

eWork – Digitization and Working from Home

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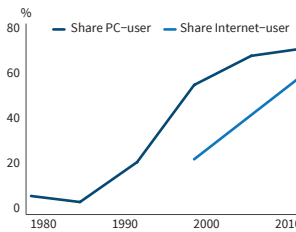


Motivation

- Digitization profoundly changes **how** and **where** we work
- Not everyone is (can be) a gig worker**
- Working from Home (WfH)** – within a traditional work arrangement – is often mentioned as an example of **virtual** and **mobile** work that may be facilitated by digital technologies
- Digitization-enabled WfH may potentially affect **a large fraction of the workforce** and **a wide variety of outcomes** from productivity to residential choice

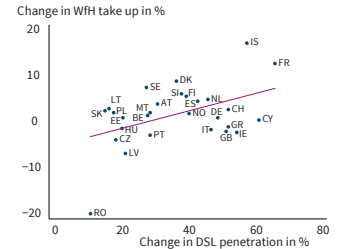


Evolution of PC- and Internet use at work



Sources: BIBB/BAuA 1979, 1986, 1992, 1999, 2006, 2012.

Change in WfH and DSL penetration (2002-09)

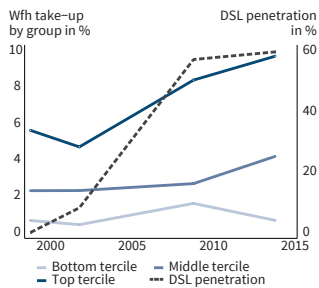


Sources: Eurostat (LFS), ITO (2019).
Notes: DSL = DSL subscriptions per 100 households

Empirical Approach

- Autor et al. (2003): computers primarily complement **non-routine interactive tasks** that are subject to **high costs of coordination and communication**
- Broadband availability should only lower the costs of WfH for **PC-using occupations**
- Consequently, we expect the largest effects on WfH take-up in occupations characterized by high intensity of non-routine, interactive tasks

WfH by occupations' degree of non-routine interactive task intensity over time



Sources: GSOEP 1999, 2002, 2009, 2014; BIBB/BAuA 1999; ITO 2019
Notes: DSL penetration = DSL subscriptions per 100 households

Identification:

$$\Delta WfH_i = \alpha + \sum_{j=1}^4 \beta_j PCuse_j \times \Delta DSL_i + \Delta X' \beta_5 + \varepsilon_i$$

$$z_i = \sum_{j=1}^4 \gamma_j PCuse_j \times PSTN_m$$

- First-difference model** to overcome biases that result from unobserved time-invariant factors that are correlated with both WfH and DSL take-up
- IV**—augmented version of Falck et al. (2014) based on
 - predetermined technological peculiarities** of the traditional public switched telephone network (PSTN) that affect DSL availability,
 - household's distance to MDF >4,200m
 - telephone infrastructure based on OPAL technology (not compatible with DSL)
 - interacted with **occupational PC-use/non-routine interactive task intensity**.
- 3SLS**—to estimate effects of digitization-enabled WfH on outcomes

Data & Sample:

- GSOEP:** nationally representative, longitudinal survey of private households
- Sample:** age 20–65, no self-employed, no marginally employed, no interns, no teaching and religious occupations, no home as main place of work
- PC-use and non-routine interactive task intensity measures based on 1999 BIBB/BAuA Employment Survey

Table 1: Descriptive statistics by household DSL adoption

	(1) No DSL	(2) DSL
N	1311	2651
WfH	0.089	0.187*
Change WfH since 2002	0.027	0.066*
Occupational PC-use intensity	0.506	0.637*
Non-routine interactive task intensity	0.309	0.375*
Residential move since 2002	0.280	0.291
Occupational change since 2002	0.304	0.335
Move to urban since 2002	-0.012	-0.004
Change to parttime since 2002	0.031	0.015
Change children in household since 2002	-0.111	-0.141
Change homeownership since 2002	0.064	0.106*
Female	0.444	0.388*
Age	47.806	46.672*

Source: GSOEP 2009; BIBB/BAuA 1999.
Notes: * Statistically different from no-dsl mean at the 5 percent confidence level.

Table 3: 3SLS Results—1st difference models

	job change (1)	occupation (2)	distance to work (3)	hourly gross wage (4)	contractual hours (5)	life satisfaction (6)	job satisfaction (7)
1.q PC-use × WfH	-0.127 (0.577)	2.516* (1.353)	27.081 (115.764)	29.915 (25.868)	-3.165 (20.141)	-22.020*** (4.986)	-9.183 (6.602)
2.q PC-use × WfH	0.041 (0.340)	0.118 (0.799)	-51.152 (111.709)	16.488 (10.442)	0.370 (8.193)	-11.020*** (2.997)	-4.394 (3.874)
3.q PC-use × WfH	0.029 (0.206)	0.551 (0.486)	-60.273 (54.975)	16.694** (7.218)	1.511 (5.590)	-5.628*** (1.859)	-0.988 (2.366)
4.q PC-use × WfH	0.118 (0.083)	0.192 (0.196)	-21.684 (21.842)	12.548*** (3.447)	0.592 (2.674)	-1.848** (0.741)	-0.049 (0.951)
N	3962	3962	3557	3592	3592	3949	3927

Source: GSOEP 2002, 2009; BIBB/BAuA 1999.
Notes: We assume zero DSL subscriptions in 2002. Instruments: „threshold at 4,200m“ and „OPAL“ as in Falck et al. (2014), interacted with occupational PC-use intensity. PC-use is defined as avg. share in 2-digit occupation based on BIBB/BAuA Employment Survey 1999 and merged to individual's 2002 job. 1.q PC-use = occupations with 0-30% pc use, 2.q PC-use = 30-70%, 3.q PC-use = 70-90%, 4.q PC-use = 90-100%. 1.q interactive = 0-20% nonroutine interactive tasks intensity, 2.q interactive = 20-40%, 3.q interactive = 40-50%, 4.q = 50-60%.
*** significant at 1%; ** significant at 5%; * significant at 10%.

Effect magnitude:

In non-routine interactive /PC-use intensive occupations, DSL adoption between 2002 and 2009 increased WfH by **~17-20 ppts** (2002 mean: 24%).

Conclusions & Outlook

Here:

Exploiting the historical variation in the pre-existing telephone infrastructure, we show that **DSL availability significantly increased WfH in non-routine interactive (PC-use intensive) occupations**.

Next:

- Who are the compliers?
- Intensive vs. extensive margin
- Mechanisms: demand- or supply-side effect?

- What happens beyond the broadband introduction phase?

- Develop novel instrument to examine years of broadband speed upgrade since 2009
- Explore additional datasets (e.g. PAIRFAM, German Microcensus, time use survey)