

Returns to digital skills use, temporary employment, and trade unions in European labour markets

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CEDEFOP WORKSHOP

Human-centred digital transitions: skill mismatches in European workplaces

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Introduction

- ▶ The socio-economic changes spurred by technological advancements have had significant implications for the functioning of labour markets
- ▶ Technological change as a significant catalyst for modifications in the returns to education, employment, and wage prospects of distinct segments of the workforce (Autor et al., 2003; Goos et al., 2014; Haslberger, 2021; Oesch and Rodríguez Menés, 2011).
 - ▶ SBTC (skilled vs. unskilled workers)
 - ▶ RBTC (routine vs. nonroutine task competencies)
- ▶ Recent empirical evidence → context-specific effects (Oesch and Piccitto, 2019; Klenert et al. 2020; Barbieri et al. 2021; Kristal and Edler, 2021) → LM regulations and institutions as moderators of technological and market-driven mechanisms
 - ▶ trade unions prevent technological advancements from spurring consequential occupational and structural changes (Kristal and Cohen, 2015; Kristal and Edler, 2021; Parolin, 2021)

Introduction

Building on this, our aim is to

- ▶ identify the wage premium associated with on-the-job usage of digital skills, i.e. a set of skills that are in line with skill-bias-technical change perspective
- ▶ detect (if any) the role played by institutional factors as moderators of the effect of (demand-driven) digital skill usage
 - ▶ allowing for wage effects at the micro level among workers with distinct contractual arrangements (namely, temporary and permanent workers)

Introduction

The focus of this contribution is not on the effect of a specific technology (here ICT) on class or occupational structure, but **the returns to hetero-directed use of ICT-related skills on wages**, after the job-matching process

- ▶ **controlling for broad occupational groups** (so to get rid of most of the “task content” effects)
- ▶ testing for **the moderating role of institutional factors**, such as **micro level contractual arrangement** (temporary vs permanent workers) and **trade union membership** for distinct contractual groups

Data

Dataset: European Skills and Jobs Survey (ESJS) by CEDEFOP - 2nd wave

- ▶ Total of 46,213 observations (25-64 years) across EU, Norway, and Iceland
- ▶ Sampling: Random sample - representative of the broader workforce + non-probabilistic survey
- ▶ Key Features: Digital skill usage, wage data, contract type, union membership
- ▶ **KEY POINT:** this is the only dataset that collects data on both ict endowments contractual arrangements and trade union membership!

Data

Key variables

- ▶ Dependent Variable: Logarithm of hourly (net) income
- ▶ Independent Variables:
 - ▶ Digital Skills Index (ictskills): count of declared digital skills (D_PC*)
 - ▶ Contract Type: Temporary or permanent
 - ▶ Union Membership: Binary (member or non-member)
- ▶ Controls: Age, tenure, education, gender, sector, and firm size, training, country, working hours

Table: Summary Statistics by Trade Union Membership

Variable	Not Trade Union Members		Trade Union Members		Total	
	Mean	SD	Mean	SD	Mean	SD
ln(h_wage)	2.01	0.75	2.34	0.79	2.09	0.77
h_wage	9.71	9.81	13.33	11.42	10.55	10.32
ictskills	4.15	2.70	4.20	2.67	4.16	2.70
temporary	0.14	0.35	0.09	0.29	0.13	0.34
public	0.29	0.45	0.47	0.50	0.33	0.47
training	0.60	0.49	0.69	0.46	0.62	0.49
gender	0.76	0.43	0.84	0.37	0.78	0.41
age	42.84	10.23	45.04	10.25	43.35	10.28
w_hours	37.94	7.86	37.57	7.47	37.85	7.77
N		15,530		4,675		20,205

Identification Strategy

- ▶ Main Approach: Mincer earnings equation
- ▶ Equation:

$$Y_{i,c,s} = X_{ki}\beta_k + \delta_c + \gamma_s + \epsilon_i$$

where Y : Log of hourly wage, X : Covariates, δ : Country FE, γ : Sector FE

- ▶ Adjustments:
 - ▶ Propensity Score Matching (PSM) to balance worker characteristics on trade union variable
 - ▶ Instrumental Variables (IV) to address ICT endogeneity

Identification Strategy

The Leave-One-Out Mean Instrument (Cette et al., 2022) is defined as:

$$\tilde{Z}_i = \frac{1}{N-1} \sum_{c_j \neq c_i} Z_{s,I,f,t}$$

where:

- ▶ \tilde{Z}_i is the mean of Z for all $c_j \neq c_i$
- ▶ s = sector
- ▶ I = ISCO (1 digit)
- ▶ f = firm size
- ▶ t = type of contract
- ▶ c = country of individual i or j

Results

Table: Model estimates

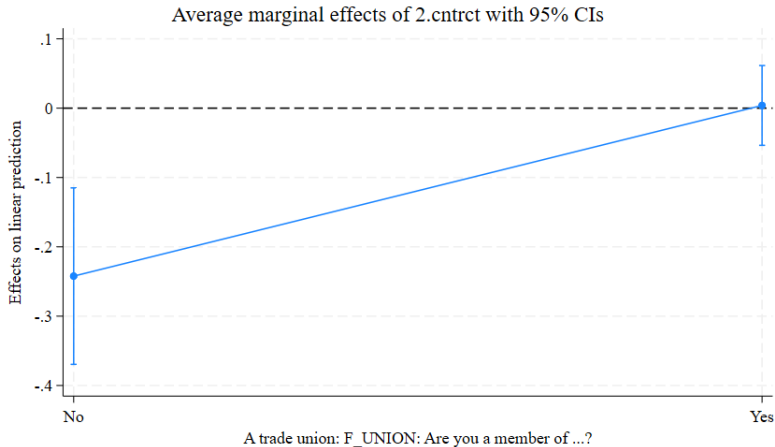
	(1) baseline	(2) interaction	(3) PSM	(4) IV_ict_PSM
temporary	-0.090*** (0.015)	-0.062** (0.022)	-0.116 (0.060)	0.103 (0.093)
ictskills	0.026*** (0.002)	0.030*** (0.003)	0.022*** (0.004)	0.063*** (0.019)
union member	0.014 (0.012)	0.026 (0.023)	-0.012 (0.027)	0.065 (0.046)

Robust standard errors in parentheses

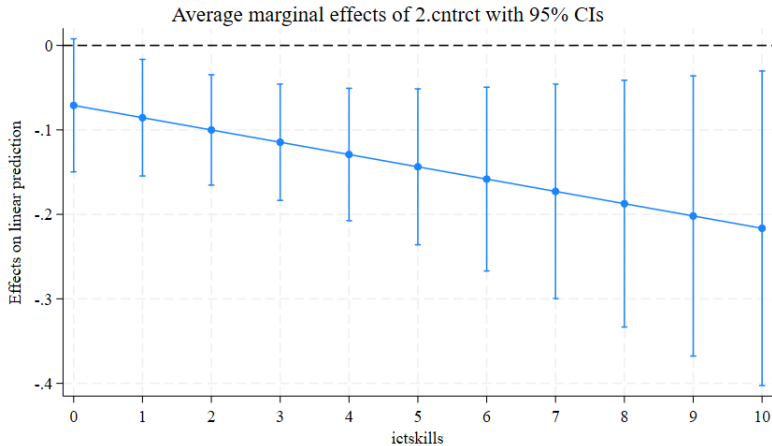
Clustered standard errors for IV model specification

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

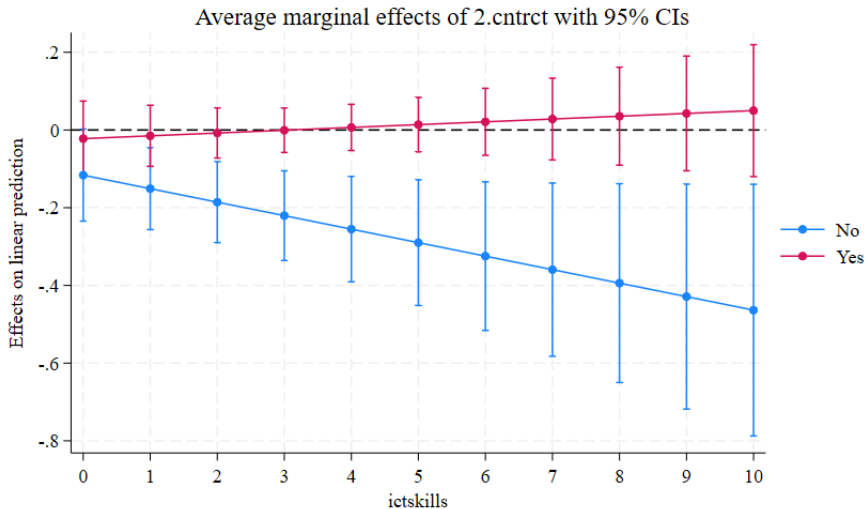
Temporary contract by union membership



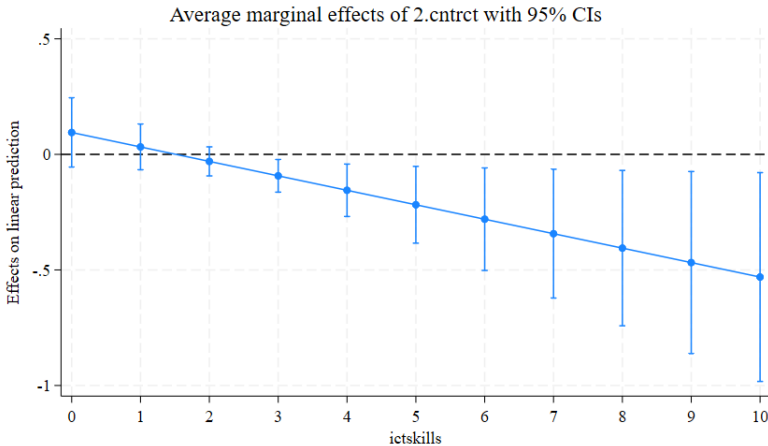
ICT skills for temporary workers



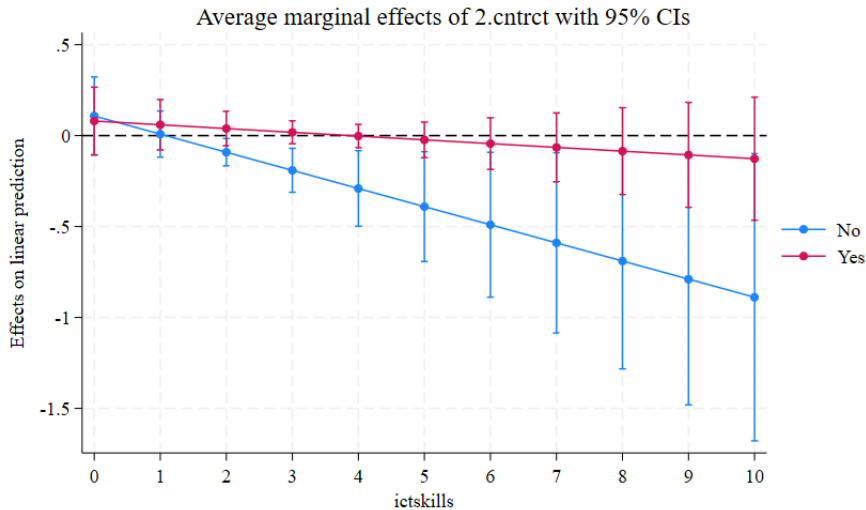
ICT skills for temporary workers by union status



ICT skills for temporary workers - IV



ICT skills for temporary workers - IV by union status



Conclusion Remarks

- ▶ **Digital skill usage at work** significantly increases wages, but the extent of the impact varies by contract type and union membership.
- ▶ **Union membership** mitigates wage disparities between temporary and permanent workers, especially in ICT-related wage premiums.
- ▶ The influence of digital skills on wages is shaped not only by individual capabilities but also by institutional and labour market conditions.
- ▶ Policy Implications: Strengthening trade unions and promoting equitable **access to digital skills training** can reduce wage inequalities and foster labour market inclusivity.
- ▶ **Future Directions:** Investigating the long-term effects of digitalization and varying trade union strategies across countries can offer deeper insights.

Appendix

AME trade union membership on trade union density ratio temporary/permanent

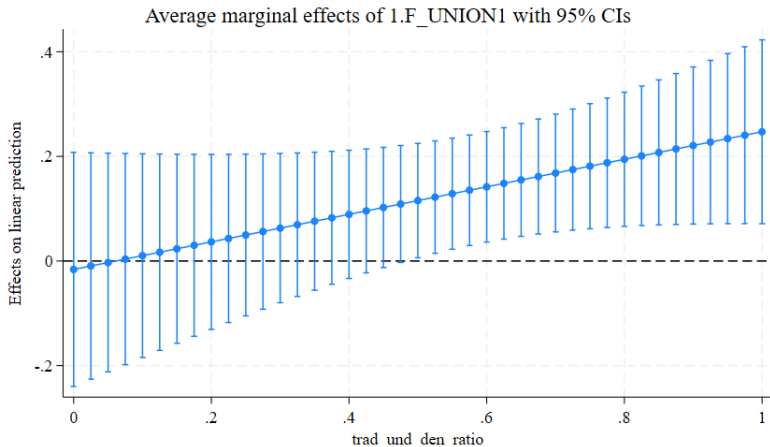


Table: Descriptive Statistics by Trade Union Membership

	Trade union membership		
	No	Yes	Total
N	15,530 (76.9%)	4,675 (23.1%)	20,205 (100.0%)
ln(h_wage)	2.010 (0.747)	2.339 (0.794)	2.086 (0.771)
Type of contract			
Permanent	13,350 (86.0%)	4,240 (90.7%)	17,590 (87.1%)
Temporary	2,180 (14.0%)	435 (9.3%)	2,615 (12.9%)
Age category			
25-34	3,911 (25.2%)	884 (18.9%)	4,795 (23.7%)
35-44	4,863 (31.3%)	1,317 (28.2%)	6,180 (30.6%)
45-54	4,262 (27.4%)	1,455 (31.1%)	5,717 (28.3%)
55-64	2,494 (16.1%)	1,019 (21.8%)	3,513 (17.4%)
Working in your current company			
Less than a month	277 (1.8%)	47 (1.0%)	324 (1.6%)
Between 1 month and 5 months	648 (4.2%)	111 (2.4%)	759 (3.8%)
Between 6 months and 11 months	603 (3.9%)	109 (2.3%)	712 (3.5%)
Between a year and 5 years	5,247 (33.8%)	1,156 (24.7%)	6,403 (31.7%)
Between 6 years and 40 years	8,616 (55.5%)	3,173 (67.9%)	11,789 (58.3%)
Don't know	138 (0.9%)	76 (1.6%)	214 (1.1%)
No answer	1 (0.0%)	3 (0.1%)	4 (0.0%)

Table: Descriptive Statistics by Trade Union Membership

	Trade union membership		
	No	Yes	Total
N	15,530 (76.9%)	4,675 (23.1%)	20,205 (100.0%)
Fieldwork country			
Austria	435 (2.8%)	213 (4.6%)	648 (3.2%)
Belgium	301 (1.9%)	291 (6.2%)	592 (2.9%)
Bulgaria	548 (3.5%)	120 (2.6%)	668 (3.3%)
Croatia	254 (1.6%)	82 (1.8%)	336 (1.7%)
Czech Republic	656 (4.2%)	82 (1.8%)	738 (3.7%)
Denmark	69 (0.4%)	176 (3.8%)	245 (1.2%)
Estonia	396 (2.5%)	33 (0.7%)	429 (2.1%)
Finland	186 (1.2%)	359 (7.7%)	545 (2.7%)
France	1,487 (9.6%)	240 (5.1%)	1,727 (8.5%)
Germany	1,443 (9.3%)	296 (6.3%)	1,739 (8.6%)
Greece	800 (5.2%)	158 (3.4%)	958 (4.7%)
Hungary	649 (4.2%)	74 (1.6%)	723 (3.6%)
Iceland	22 (0.1%)	115 (2.5%)	137 (0.7%)
Ireland	358 (2.3%)	128 (2.7%)	486 (2.4%)
Italy	1,370 (8.8%)	330 (7.1%)	1,700 (8.4%)
Latvia	277 (1.8%)	39 (0.8%)	316 (1.6%)
Lithuania	306 (2.0%)	28 (0.6%)	334 (1.7%)
Luxembourg	182 (1.2%)	156 (3.3%)	338 (1.7%)
Netherlands	479 (3.1%)	146 (3.1%)	625 (3.1%)

Table: Descriptive Statistics by Trade Union Membership

	Trade union membership		
	No	Yes	Total
N	15,530 (76.9%)	4,675 (23.1%)	20,205 (100.0%)
Norway	122 (0.8%)	170 (3.6%)	292 (1.4%)
Poland	1,597 (10.3%)	238 (5.1%)	1,835 (9.1%)
Portugal	597 (3.8%)	107 (2.3%)	704 (3.5%)
Romania	857 (5.5%)	240 (5.1%)	1,097 (5.4%)
Slovakia	311 (2.0%)	67 (1.4%)	378 (1.9%)
Slovenia	268 (1.7%)	75 (1.6%)	343 (1.7%)
Spain	1,387 (8.9%)	280 (6.0%)	1,667 (8.3%)
Sweden	173 (1.1%)	432 (9.2%)	605 (3.0%)
A_SEX: Are you. . . ?			
Male	7,901 (50.9%)	2,501 (53.5%)	10,402 (51.5%)
Female	7,617 (49.0%)	2,171 (46.4%)	9,788 (48.4%)
Non-binanry	12 (0.1%)	3 (0.1%)	15 (0.1%)

Table: Descriptive Statistics by Trade Union Membership

	Trade union membership		
	No	Yes	Total
N	15,530 (76.9%)	4,675 (23.1%)	20,205 (100.0%)
ISCOD1			
Armed forces occupations	28 (0.2%)	3 (0.1%)	31 (0.2%)
Managers	1,598 (10.3%)	416 (8.9%)	2,014 (10.0%)
Professionals	3,847 (24.8%)	1,400 (29.9%)	5,247 (26.0%)
Technicians and associate professionals	2,435 (15.7%)	675 (14.4%)	3,110 (15.4%)
Clerical support workers	2,742 (17.7%)	678 (14.5%)	3,420 (16.9%)
Service and sales workers	2,121 (13.7%)	646 (13.8%)	2,767 (13.7%)
Skilled agricultural, forestry and fishery workers	95 (0.6%)	26 (0.6%)	121 (0.6%)
Craft and related trades workers	999 (6.4%)	313 (6.7%)	1,312 (6.5%)
Plant and machine operators, and assemblers	711 (4.6%)	249 (5.3%)	960 (4.8%)
Elementary occupations	857 (5.5%)	220 (4.7%)	1,077 (5.3%)
NA/Unidentifiable	97 (0.6%)	49 (1.0%)	146 (0.7%)
sector			
Agriculture	190 (1.2%)	28 (0.6%)	218 (1.1%)
Medium-high-tech man	683 (4.4%)	189 (4.0%)	872 (4.3%)
Medium-low-tech man	539 (3.5%)	144 (3.1%)	683 (3.4%)
Low-tech man	1,152 (7.4%)	304 (6.5%)	1,456 (7.2%)
HKI services	1,241 (8.0%)	264 (5.7%)	1,505 (7.5%)
KI market services	1,473 (9.5%)	367 (7.9%)	1,840 (9.1%)
KI financial services	639 (4.1%)	203 (4.3%)	842 (4.2%)
Other KI sev	1,334 (8.6%)	491 (10.5%)	1,825 (9.0%)
Other services	2,208 (14.2%)	690 (14.8%)	2,898 (14.3%)
Construction	561 (3.6%)	127 (2.7%)	688 (3.4%)
Trade	1,903 (12.3%)	331 (7.1%)	2,234 (11.1%)
Education	1,403 (9.0%)	750 (16.1%)	2,153 (10.7%)
Tourism	709 (4.6%)	126 (2.7%)	835 (4.1%)

Table: Descriptive Statistics by Trade Union Membership

	Trade union membership		
	No	Yes	Total
N	15,530 (76.9%)	4,675 (23.1%)	20,205 (100.0%)
Firm size			
1 to 10	3,074 (19.8%)	493 (10.5%)	3,567 (17.7%)
11 to 49	4,383 (28.2%)	1,219 (26.1%)	5,602 (27.7%)
50 to 249	4,035 (26.0%)	1,335 (28.6%)	5,370 (26.6%)
250 or more	4,038 (26.0%)	1,628 (34.8%)	5,666 (28.0%)
Education			
Lower secondary education or below (ISCED 0-2)	1,319 (8.5%)	415 (8.9%)	1,734 (8.6%)
Upper secondary or post-secondary non-tertiary education (ISCED 3-4)	5,961 (38.4%)	1,714 (36.7%)	7,675 (38.0%)
Tertiary education (ISCED 5-8)	8,246 (53.1%)	2,537 (54.3%)	10,783 (53.4%)
Don't know/No Answer	4 (0.0%)	9 (0.2%)	13 (0.1%)
w_ hours	37.938 (7.855)	37.568 (7.472)	37.853 (7.770)

Table: Model estimates

	(1) baseline	(2) interaction	(3) PSM	(4) IV_ict_PSM
2.cnrct	-0.090*** (0.015)	-0.062** (0.022)	-0.116 (0.060)	0.103 (0.093)
ictskills	0.026*** (0.002)	0.030*** (0.003)	0.022*** (0.004)	0.063*** (0.019)
1.F_UNION1	0.014 (0.012)	0.026 (0.023)	-0.012 (0.027)	0.065 (0.046)
2.cnrctc.ictskills		-0.017** (0.006)	-0.035 (0.019)	-0.102* (0.043)
2.cnrct1.F_UNION1		0.062 (0.052)	0.094 (0.076)	-0.024 (0.119)
1.F_UNION1c.ictskills		-0.007 (0.005)	-0.001 (0.006)	-0.021 (0.012)
N	19,967	19,967	19,967	19,967
r2	.617	.618	.586	.579

Standard errors in parentheses

the baseline category for ict_rec is zero

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$