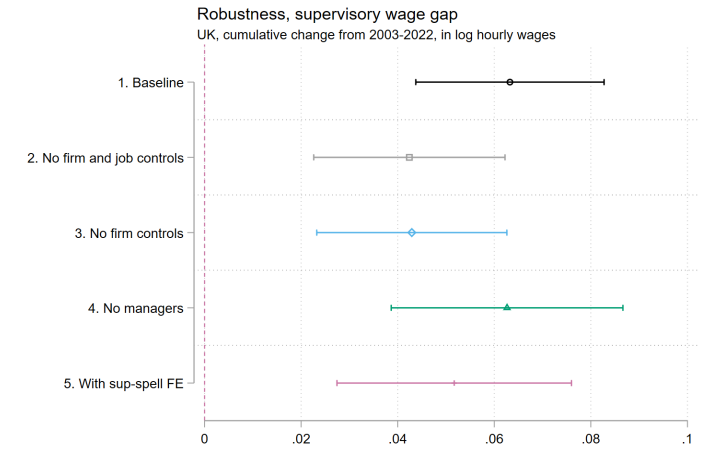
EU-SILC: robustness



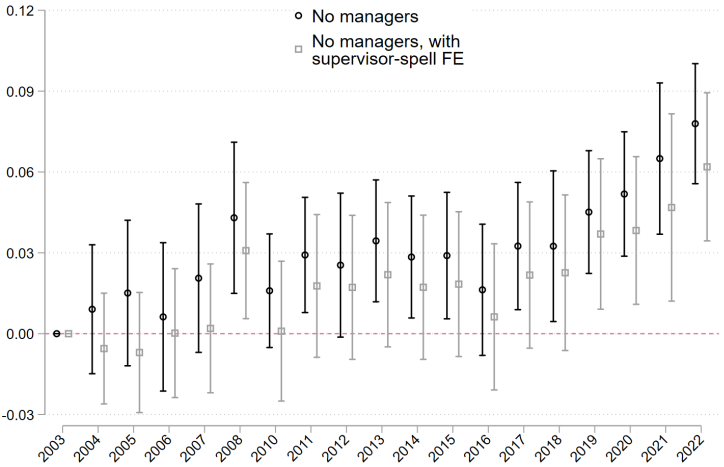
EU-SILC: by firm size



BHPS/USoc: robustness



BHPS/USoc: excluding managers



Job content channel – no systematic relationship

Tested measures of supervisory job content:

- Avg. number of supervisees (EWCS)
- Share of supervisors with $\geq$10 subordinates (EWCS)
- Supervisor task complexity (relative to non-supervisors)
- ICT capital / value added (EU KLEMS)

$\Rightarrow$ None significantly associated with SWG growth

Argues against skill- or task-biased technological change as primary driver

Table 2 – Job content (EU-SILC, industry-level)

	(1)	(2)	(3)	(4)	(5)
	Log hourly wage				
SWG	0.151***	0.137**	0.128**	0.135**	0.227**
	(0.055)	(0.059)	(0.054)	(0.054)	(0.042)
× # supervisees	0.024				
	(0.018)				
× >10 supervisees		0.145			
		(0.312)			
× Complex tasks			0.245		
			(0.357)		
× Complex tasks ratio				0.250	
				(0.297)	
× ICT / value added					-0.652
					(0.692)
Controls	Yes	Yes	Yes	Yes	Yes
Supervisor-industry-country FE	Yes	Yes	Yes	Yes	Yes
Industry-country-year FE	Yes	Yes	Yes	Yes	Yes
Observations	620,830	620,830	620,830	620,830	762,989

Employment relations – robustness

- Monitoring, outsourcing, offshoring associations robust to controls for ICT intensity and value added
- All employment-relations regressors jointly: monitoring, outsourcing, offshoring remain significant
- Wage coordination measured at country level (industry-level not available)
- Union density measured at industry-country level – no significant association

Table B1 – EU-SILC: SWG × 2022 across specifications

	(1) Base	(2) Job ctrls	(3) + Firm	(4) Restr.	(5) Unwgt.	(6) Excl. top 5%	(7) Net wage	N
SWG × 2022	0.068***	0.065***	0.055***	0.057***	0.065***	0.063***	0.043***	0.
	(0.009)	(0.013)	(0.013)	(0.014)	(0.010)	(0.011)	(0.014)	(
Observations	1,074,690	1,068,008	875,227	875,227	1,068,633	1,023,251	811,704	1,(
Adj. R^2	0.610	0.619	0.630	0.618	0.626	0.631	0.640	
Sup-ind-country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Ind-country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

SE clustered at supervisor-industry-country level. All specifications based on Eq. (1). Cumulative change in SWG, 2022 vs. 2003, shown. Full sequence in paper Table B1.

Table B2 – BHPS/USoc: SWG × 2022 across specifications

	(1) Baseline	(2) No firm/job ctrls	(3) No firm ctrls	(4) No mgrs	(5) + Sup-spell FE
SWG × 2022	0.063***	0.042***	0.043***	0.063***	0.052***
	(0.010)	(0.010)	(0.010)	(0.012)	(0.012)
Observations	177,412	180,339	180,234	144,625	162,101
Adj. R^2	0.486	0.453	0.455	0.479	0.771
Sup-spell FE	No	No	No	No	Yes
Ind-year FE	Yes	Yes	Yes	Yes	Yes
Sup-industry FE	Yes	Yes	Yes	Yes	Yes

Models 1–4 based on Eq. (1); Model 5 adds supervisor-spell FE (Eq. 2). SE clustered at individual level. Sup-spell FE absorb ∼20% of the rise.

Table B3 – WERS robustness

	(1) ML interval	(2) ML interval, within-firm	(3) Firm panel, OLS	(4) Firm panel, ML
SWG × 2011	0.041***	0.031***	0.046**	0.042*
	(0.014)	(0.012)	(0.019)	(0.015)
Observations	10,337	10,337	1,944	2,085
Sup-industry FE	Yes			
Industry-year FE	Yes			
Supervisor-firm FE		Yes		
Firm-year FE		Yes		
Firm FE			Yes	Yes
Year FE			Yes	Yes

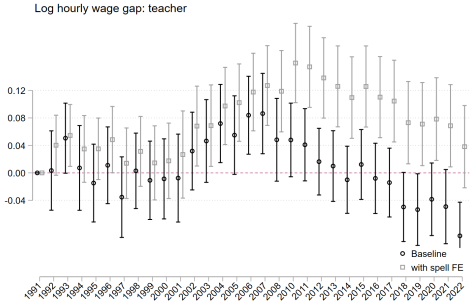
ML interval regression addresses wage-band measurement; firm-panel collapses wages to firm level. SE clustered at firm.

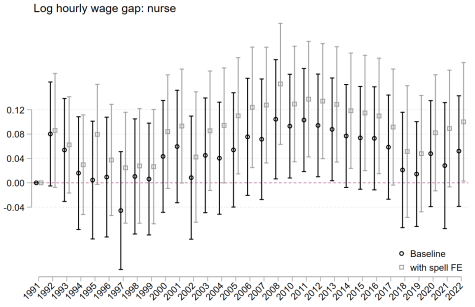
Table B4 – Employment relations: robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SWG × Monitoring	1.075***	1.327***					0.999***
	(0.310)	(0.283)					(0.285)
SWG × Outsourcing			2.146**	1.129**			1.286**
			(0.971)	(0.502)			(0.589)
SWG × Offshoring					1.130**	1.316**	1.557***
					(0.545)	(0.571)	(0.516)
SWG × ICT / VA	-1.630**	-1.491**	-0.003	-0.433	-0.923	-0.835	-0.956
	(0.626)	(0.668)	(3.551)	(0.752)	(0.655)	(0.682)	(0.624)
SWG × Log VA		0.375*		0.144		0.222	0.565***
		(0.197)		(0.215)		(0.185)	(0.204)
Observations	707k	707k	824k	662k	763k	763k	696k
Sup-ind-country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind-country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

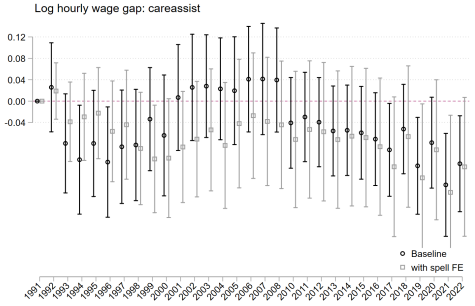
Monitoring, outsourcing, offshoring associations robust to ICT intensity and value-added controls; (7) includes all jointly.

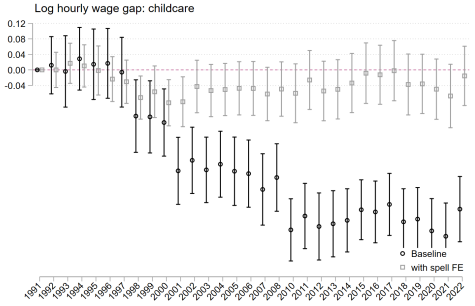
Sectoral wage gaps – selected occupations



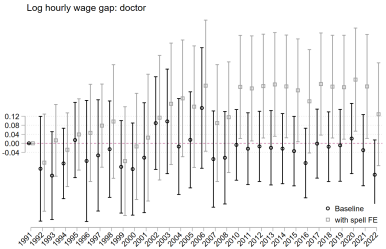


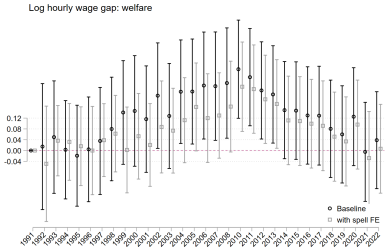
Sectoral wage gaps – care work





Sectoral wage gaps – doctors and welfare





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