



Consequences of the Expansion of Working from Home and Digitalisation on Teleworkers' Work Intensification, Well-Being and Mental Health

Laetitia HAURET (LISER), Ludivine MARTIN (LISER, CREM, IZA)



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Background

- The labour market is undergoing substantial changes related to digital transformation, affecting occupational and skill structures (e.g. Arntz et al., 2016)
- Most of the jobs are changing with an increased use of digital tools. Cedefop (2020) shows that, in 2019, digital skills represented 20% of total skills demand in online job ads; this share has increased to 23% in 2020, which is the largest increase among all skills requested in online job ads

Background

- In 2021, we observed that:
 - Remote workers face more work intensification than other employees:
 - Working long hours: 14% versus 12%
 - Work intensity or workload: 71% versus 65%
 - A lower proportion of remote workers have a high well-being score: 49% versus 53%
 - There is no difference in the proportion of employees who are emotionally exhausted

Existing literature

- 1. Working from home (WfH) is linked to work intensification, well-being and mental health but mixed results:**
 - ✓ **No consensus on the link between WfH and the number of hours worked:** employees work the same number of hours while WfH or on site, while other find a decrease or an increase when at home (Giménez-Nadal & Velilla, 2020; Kifor et al., 2021; Pabilonia & Vernon, 2022)
 - ✓ **Positive association between WfH and workload:** due to fewer interruptions (Kunze et al., 2020; Tietze & Musson, 2002), higher motivation to thank employer for the opportunity to work remotely (Broadfoot, 2001; Kelliher & Anderson, 2010) or the normative expectation to be an ideal employee (Taskin & Devos, 2005)
 - ✓ **No consensus on the link between WfH and psychological well-being:** no relationship (Leitner, 2024), positive association (Boulet & Parent-Lamarche, 2022)
 - ✓ **No consensus on the relationship between WfH and bad mental health or job stress:** lack in-person interaction, more social isolation, blurred work-home boundary, or digital fatigue (EU-OSHA, 2024, Kotera & Correa Vione, 2020), but lower job stress (Olsen et al., 2023), lower burnout (Moens et al., 2022), good self-rated mental health (Bodner, 2022)

Existing literature

2. The role of digital transformation is less studied:

- ✓ **Few evidence on the association between the use of digital tools and work intensification (working hours or workload) in a WfH context:** positive association with work intensity (Soucek et al., 2024)
- ✓ **No consensus between digitalisation and employee well-being:** digital use reduces job satisfaction (Martin, Hauret, et al., 2022), positive association between technostress and psycho-physical disorders (Zito et al., 2021). But technology acceptance is positively related to work engagement (Shamsi et al., 2021)
- ✓ **Positive association between the use of digital tools and bad mental health or job stress:** digital use or technostress in a WfH environment is shown to be positively related to remote workers' job stress (Martin, Hauret, et al., 2022; Molino et al., 2020). Techno-stressors are positively correlated with burnout and anxiety symptoms (Consiglio et al., 2023)

Our contribution

- Fill the gaps identified in the literature by studying the link between digitalisation and work intensification, mental health and well-being
- Focus on remote workers

Research question:

Does digitalisation drive work intensification, well-being and mental health of remote workers?

- As remote workers are not confronted with a single type of digital tool, but a variety of them, it is imperative to consider their digital environment
- We make a distinction between a wide range of digital tools exposure

Data

- **For work intensification, well-being and mental health at work:**
2021 European Working Conditions and Telephone Survey (EWCTS) conducted by Eurofound
- **For digitalisation:**
5 external data sources: EU-KLEMS, EIB, Prytkova et al. (2024), Lewandowski et al. (2022) and Tolan et al. (2021)
- **17 EU countries covered:** Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Latvia, Lithuania, Netherlands, Slovenia, Slovakia, Sweden and Spain
- Due to data availability, exclusion of some business sectors (NACE Rev 2 1d: A, B, D, E, O, P, Q, T and U)
- Focus on employees who work from home always or often

Definition of dependent variables

- **Work intensification:**
 - Working long hours: working at least 48 hours a week
 - Work intensity or workload: working at very high speed or working to tight deadlines or having emotionally disturbing work
- **Well-being at work:**
 - Having a high score of WHO-5 Well-Being Index (Topp et al., 2015) (covering: cheerful and good spirits; calm and relaxed; active and vigorous; fresh and rested; daily life filled with interesting things)
- **Bad mental health:**
 - Feeling, at least occasionally, emotionally exhausted by work

Definition of digital tools exposure

Indicator	Definition	Sources	Year	Level of match
Communication technologies (CT) density exposure	Net capital stock of telecommunications equipment / employment	EU-KLEMS	2020	Country & sector
Information technologies (IT) density exposure	Net capital stock of computer hardware / employment	EU-KLEMS	2020	Country & sector
Database (DB) density exposure	Net capital stock of computer software and database / employment	EU-KLEMS	2020	Country & sector
ADT investments	Advanced Digital Technologies - firms	EIB	2021	Group of countries & sector
ADT exposure	Advanced Digital Technologies -occupation/sector	Prytkova et al. (2024)	2012-2021	Sector & occupation
AI risk exposure	Artificial intelligence risk	Tolan et al. (2021)	2020	Occupation
Automation risk exposure	Standardized Routine Task Intensity	Lewandowski et al. (2022)	2017	Country & occupation

Dummy = 1 if the value of the indicator is at the upper end of the distribution in the sample (>75%)

Definition of control variables

- **Individual characteristics:** EWCTS

Gender, age, highest level of education, and having children

- **Job characteristics:** EWCTS

Skill level of occupation, tenure, having an open-ended contract, and working part-time

- **Firms characteristics:** EWCTS

Firm size, private sector, and business sectors

- **Country characteristics:** EWCTS + OECD

4 country groups, country unemployment rate and country yearly GDP growth + Employment Protection Legislation:

- Share of employees covered by a collective agreement (2018)
- Share of employees who are trade union members (2018)
- Strictness of regulation on the use of fixed-term and temporary work agency contracts (2019)
- Strictness of regulation of collective dismissal (2019)
- Strictness of regulation of individual dismissal of employees on regular/indefinite contracts (2019)

Methodology

1. Regressions of dependent variables with digital tools exposure by taking into account potential sample selection:

$$Y_{ijc}^m = \alpha_0 + \beta'CT + \gamma'IT + \delta'DB + \theta'ADTinv + \vartheta'ADTexp + \pi'AI + \rho'RTI + \mu'X_{ijc} + \sigma'J_{ijc} + \tau'F_{jc} + \varphi'C_c + \varepsilon_{ijc} \text{ if } Z=1$$

$$\text{Where } Z_{ijc} = a'X_{ijc} + b'J_{ijc} + c'F_{jc} + d'C_c + e'T_{ijc} + f'S_{ijc} + \omega_{ijc}$$

where Y_{ijc}^m refers to dependent variables of worker i in industry j and country c in 2021. α_0 is the constant, X_{ijc} are control variables about employees' characteristics, J_{ijc} about job characteristics, F_{jc} about firm characteristics, C_c about country characteristics and ε_{ijc} the remaining error term.

In the selection equation we add: T_{ijc} : Index of job teleworkability and S_{ijc} : Index of social interaction

2. Cluster analysis to determine digital profiles using K-means

3. Regressions of dependent variables on cluster of digital profiles by taking into account potential sample selection:

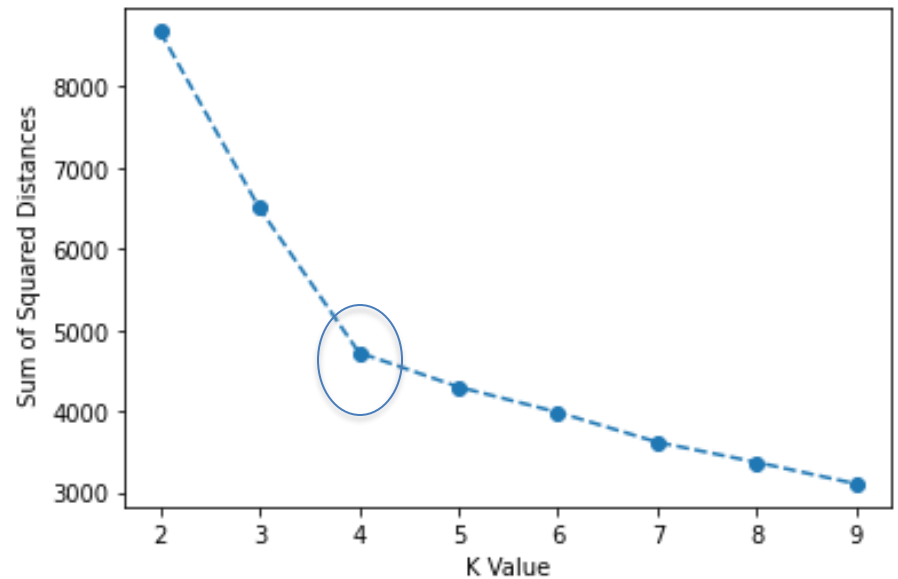
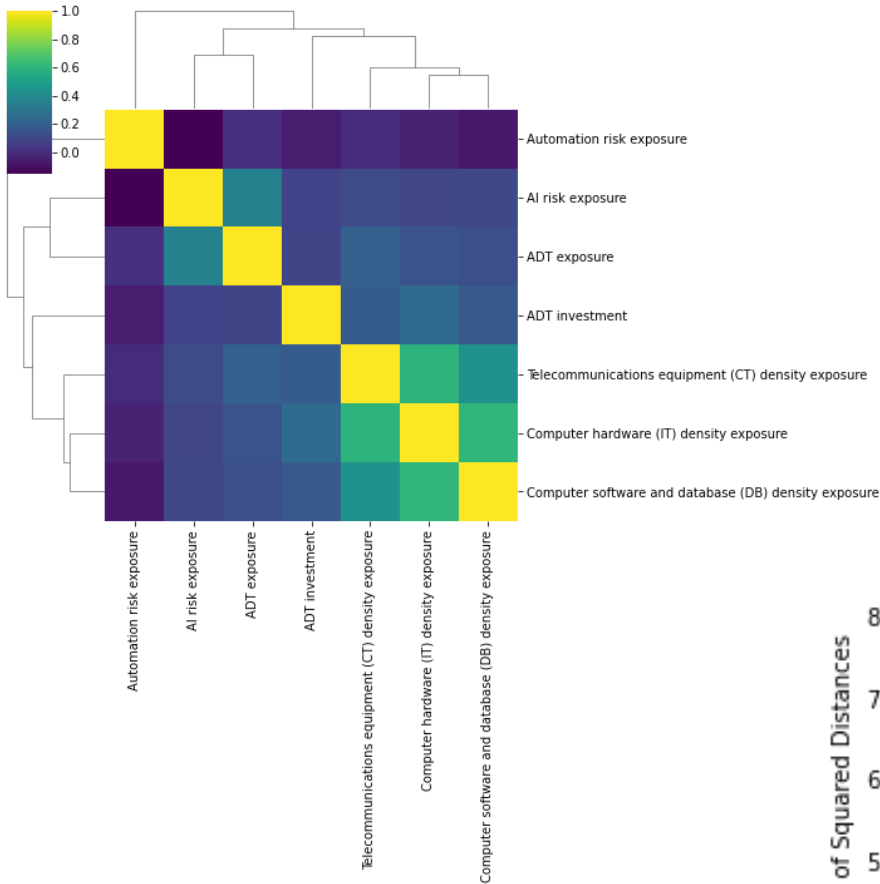
$$Y_{ijc}^m = \alpha_0 + \beta'DigitalProfile + \mu'X_{ijc} + \sigma'J_{ijc} + \tau'F_{jc} + \varphi'C_c + \varepsilon_{ijc} \text{ if } Z=1$$

$$\text{Where } Z_{ijc} = a'X_{ijc} + b'J_{ijc} + c'F_{jc} + d'C_c + e'T_{ijc} + f'S_{ijc} + \omega_{ijc}$$

Main results – digital tools exposure

	Heckprobit	Heckprobit	Probit	Probit
	Working long hours	Work intensity	High score of well-being	Bad mental health (emotionally exhausted)
CT density exposure	0.0497	0.0154	-0.0151	0.0640*
	(0.0315)	(0.0196)	(0.0394)	(0.0330)
IT density exposure	-0.0583	-0.0958***	0.0148	-0.114***
	(0.0555)	(0.0325)	(0.0332)	(0.0361)
DB density exposure	0.0516*	0.0654**	-0.0186	0.0148
	(0.0295)	(0.0265)	(0.0303)	(0.0451)
ADT investments	0.0161	0.0197	-0.0761	-0.00185
	(0.0525)	(0.0432)	(0.0528)	(0.0670)
ADT exposure	-0.0871**	-0.0294	-0.00299	-0.0186
	(0.0358)	(0.0258)	(0.0207)	(0.0334)
AI risk exposure	-0.202***	-0.0844***	0.00733	-0.0699***
	(0.0592)	(0.0267)	(0.0285)	(0.0249)
Automation risk exposure (RTI)	-0.134***	-0.101**	0.0178	-0.0927***
	(0.0502)	(0.0421)	(0.0204)	(0.0280)
Individuals controls	Yes	Yes	Yes	Yes
Labour market controls	Yes	Yes	Yes	Yes
Nb of observations	20,237	20,641	-	-
Nb of teleworkers	5,430	5,528	7,088	3,661
Log likelihood	-10614.25	-12010.59	-4764.5783	-2330.3242

Cluster of digital profiles (K-means)



4 digital environments profiles

Low impacted by digitalisation (Reference group)	Past wave of digitalisation	Automation wave	New wave of digitalisation
42%	23%	18%	17%
Less exposed, than the others, to the different wave of digitalisation	More exposed, than the others, to the past wave of digitalisation	More exposed, than the others, to automation	More exposed, than the others, to the new wave of digitalisation
	CT, IT, DB, ADT investments	High RTI score	AI, ADT exposure

Main results – Digital environments profiles

	Heckprobit	Heckprobit	Probit	Probit
	Working long hours	Work intensity	High score of well-being	Bad mental health (emotionally exhausted)
Low digitalisation	Ref.	Ref.	Ref.	Ref.
Past wave	-0.163**	-0.0565	-0.127***	-0.116
	(0.0711)	(0.0740)	(0.0389)	(0.0925)
Automation wave	-0.105	-0.129	-0.0407	-0.156**
	(0.0857)	(0.0913)	(0.0528)	(0.0741)
New wave	-0.646***	-0.248***	-0.0841*	-0.306***
	(0.0921)	(0.0523)	(0.0449)	(0.0643)
Individuals controls	Yes	Yes	Yes	Yes
Labour market controls	Yes	Yes	Yes	Yes
Nb of observations	20,237	20,641		
Nb of teleworkers	5,430	5,528	7,088	3,661
Log likelihood	-10625.92	-12024.78	-4766.6391	-2335.113

Main results – Digital profiles - Gender

	Heckprobit	Heckprobit	Heckprobit	Heckprobit	Probit	Probit	Probit	Probit
	Working long hours	Working long hours	Work intensity	Work intensity	High score of well-being	High score of well-being	Bad mental health	Bad mental health
	Men	Women	Men	Women	Men	Women	Men	Women
Low digitalisation	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Past wave	-0.279*** (0.0789)	0.0512 (0.0898)	-0.0371 (0.0831)	-0.105 (0.156)	-0.117* (0.0616)	-0.115 (0.0722)	-0.164 (0.150)	-0.0323 (0.157)
Automation wave	-0.133 (0.100)	0.00525 (0.130)	-0.0322 (0.127)	-0.238 (0.150)	-0.150 (0.0995)	0.130 (0.0892)	-0.106 (0.0988)	-0.195 (0.163)
New wave	-0.669*** (0.0894)	-0.541** (0.260)	-0.203*** (0.0661)	-0.339*** (0.0576)	-0.0821 (0.0555)	-0.0719 (0.172)	-0.342*** (0.0631)	-0.244* (0.131)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LM controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nb obs	11,814	8,423	12,048	8,593				
Nb remote worker	2,479	2,952	2,526	3,003	3,810	3,278	1,999	1,662
Log likelihood	-6326.698	-4210.728	-6981.734	-4959.387	-2678.7088	-2040.5191	-1277.0947	-1015.0311

Main results – Digital profiles - Age

	Heckprobit	Heckprobit	Heckprobit	Heckprobit	Probit	Probit	Probit	Probit
	Working long hours	Working long hours	Work intensity	Work intensity	High score of well-being	High score of well-being	Bad mental health	Bad mental health
	Less than 45	45 and more	Less than 45	45 and more	Less than 45	45 and more	Less than 45	45 and more
Low digitalisation	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Past wave	-0.0792	-0.232**	0.00949	-0.150	-0.109	-0.155**	-0.455***	0.224*
	(0.114)	(0.101)	(0.0627)	(0.138)	(0.0766)	(0.0644)	(0.133)	(0.120)
Automation wave	-0.201	-0.0633	-0.266**	-0.0270	-0.0354	-0.0114	-0.377*	0.0255
	(0.160)	(0.107)	(0.132)	(0.0825)	(0.0772)	(0.101)	(0.204)	(0.0978)
New wave	-0.407***	-0.952***	-0.200**	-0.326***	-0.193**	0.0660	-0.326***	-0.297**
	(0.0823)	(0.108)	(0.0891)	(0.0749)	(0.0922)	(0.0845)	(0.0800)	(0.122)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Labour market controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nb obs	12,182	8,055	12,397	8,244				
Nb remote w.	3,654	1,777	3,707	1,822	4,270	2,818	2,182	1,479
Log likelihood	-5601.717	-4929.759	-6456.443	-5491.151	-2535.4395	-2182.5168	-1220.9894	-1074.1025

Next steps

- Test other estimation models:
 - Conditional mixed-process (CMP) regression to take into account correlations between outcome variables
 - Structural equation modeling (SEM) to test if work intensification drives well-being, and well-being drives mental health
 - Other ideas?

Main take away

- Digitalisation is linked to remote workers' work intensification, well-being and mental health. However, the nature of this link depends on the digital environment in which remote workers work, in particular, on the digital wave with which they are most confronted:
 - The new wave of digitalisation enables the limitation of the two measures of work intensification, in contrast to the past wave that only limits working long hours
 - Both past and new waves of digitalisation are detrimental to the well-being of teleworkers
 - While previous wave of digitalisation is not linked to the mental health of remote workers, the automation wave and new wave are negatively linked to the feeling of emotional exhaustion
- The results are heterogeneous by gender and age

Thanks for your attention

Laetitia HAURET
laetitia.hauret@liser.lu

Ludivine MARTIN
ludivine.martin@liser.lu

WeLaR is Horizon Europe research project examining the impact of digitalisation, globalisation, climate change and demographic shifts on labour markets and welfare states in Europe. It aims to improve the understanding of the individual and combined effects of these trends and to develop policy proposals fostering economic growth that is distributed fairly across society and generates opportunities for all.

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