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# Digital Capacity and Employment Outcomes: Microdata Evidence from Pre- and Post-COVID-19 Europe

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# Outline

- 1 Background
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- 3 Contribution
- 4 Data
- 5 Results
- 6 Summary
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# Background and Stylized facts

- Macroeconomic perspective

- Tinbergen's race (1974) postulates the role of technological progress in widening inequality unless countered by increase in supply of human capital

- Skill-biased technological change: implications on employment and earnings: Goldin and Katz, 2008; Acemogly and Autor, 2012, 2011.

- Micro-empirical literature on digitalization

- firm-level studies on digital diffusion and disruption effects upon productivity: Nicoletti et al, 2020; Gal et al, 2019; Heredia et al., 2022; Pareliussen and Mosiashvili, 2020; Skog et al 2018; Corrado et al, 2017.

- Individual/household level research on digital divide: Akerman et al, 2015; Brynjolfsson and McAfee, 2012.

- Increasing emphasis on digital skills instead of the access to Internet and digital technologies

- A second level digital divide according to DiMaggio and Hargittai (2001), Hargittai (2002), Van Deursen and Van Dijk (2011).

# Labour economics perspective

- Effects of digitalization at the extensive margin on the employment (Non et al, 2021; Krutova et al, 2021; Bejaković and Mrnjavac, 2020; Evangelista et al, 2014)
  - improved employability of workers with mobility/time restrictions
  - reduction in labour search frictions and better job match
  - job creation and re-design: platform economy jobs, fully/partly remote jobs
- Effects of digitalization on productivity and labour supply at the intensive margin (Falck et al, 2021, Eggenberger and Backes-Gellner, 2021; Akerman et al, 2015)
  - Skill-driven improvement in productivity and returns to ICT skills
  - Compensating differentials related to partly/fully remote working opportunities

# Digital skills and employment: pre- and post-COVID-19 era

- Sostero et al (2020): Teleworkable employment in Europe increased on average by 20% after COVID-19 eruption.
  - strongest implications for "middle-skilled" employees whose work organization changed most dramatically
- Soh et al (2022): Digital employment remained more resilient during COVID-19 recession in the US, but there was no increase in absolute demand for digital occupations.
  - separating cognitive, routine and manual digital occupations they find that most of shielded digital employment arises from the cognitive digital work.
- Brinca et al (2021): 2/3rd of the drop in the aggregate growth rate of work hours in the US in March-April 2020 attributable to labor supply
- Gallant et al 2020: Alike previous crises in the US, COVID-19 breakout increased job separations, but unlike past recessions did not drop the hiring rates.
- Comparative COVID-19 implications across Europe
  - Fana et al (2020): Employment impact of COVID-19 across countries, sectors, low-, medium-, high-paid jobs
  - Müller et al (2021), Drahoukoupil and Müller (2021): Comparative view on COVID-19 job-retention-schemes

# The Aim and Contribution

- Micro-evidence on the link between broadband Internet access, digital skills and employment status pre- and post-COVID-19 in Europe
  - ✓ What have been the roles of Internet access, educational attainment level and digital skills on employment status?
  - ✓ How have the COVID-19-related economic and social disruptions mediated the skills–employment relationship in Europe?
  - ✓ Do intra-family spillovers from tertiary education matter for other family members' employment status?
  - ✓ Has COVID-19 regime changed the significance of intra-family tertiary education spillovers?

# Cognitive skills and digital capacity

- Educational attainment is a proxy for the level of general cognitive skills.
- Digital empowerment/capacity is accounted for on two levels
  - 1 Access to (broadband) Internet
  - 2 The level in digital skills
- Cognitive and digital skills association pre- and post-COVID-19 with
  - 1 Likelihood to be out of employment (unemployed or inactive, excl students out of labour force)
  - 2 Likelihood to hold a non-manual occupation corresponding to ISCO 0-5: managers, professionals, officials, clerks, technicians and service workers.
- Estimation framework includes estimations upon manual employment (ISCO 6-9) and ICT-employment, but these outcomes are not of main interest.

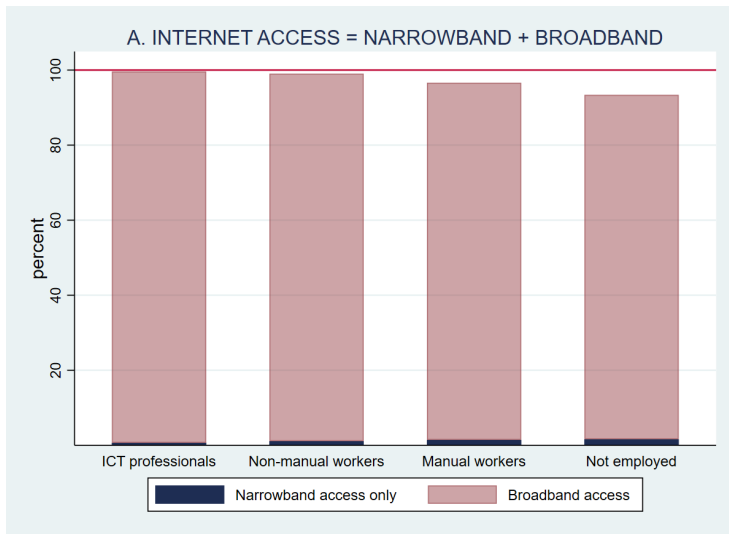
# Data on digital skills and employment

Community Statistics on Information Society (CSIS) waves 2017, 2019, 2021.

- Individual and household level data from 26 EU member countries and Norway
  - AT, BE ,BG ,CY, CZ, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, IT, LT, LU, LV, MT, NL, NO, PL, PT, SE, SI, SK.
  - Romania not included due to data issues.
    - individuals aged 25–54 years
    - employed, self-employed or unemployed/inactive, sample excludes students not in labour force
- Sample has altogether 262 277 individual-wave observations nested in 129 413 households
  - **unemployed 9.45%, 10.85% inactive**
  - manual workers 21.12%
  - **non-manual workers 55.84%**
  - ICT professionals 2.74%

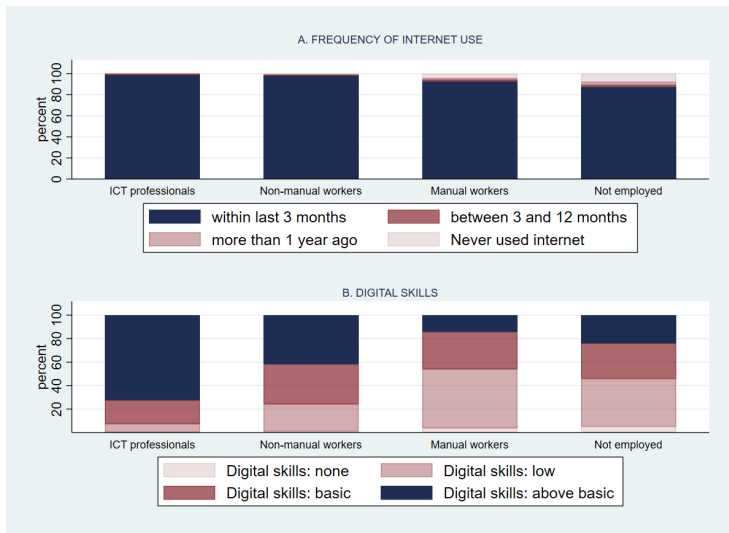


# Access to Internet in Europe



Source: Community Statistics on Information Society, 2021.

# Frequency of Internet use and digital skills



## CSIS: Digital skills

CSIS gives a multi-dimensional measure of digital skills:

- 1 information and data literacy skills;
- 2 communication and collaboration skills;
- 3 problem solving skills and
- 4 digital content creation skills
- 5 digital safety skills

Within and across these skill dimensions the individuals are divided into

- 1 no skills;
- 2 low skills;
- 3 basic skills and
- 4 above basic skills

# CSIS: Community Statistics on Information Society

CSIS has 6 modules, each containing several multiple-choice questions.

Altogether 127 original variables/questions plus 5 derived and computed by Eurostat synthetic digital skills measures.

- Household level
  - ① Module A: Access to ICT in the household; 3 variables/questions
- Individual level
  - ② Module B: Use of the Internet, 22 variables/questions
  - ③ Module C: Use of E-Government, 11 variables/questions
  - ④ Module D: Use of E-Commerce, 64 variables/questions
  - ⑤ Module E: E-skills, 17 variables/questions
  - ⑥ Module F: Internet security: Privacy and protection of personal data, 10 variables/questions.

## Data on COVID-19

The NUTS1 level regional and country level data on COVID-19 were retrieved from three sources.

- The cumulative COVID-19 incidence rates by 2021 were sourced from
  - 1 Naqvi (2021): COVID-19 European Regional Tracker, an open data source at sub-national level for 26 European countries
  - 2 Our World in Data COVID-19 dataset for (small) countries missing NUTS1 level information
- The COVID-19 containment and closure aggregate indices, the composite stringency index and Economic Support Index (ESI)
  - 3 Hale et al (2021): the Oxford COVID-19 Government Response Tracker (OxCGRT)

# Joint estimation of employment and digital skills

- Bivariate (recursive) ordered probit estimated with FIML, household level clustered standard errors.
  - 1 Ordered employment outcome: (1) not employed; (2) manual workers; (3) non-manual workers and (4) ICT professionals
  - 2 Ordered digital skills: 0 - none; 1 - low; 2 - basic; 4 - above basic

Regional & household instruments → Digital skills

Digital skills,  $DSK_{ordered}$  ⇒ Employment,  $EMPL_{ordered}$

endogenous digital skills:  $DSK_i = \mathbf{x}'_{1jt} \gamma_1 + \mathbf{x}'_{1ht} \gamma_2 + \delta_{1j} + \delta_{1t} + \varepsilon_{1i}$

employment:  $EMPL_i = COVID_j \times \mathbf{x}'_{2i} \alpha_1 + \mathbf{x}'_{2i} \alpha_2 + \mathbf{z}'_i \beta + \delta_{2j} + \delta_{2t} + \varepsilon_{2i}$

## • INSTRUMENTS

- Household demographics: age and gender composition of other working age (25-54) family members
- Regional NUTS1 and country aggregates on digital access/use, share of population with tertiary education, country-age-group mean digital skills

# Marginal effects upon probability to be out of employment

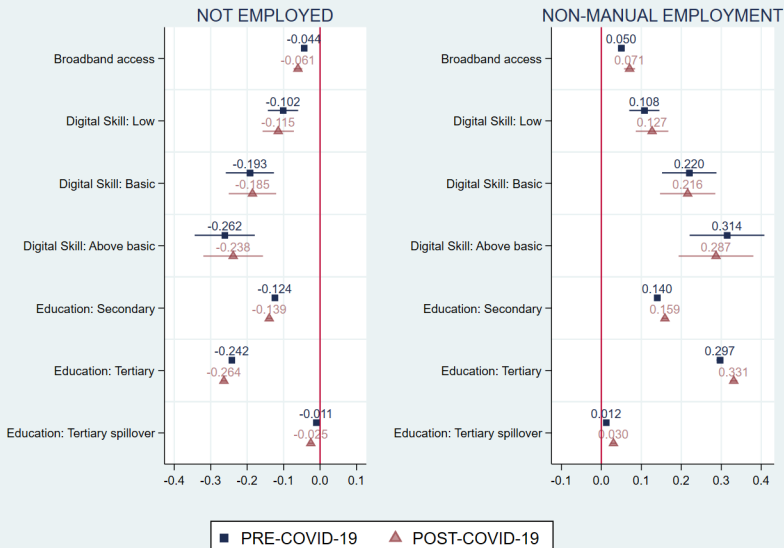
| Probability of non-participation    | Conditional on marginal effects |                        |                        |                        | Unconditional marginal effects              |                        |                                |                        |                        |                        |
|-------------------------------------|---------------------------------|------------------------|------------------------|------------------------|---|------------------------|--------------------------------|------------------------|------------------------|------------------------|
|                                     | Pre- and post-COVID-19 samples  |                        |                        |                        | Total sample including 2017, 2019, and 2021 |                        |                                |                        |                        |                        |
|                                     | Ordered <i>probit</i>           |                        | Ordered <i>probit</i>  |                        |   |                        | Extended ordered <i>probit</i> |                        |                        |                        |
|                                     | Pre-Covid19                     | Stringency             | Cumulative Cases       |                        | Stringency                                  |                        | Cumulative Cases               |                        | Stringency             |                        |
| Post-Covid19                        |                                 | Pre-Covid19            | Post-Covid19           | Pre-Covid19            | Post-Covid19                                | Pre-Covid19            | Post-Covid19                   | Pre-Covid19            | Post-Covid19           |                        |
| Broadband Internet access           | -0.0413***<br>(0.0045)          | -0.0574***<br>(0.0087) | -0.0435***<br>(0.0031) | -0.0610***<br>(0.0061) | -0.0450***<br>(0.0032)                      | -0.0526***<br>(0.0058) | -0.0439***<br>(0.0032)         | -0.0607***<br>(0.0061) | -0.0453***<br>(0.0032) | -0.0525***<br>(0.0058) |
| Digital skills, base "none"         |                                 |                        |                        |                        |   |                        |                                |                        |                        |                        |
| Skills, low                         | -0.0940***<br>(0.0051)          | -0.1133***<br>(0.0079) | -0.1019***<br>(0.0035) | -0.1139***<br>(0.0057) | -0.1033***<br>(0.0036)                      | -0.1087***<br>(0.0053) | -0.1017***<br>(0.0212)         | -0.1148***<br>(0.0219) | -0.1031***<br>(0.0216) | -0.1093***<br>(0.0221) |
| Skills, basic                       | -0.1737***<br>(0.0054)          | -0.1803***<br>(0.0081) | -0.1911***<br>(0.0037) | -0.1831***<br>(0.0058) | -0.1922***<br>(0.0038)                      | -0.1784***<br>(0.0055) | -0.1926***<br>(0.0337)         | -0.1855***<br>(0.0332) | -0.1937***<br>(0.0343) | -0.1802***<br>(0.0338) |
| Skills, above basic                 | -0.2441***<br>(0.0054)          | -0.2288***<br>(0.0082) | -0.2619***<br>(0.0037) | -0.2373***<br>(0.0059) | -0.2651***<br>(0.0038)                      | -0.2274***<br>(0.0056) | -0.2616***<br>(0.0421)         | -0.2384***<br>(0.0417) | -0.2647***<br>(0.0429) | -0.2285***<br>(0.0426) |
| Education, base "below secondary"   |                                 |                        |                        |                        |   |                        |                                |                        |                        |                        |
| Secondary education                 | -0.1269***<br>(0.0039)          | -0.1335***<br>(0.0057) | -0.1237**<br>(0.0025)  | -0.1413***<br>(0.0039) | -0.1242***<br>(0.0025)                      | -0.1384***<br>(0.0038) | -0.1243***<br>(0.0026)         | -0.1395***<br>(0.0039) | -0.1247***<br>(0.0026) | -0.1369***<br>(0.0037) |
| Tertiary education                  | -0.2363***<br>(0.0040)          | -0.2541***<br>(0.0058) | -0.2417***<br>(0.0026) | -0.2650***<br>(0.0039) | -0.2441***<br>(0.0026)                      | -0.2585***<br>(0.0039) | -0.2424***<br>(0.0027)         | -0.2639***<br>(0.0039) | -0.2446***<br>(0.0028) | -0.2579***<br>(0.0039) |
| Household other, tertiary education | -0.0128***<br>(0.0021)          | -0.0328***<br>(0.0045) | -0.0113***<br>(0.0015) | -0.0273***<br>(0.0032) | -0.0102***<br>(0.0015)                      | -0.0296***<br>(0.0030) | -0.0106***<br>(0.0015)         | -0.0255***<br>(0.0032) | -0.0096***<br>(0.0015) | -0.0278***<br>(0.0030) |
| Corr(EmplStatus & DigSkill)         |                                 |                        |                        |                        |   |                        | 0.1903***<br>(0.0483)          |                        | 0.1866***<br>(0.0494)  |                        |
| Log-Likelihood                      | 312 168 497.2                   | -162 382 447.4         | -246 395.66            |                        | -246 386.88                                 |                        | -568 900.3                     |                        | -568 894.7             |                        |
| Observations                        | 175 971                         | 86 306                 | 262 277                |                        | 262 277                                     |                        | 262 277                        |                        | 262 277                |                        |
| Households                          | 108 850                         | 72 683                 | 129 413                |                        | 129 413                                     |                        | 129 413                        |                        | 129 413                |                        |
| Wald Chi-square                     | 23 688.26                       | 10 295.82              | 60 526.39              |                        | 60 663.41                                   |                        |                                |                        |                        |                        |
| Pseudo R-square                     | 0.1350                          | 0.1074                 | 0.1269                 |                        | 0.1269                                      |                        |                                |                        |                        |                        |

## Conditional and unconditional estimates

- Conditional and unconditional marginal effects are qualitatively similar
  - No major differences in coefficients from the uni- and bivariate estimations
  - The correlation between unobservables is 0.19 in both two-equation specifications: with COVID-19, regional cumulative cases and with COVID-19, governments stringency measures.
- Hints that digital skills may be endogenous due to measurement error and/or reverse causality



## Results



\* Data: CSIS 2017, 2019, 2021, Nagvi (2021): COVID-19 European Regional Tracker. Eurostat.



## Findings: non-participation

- Household Internet access decreases non-participation
  - ✓ pre-COVID-19: by  $\sim 4 - 4.5\%$
  - ✓ post-COVID-19: by  $\sim 5 - 6\%$
- Digital skills decrease non-participation
  - ✓ pre-COVID-19: Low - by  $\sim 9 - 10\%$ ; Basic - by  $\sim 19\%$ , Above Basic - by  $\sim 26 - 26.5\%$
  - ✓ post-COVID-19: Low - by  $\sim 11 - 11.5\%$ ; Basic - by  $\sim 18 - 18.5\%$ , Above Basic - by  $\sim 23 - 24\%$
- Tertiary education decreases non-participation
  - ✓ pre-COVID-19: secondary - by  $\sim 12 - 13\%$ ; tertiary - by  $\sim 24 - 24.5\%$
  - ✓ post-COVID-19 secondary - by  $\sim 13 - 14\%$ ; tertiary - by  $\sim 25 - 26.5\%$
- Education spillovers within family decrease non-participation
  - ✓ pre-COVID-19: by  $\sim 1\%$
  - ✓ post-COVID-19 by  $\sim 2.5 - 3\%$

# Marginal effects upon probability of non-manual occupation

| Probability of employment in non-manual occupations (ISCO 0–5) | Conditional on marginal effects |                       | Unconditional marginal effects              |                       |                       |                       |                                |                       |                       |                       |
|--|---------------------------------|-----------------------|---|-----------------------|-----------------------|-----------------------|--------------------------------|-----------------------|-----------------------|-----------------------|
|  | Pre- and post-COVID-19 samples  |                       | Total sample including 2017, 2019, and 2021 |                       |                       |                       |                                |                       |                       |                       |
|  | Ordered <u>probit</u>           |                       | Ordered <u>probit</u>                       |                       |                       |                       | Extended ordered <u>probit</u> |                       |                       |                       |
|  | Pre-Covid19                     | Stringency            | Cumulative Cases                            |                       | Stringency            |                       | Cumulative Cases               |                       | Stringency            |                       |
| Post-Covid19   |                                 | Pre-Covid19           | Post-Covid19                                | Pre-Covid19           | Post-Covid19          | Pre-Covid19           | Post-Covid19                   | Pre-Covid19           | Post-Covid19          |                       |
| Broadband Internet access                                      | 0.0488***<br>(0.0053)           | 0.0633***<br>(0.0094) | 0.0493***<br>(0.0035)                       | 0.0710***<br>(0.0070) | 0.0506***<br>(0.0036) | 0.0616***<br>(0.0067) | 0.0497***<br>(0.0036)          | 0.0707***<br>(0.0071) | 0.0510***<br>(0.0037) | 0.0615***<br>(0.0067) |
| Digital skills, base "none"                                    |                                 |                       |   |                       |                       |                       |                                |                       |                       |                       |
| Skills, low  | 0.1037***<br>(0.0053)           | 0.1207***<br>(0.0079) | 0.1082***<br>(0.0035)                       | 0.1262***<br>(0.0060) | 0.1094***<br>(0.0036) | 0.1211***<br>(0.0056) | 0.1076***<br>(0.0192)          | 0.1269***<br>(0.0208) | 0.1088***<br>(0.0195) | 0.1214***<br>(0.0212) |
| Skills, basic  | 0.2064***<br>(0.0058)           | 0.1998***<br>(0.0083) | 0.2184***<br>(0.0039)                       | 0.2135***<br>(0.0062) | 0.2190***<br>(0.0039) | 0.2098***<br>(0.0059) | 0.2199***<br>(0.0347)          | 0.2160***<br>(0.0353) | 0.2206***<br>(0.0352) | 0.2118***<br>(0.0363) |
| Skills, above basic  | 0.3079***<br>(0.0061)           | 0.2590***<br>(0.0086) | 0.3151***<br>(0.0040)                       | 0.2857***<br>(0.0064) | 0.3183***<br>(0.0041) | 0.2758***<br>(0.0061) | 0.3144***<br>(0.0477)          | 0.2868***<br>(0.0477) | 0.3174***<br>(0.0484) | 0.2770***<br>(0.0491) |
| Education, base "below secondary"                              |                                 |                       |   |                       |                       |                       |                                |                       |                       |                       |
| Secondary education  | 0.1507***<br>(0.0044)           | 0.1476***<br>(0.0060) | 0.1391***<br>(0.0027)                       | 0.1611***<br>(0.0041) | 0.1393***<br>(0.0027) | 0.1586***<br>(0.0040) | 0.1397***<br>(0.0029)          | 0.1591***<br>(0.0041) | 0.1397***<br>(0.0030) | 0.1570***<br>(0.0040) |
| Tertiary education   | 0.3076***<br>(0.0051)           | 0.3013***<br>(0.0066) | 0.2960***<br>(0.0031)                       | 0.3320***<br>(0.0044) | 0.2983***<br>(0.0032) | 0.3255***<br>(0.0045) | 0.2967***<br>(0.0043)          | 0.3312***<br>(0.0047) | 0.2989***<br>(0.0045) | 0.3252***<br>(0.0047) |
| Household other, tertiary education                            | 0.0154***<br>(0.0025)           | 0.0367***<br>(0.0050) | 0.0129***<br>(0.0017)                       | 0.0324***<br>(0.0038) | 0.0116***<br>(0.0017) | 0.0354***<br>(0.0036) | 0.0121***<br>(0.0017)          | 0.0303***<br>(0.0038) | 0.0109***<br>(0.0018) | 0.0332***<br>(0.0037) |
| <u>Corr(EmplStatus &amp; DigSkill)</u>                         |                                 |                       |   |                       |                       |                       | 0.1903***<br>(0.0483)          |                       | 0.1866***<br>(0.0494) |                       |
| Log-Likelihood   | -312 269 963.5                  | -162 519 185.8        |   | -246 395 66           |                       | -246 386 88           |                                | -568 900.3            |                       | -568 894.7            |
| Observations   | 175 971                         | 86 306                |   | 262 277               |                       | 262 277               |                                | 262 277               |                       | 262 277               |
| Households   | 108 850                         | 72 683                |   | 129 413               |                       | 129 413               |                                | 129 413               |                       | 129 413               |
| Wald Chi-square  | 23 645.04                       | 10 287.07             |   | 60 526.39             |                       | 60 663.41             |                                |                       |                       |                       |
| Pseudo R-square  | 0.1347                          | 0.1067                |   | 0.1269                |                       | 0.1269                |                                |                       |                       |                       |

## Findings: non-manual employment

- Household Internet access increase non-manual employment
  - ✓ pre-COVID-19: by ~ 5%
  - ✓ post-COVID-19: cumulative cases by ~ 7%, stringency by ~ 6%
- Digital skills increase non-manual employment
  - ✓ pre-COVID-19: Low - by ~ 10 – 11%; Basic - by ~ 21 – 22%, Above Basic - by ~ 31 – 32%
  - ✓ post-COVID-19: Low - by ~ 12 – 13%; Basic - by ~ 20 – 22%, Above Basic - by ~ 26 – 29%
- Tertiary education increase non-manual employment
  - ✓ pre-COVID-19: secondary - by ~ 14 – 15%; tertiary - by ~ 30 – 31%
  - ✓ post-COVID-19 secondary - by ~ 15 – 16%; tertiary - by ~ 32.5 – 33%
- Education spillovers within family increase non-manual employment
  - ✓ pre-COVID-19: by ~ 1 – 1.5%
  - ✓ post-COVID-19 by ~ 3 – 3.5%

# Marginal effects at secondary and tertiary education



\* Data: CSIS 2017, 2019, 2021. Naqvi (2021): COVID-19 European Regional Tracker. Eurostat.



# Summary Results

- COVID-19 did not fundamentally change the skill-employment link.
  - General cognitive skills from educational attainment became even more important. Confirming evidence by Soh et al (2022).
- Analysis still suggests some COVID-19 twists in employment benefits that arose on two levels:
  - ✓ Gains from internet connection at home
  - ✓ Digital skills positive effect at lower end of the digital skill distribution and negative effect at the higher end of skill distribution remain statistically insignificant in two equation eprobit estimation, but remain marginally significant in single equation ordered probit estimation.
  - ✓ Digitally literate gained from higher educational attainment level that empowered them with flexibility and capacity for re-organising their work.
- Private benefits from Internet connection and from entry-level digital skills are likely to vanish over time being suppressed by growing Internet access and digital skill levels
- Contrasting estimations w.r.t cumulative cases and stringency measures shows that governments containment and support measures have
  - suppressed the effect of broadband access
  - suppressed the skill effect
  - magnified the within household spill-over effect upon employment outcomes

# Cross-Model Wald Test

| <i>Parameters</i>                                     | <i>Wald chi-square</i> | <i>p-value</i> |
|---|------------------------|----------------|
| Broadband internet access (BIACC)                     | 5.0522**               | 0.0246         |
| <i>Digital skills: base skills, none</i>              |                        |                |
| Skills, low   | 3.4284*                | 0.0641         |
| Skills, basic   | 0.8507                 | 0.3563         |
| Skills, above basic                                   | 14.2419***             | 0.0002         |
| <i>Educational attainment: base primary education</i> |                        |                |
| Secondary education                                   | 0.8908                 | 0.3453         |
| Tertiary education                                    | 25.6215***             | 0.0000         |
| Household spillover, tertiary education               | 6.4265**               | 0.0112         |

- Ordered probit estimates:
  - cumulative COVID-19 cases by NUTS1 regions, COVID-19 European Regional Tracker Naqvi(2021)
  - COVID-19 stringency index, Oxford COVID-19 Government Response Tracker (OxCGRT), Hale et al.(2021)
- Clogg-Petkova-Haritou. 1995. "Statistical methods for comparing regression coefficients between models." American journal of sociology 100(5): 1261-1293.

## Conclusions and Further Study

- The results manifest skill-biased labour market outcomes in response to COVID-19
  - digital empowerment effects via digital access, education and family effects strengthened post COVID-19
- The formal education is highly complementary to digital empowerment and its role has increased post COVID-19 - directly and indirectly via family spillovers
- Tentative evidence on inverted digital divide during Covid-19 pandemic (Grishchenko, 2022)
  - the gain gap between "no skills" and "low skills" widened at the lower end of digital skills distribution
  - the gain gap shrank at the higher end of digital skills distribution
- Further studies on richer data have to cast light which worker groups benefit most from the digital skills and what dynamics might be expected for the future.



# Thank You

- Questions?

# Probit Results

## Ordered Probit estimations, Cumulative Covid-19 cases



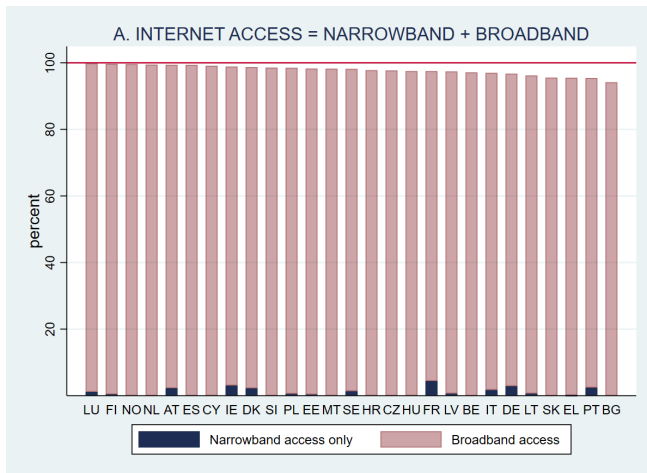
# Marginal effects at secondary and tertiary education



\* Data: CSIS 2017, 2019, 2021. Naqvi (2021): COVID-19 European Regional Tracker. Eurostat.



# Access to Internet in Europe

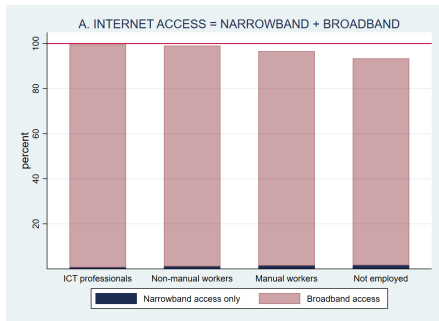


Source: Community Statistics on Information Society, 2021.

On average  $\approx 4\%$  of households (incl a member aged 25–54) have no broadband access from home.

Question: Do you or anyone in your household have access to the Internet (over broadband connection) at home?

- Fixed broadband: DSL, ADSL, VDSL, cable, optical fibre, satellite, public WiFi connections
- Mobile broadband: via mobile phone network, at least 3G, e.g. UMTS, using (SIM) card or USB key, mobile phone or smart phone as modem



Source: Community Statistics on Information Society, 2021.

## Descriptive Statistics

|                                    | Pre Covid-19: CSIS2017/2019 |               |                   |                  |          | Post Covid-19: CSIS2021 |               |                   |                  |           |
|------------------------------------|-----------------------------|---------------|-------------------|------------------|----------|-------------------------|---------------|-------------------|------------------|-----------|
|                                    | Unemployed/inactive         | Manual worker | Non-manual worker | ICT professional | Total    | Unemployed/inactive     | Manual worker | Non-manual worker | ICT professional | Total     |
| No of observations                 | 36 218                      | 38 403        | 97 041            | 4 300            | 175 971  | 17 027                  | 17 002        | 40 407            | 2 870            | 85 306    |
| Percentage from total              | 21%                         | 22%           | 55%               | 2%               | 100%     | 20%                     | 20%           | 57%               | 3%               | 100%      |
| <b>Proportions</b>                 |                             |               |                   |                  |          |                         |               |                   |                  |           |
| Broadband access in household      | 0.8655                      | 0.9130        | 0.9882            | 0.9923           | 0.9973   | 0.9265                  | 0.9500        | 0.9750            | 0.9886           | 0.9406    |
| Internet use: within 3 months      | 0.8194                      | 0.8868        | 0.9770            | 0.9956           | 0.9275   | 0.8977                  | 0.9330        | 0.9831            | 0.9907           | 0.9560    |
| Internet use: between 3-12 months  | 0.0196                      | 0.0174        | 0.0054            | 0.0012           | 0.0107   | 0.0144                  | 0.0129        | 0.0039            | 0.0011           | 0.0077    |
| Internet use: more than 1 year ago | 0.0299                      | 0.0187        | 0.0063            | 0.0026           | 0.0134   | 0.0242                  | 0.0119        | 0.0060            | 0.0065           | 0.0119    |
| Internet use: Never                | 0.1311                      | 0.0770        | 0.0113            | 0.0007           | 0.0484   | 0.0637                  | 0.0369        | 0.0070            | 0.0017           | 0.0243    |
| Digital skills: none               | 0.2003                      | 0.1284        | 0.0271            | 0.0053           | 0.0820   | 0.1503                  | 0.1011        | 0.0258            | 0.0106           | 0.0457    |
| Digital skills: low                | 0.3646                      | 0.4528        | 0.1785            | 0.0281           | 0.2708   | 0.3557                  | 0.4530        | 0.2319            | 0.0738           | 0.2865    |
| Digital skills: average            | 0.2521                      | 0.2714        | 0.3149            | 0.1709           | 0.2892   | 0.2655                  | 0.2972        | 0.3281            | 0.1919           | 0.3046    |
| Digital skills: above average      | 0.1831                      | 0.1474        | 0.4795            | 0.7963           | 0.3579   | 0.2285                  | 0.1487        | 0.4723            | 0.7237           | 0.3332    |
| Education: below secondary         | 0.3771                      | 0.3150        | 0.0800            | 0.0294           | 0.1874   | 0.3223                  | 0.2891        | 0.0723            | 0.0279           | 0.1463    |
| Education: secondary               | 0.4490                      | 0.6057        | 0.4668            | 0.3306           | 0.4738   | 0.4412                  | 0.6137        | 0.3981            | 0.2718           | 0.4463    |
| Education: tertiary                | 0.1739                      | 0.0793        | 0.4833            | 0.6400           | 0.3388   | 0.2365                  | 0.0972        | 0.5296            | 0.7003           | 0.3884    |
| Female                             | 0.6543                      | 0.2692        | 0.3557            | 0.1669           | 0.4998   | 0.6234                  | 0.2532        | 0.5646            | 0.1736           | 0.5006    |
| Age: 25-34                         | 0.2955                      | 0.2497        | 0.2892            | 0.3518           | 0.2856   | 0.3432                  | 0.2502        | 0.2823            | 0.3593           | 0.2907    |
| Age: 35-44                         | 0.3203                      | 0.3477        | 0.3330            | 0.3731           | 0.3442   | 0.2955                  | 0.3448        | 0.3580            | 0.3552           | 0.3415    |
| Age: 45-54                         | 0.3842                      | 0.4026        | 0.3338            | 0.2751           | 0.3638   | 0.3613                  | 0.4050        | 0.3617            | 0.2855           | 0.3479    |
| Density populated                  | 0.3914                      | 0.2930        | 0.4412            | 0.5712           | 0.4027   | 0.4262                  | 0.2882        | 0.4600            | 0.5991           | 0.4170    |
| Intermediate                       | 0.3482                      | 0.3349        | 0.3340            | 0.3059           | 0.3361   | 0.3568                  | 0.3489        | 0.3324            | 0.2873           | 0.3392    |
| Thirly populated                   | 0.2605                      | 0.3701        | 0.2247            | 0.1229           | 0.2611   | 0.2170                  | 0.3490        | 0.2175            | 0.1136           | 0.2438    |
| Less developed                     | 0.3112                      | 0.3138        | 0.1951            | 0.1378           | 0.2420   | 0.2738                  | 0.3338        | 0.2135            | 0.1775           | 0.2489    |
| Transition region                  | 0.1421                      | 0.1290        | 0.1118            | 0.0989           | 0.1207   | 0.1621                  | 0.2134        | 0.2006            | 0.1355           | 0.1592    |
| Highly developed                   | 0.5407                      | 0.5469        | 0.8772            | 0.7606           | 0.6251   | 0.5564                  | 0.4467        | 0.5694            | 0.6666           | 0.5451    |
| EEA region                         | 0.0080                      | 0.0079        | 0.0159            | 0.0146           | 0.0122   | 0.0078                  | 0.0061        | 0.0165            | 0.0204           | 0.0128    |
| <b>Means (standard deviations)</b> |                             |               |                   |                  |          |                         |               |                   |                  |           |
| Children                           | 0.4520                      | 0.4685        | 0.4608            | 0.4483           | 0.4604   | 0.4136                  | 0.4441        | 0.4640            | 0.4071           | 0.4479    |
|                                    | (0.4977)                    | (0.4990)      | (0.4985)          | (0.4971)         | (0.4984) | (0.4925)                | (0.4989)      | (0.4973)          | (0.4917)         | (0.4973)  |
| No household                       | 3.2710                      | 3.3143        | 3.0329            | 2.9336           | 3.1381   | 3.1610                  | 3.2600        | 3.0372            | 2.8007           | 3.0995    |
|                                    | (1.5388)                    | (1.5085)      | (1.3534)          | (1.3504)         | (1.4317) | (1.5109)                | (1.4890)      | (1.3394)          | (1.3122)         | (1.4091)  |
| Unemployment % by NUTS1            | 9.4848                      | 7.5291        | 6.9485            | 6.5473           | 7.5487   | 8.1849                  | 6.9372        | 6.5994            | 6.1760           | 6.9724    |
|                                    | (6.1264)                    | (4.9100)      | (4.6313)          | (4.3621)         | (5.1085) | (5.0946)                | (4.3687)      | (3.9683)          | (3.4942)         | (4.3319)  |
| Cumulative cases per Mill          | 12.3157                     | 13.0794       | 13.1162           | 13.6553          | 12.9854  | 4.3105                  | (4.5253)      | (4.5453)          | (4.8526)         | (4.5184)  |
|                                    | 62.1228                     | 60.5339       | 61.0766           | 59.7815          | 61.1340  | (8.1896)                | (8.2377)      | (8.1000)          | (8.0581)         | (8.2687)  |
| Containment stringency             | 66.1311                     | 64.2981       | 61.8548           | 61.8548          | 63.2027  | (21.6821)               | (21.3888)     | (21.6821)         | (21.3888)        | (21.5712) |
| Economic Support Index             |                             |               |                   |                  |          |                         |               |                   |                  |           |