Adjustments of Local labour markets to the COVID-19 crisis: the role of digital capital and working-from-home

Sarra Ben Yahmed [1] , Francesco Berlingieri [2] and Eduard Brüll [1]

[1]ZEW

[2]European Commission, Joint Research Centre

August 2023

Motivation

- Digital capital and remote work crucial during the pandemic
  - Digital capital necessary for remote work
  - Continue working despite containment measures
  - Organisational flexibility, better cope with disruption of supply chains
  - Move business online

How did digital capital and remote work affect local employment responses to the crisis in the short to medium run? How did they interact ?

Motivation

- Digital capital and remote work crucial during the pandemic
  - Digital capital necessary for remote work
  - Continue working despite containment measures
  - Organisational flexibility, better cope with disruption of supply chains
  - Move business online

  How did digital capital and remote work affect local employment responses to the crisis in the short to medium run? How did they interact ?

- Digital capital and remote work related to spatial inequality
  - Poorer regions have a worse digital infrastructure
  - Poorer regions have a lower share of jobs that can be done remotely (Irlacher and Koch, 2021)

  What are the implications for employment inequality across space ?

Contribution

Impact of recessions on local labor markets

- Long-term declines in employment in more-affected regions
  Yagan, 2019; Hershbein and Stuart, 2020, for the U.S.
- Increase in inequality after past pandemics/recessions
  Furceri et al., 2020; Ma et al., 2020; Hershbein and Kahn, 2018
- Inclduing Covid-19 tended to exacerbate existing income and regional inequalities in the short run
  Stantcheva, 2021

$\Rightarrow$ The Covid crisis is different: lockdown, closure of specific sectors, **new role of ICT and remote work**

Contribution

Short-run regional impact of Covid-19 crisis

- Local (un)employment affected by infection rates and lockdown measures
  Aum et al., 2020; Bauer and Weber, 2020; Böhme et al, 2020
- German counties with a higher share of teleworkable jobs experienced fewer short-time work registrations and fewer SARS-CoV-2 cases in March/April 2020
  Alipour, Fadinger and Schymik, 2020

$\Rightarrow$ We look at the role of digital capital and how it matters for remote work to affect employment

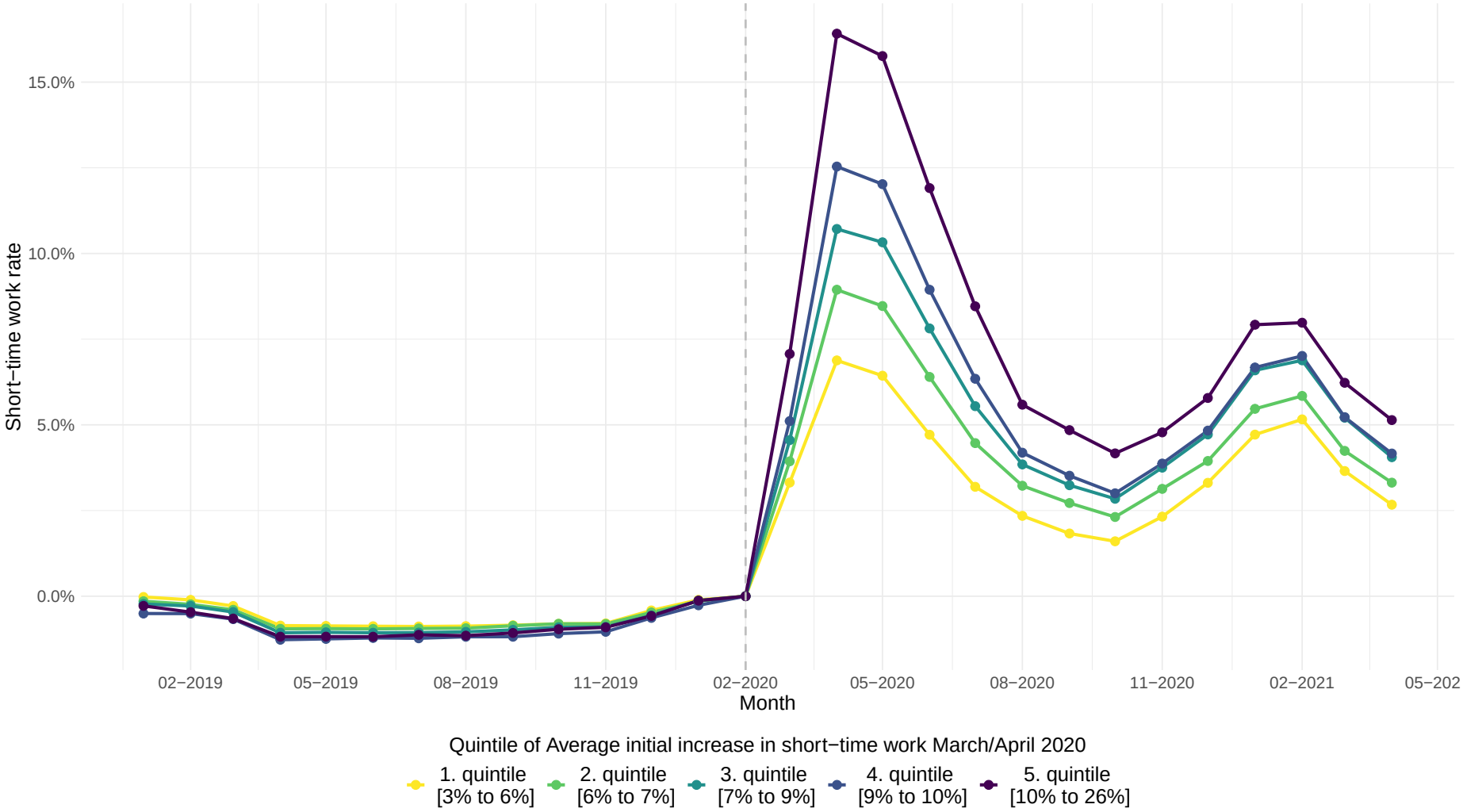
$\Rightarrow$ Short-time work, unemployment, and firm dynamics

$\Rightarrow$ We look at the medium run responses

Employment data

- German Federal Employment Agency
- Short-time work : 6-month lag, place of work, head count
  Short-time work rate: share of people on STW in the labour force
- To combine residence- and job-based measures, we aggregate districts (Kreise) at the local labour market level (257 *Arbeitsmarktreport*)

Short-time work across local labour markets



Digitalisation measures

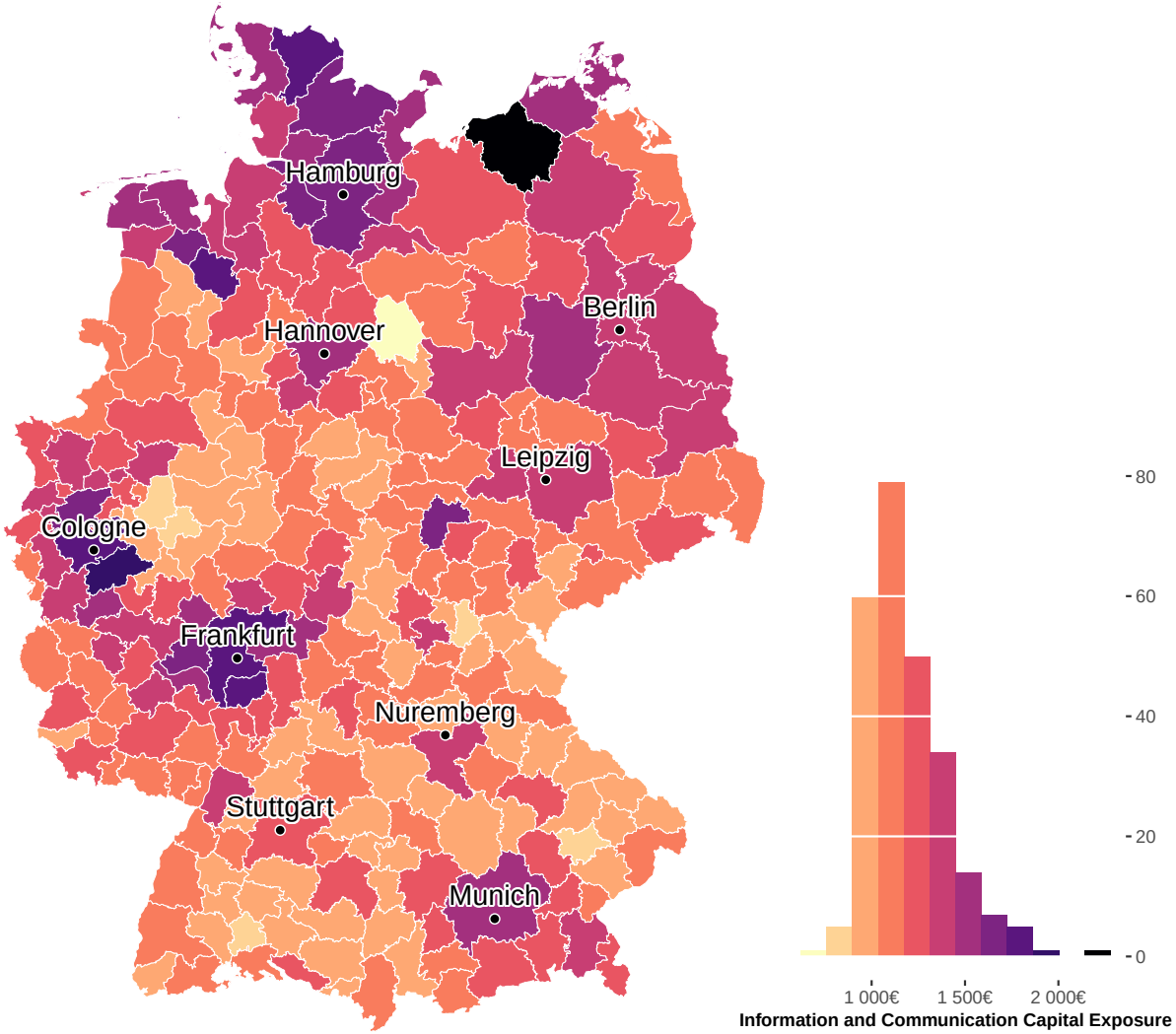
1. Local ICT capital endowment
   - ICT capital stocks in 40 industries for 2019, EU Klems
   - Index at the local level based on industry composition

$$K_{ICT,l} = \sum_{i=1}^{I} \frac{E_{i,l}}{E_l} \times \frac{K_{ICT,i}}{E_i}$$

   - Variation in local industry employment structure just before the pandemic.
   - Different specialisation in ICT-intensive industries at the regional level.
   - "Average potential for digital capital of a region"
   - No variation in digital capital within detailed industry across local labour markets, likely endogenous to other regional characteristics.

Information and Communication Capital Exposure

Information and communication capital per worker in 2019



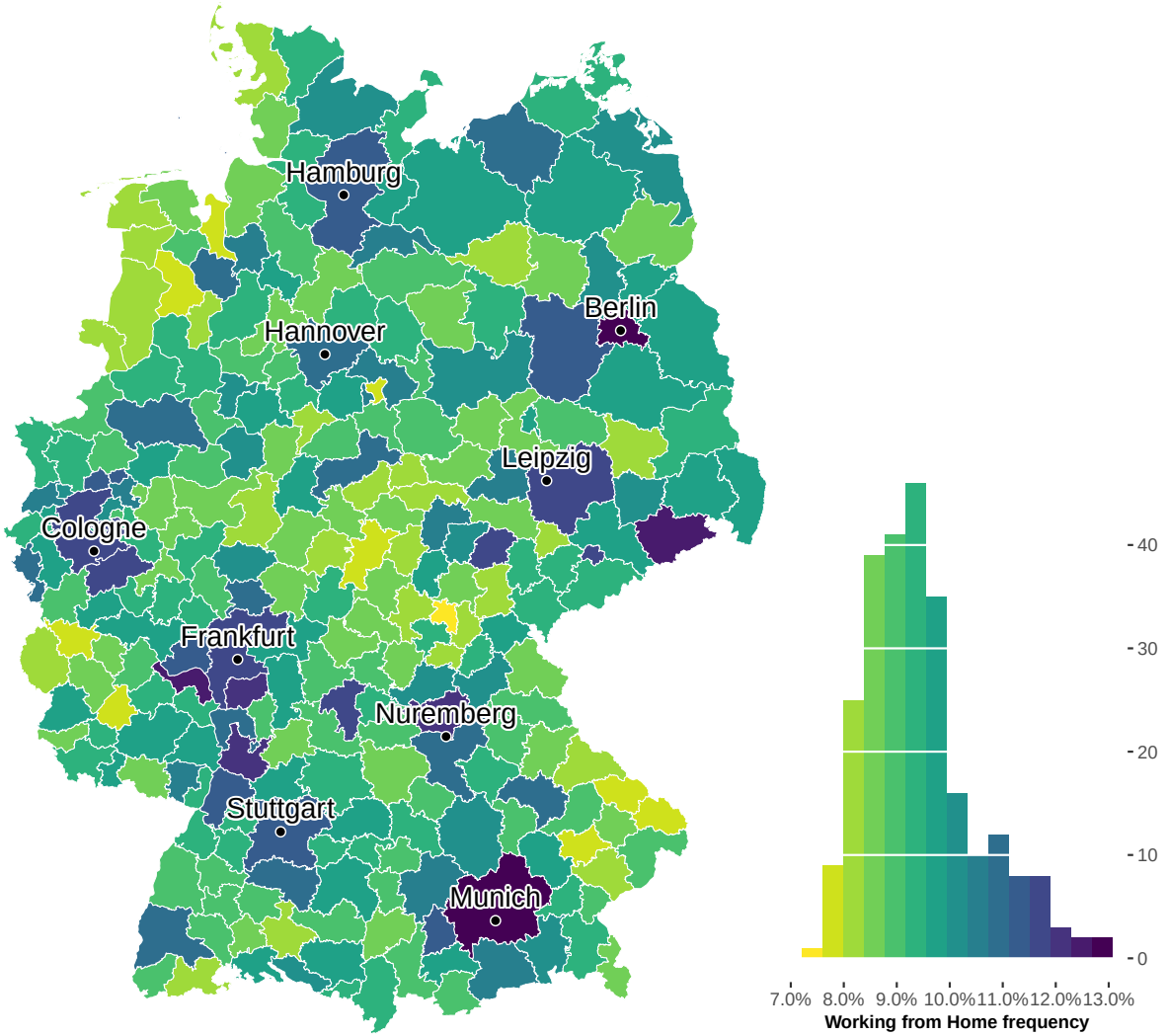
Digitalisation measures

2. Local working-from-home potential
   - At occupational level 2018, BiBB/BauA Employment Survey
   - Different indexes based on pre-crisis usage or teleworkable tasks
   - Index at the level of local labour markets based on occupational composition

$$WfH_r = \sum_{o=1}^{O} \frac{E_{o,r}}{E_{\text{total},r}} \times \frac{WfH_o}{E_{o,\text{national}}}$$

Working from Home frequency

Share of frequent/always teleworkers in pre−period



Identification strategy

- Difference-in-Differences with a continuous treatment
- Intensity of the treatment depends on a region's pre-crisis exposure to digital capital and working-from-home potential
- Control for systematic differences across regions using a propensity score weighting procedure
- Non-parametric covariate balancing generalised propensity score (npCBGPS) methodology by Fong et al. (2018)
- Estimate the effect of digitaliation on a pseudo-population of regions without relationship between local exposure variables and observable characteristics.

Identification strategy

i Strong parallel trends assumption
Regions at all exposure levels would have experienced the same trends in potential outcome if the COVID-19 crisis had not occur.

Pre-trends

Identification strategy

i Strong parallel trends assumption
Regions at all exposure levels would have experienced the same trends in potential outcome if the COVID-19 crisis had not occur.

Pre-trends

ii Conditional independence assumption
Conditionaly on covariates, no unobserved selection into specific levels of digitalisation.

Covariates

Identification strategy

i Strong parallel trends assumption
Regions at all exposure levels would have experienced the same trends in potential outcome if the COVID-19 crisis had not occur.

Pre-trends

ii Conditional independence assumption
Conditionaly on covariates, no unobserved selection into specific levels of digitalisation.

Covariates

iii Stable unit treatment value assumption
The level of digitalisation in one region should not have employment effects in another region.

Identification strategy

i Strong parallel trends assumption
Regions at all exposure levels would have experienced the same trends in potential outcome if the COVID-19 crisis had not occur.

ii Conditional independence assumption
Conditionaly on covariates, no unobserved selection into specific levels of digitalisation.

iii Stable unit treatment value assumption
The level of digitalisation in one region should not have employment effects in another region.

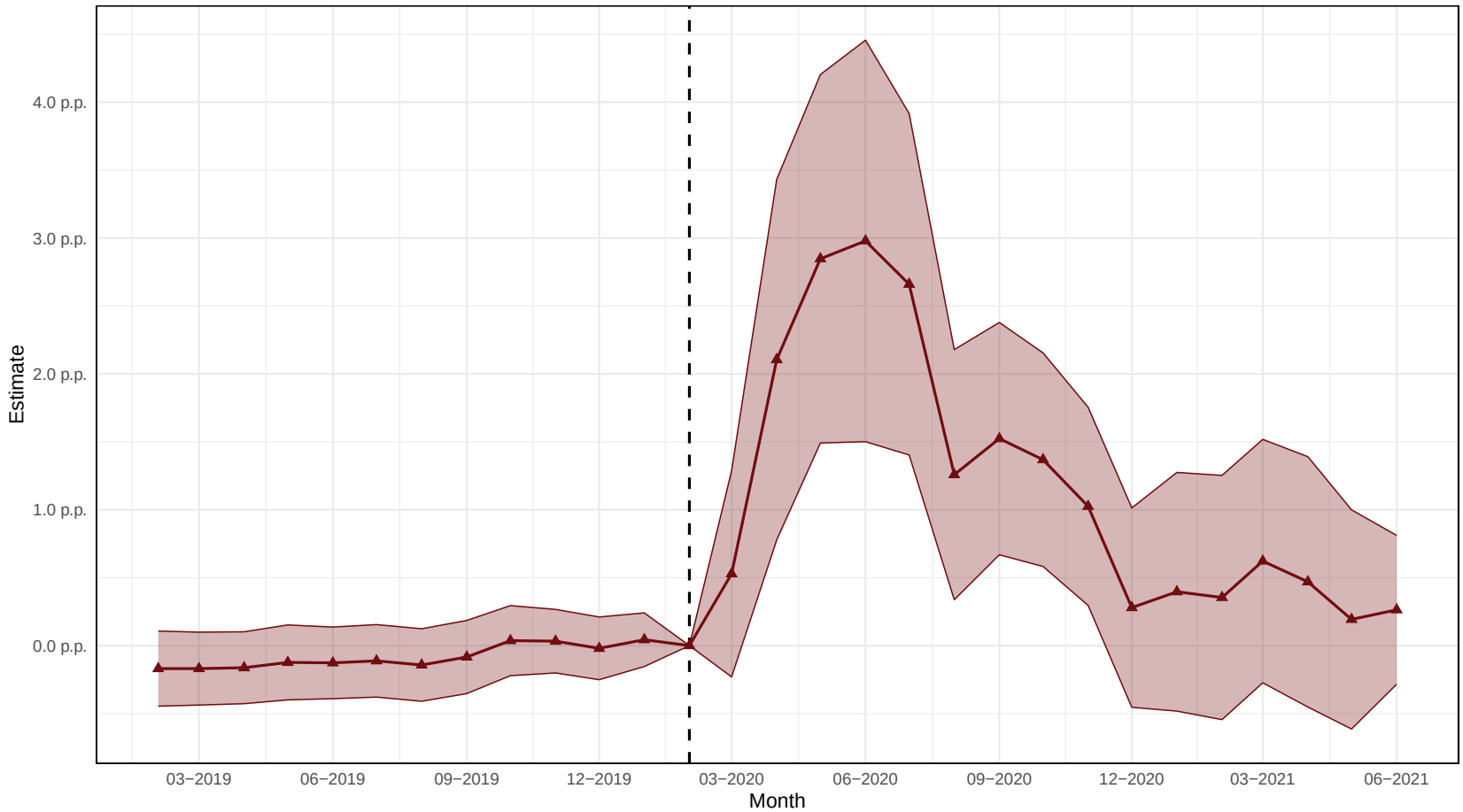
- Local labour markets defintion minimises commuting across local labour markets
- Large migration or capital transfer would only happen over a longer time horizon in Germany
- Stawarz et al. (2022) even document a drop in inter-county migration in 2020.

Event-study framework

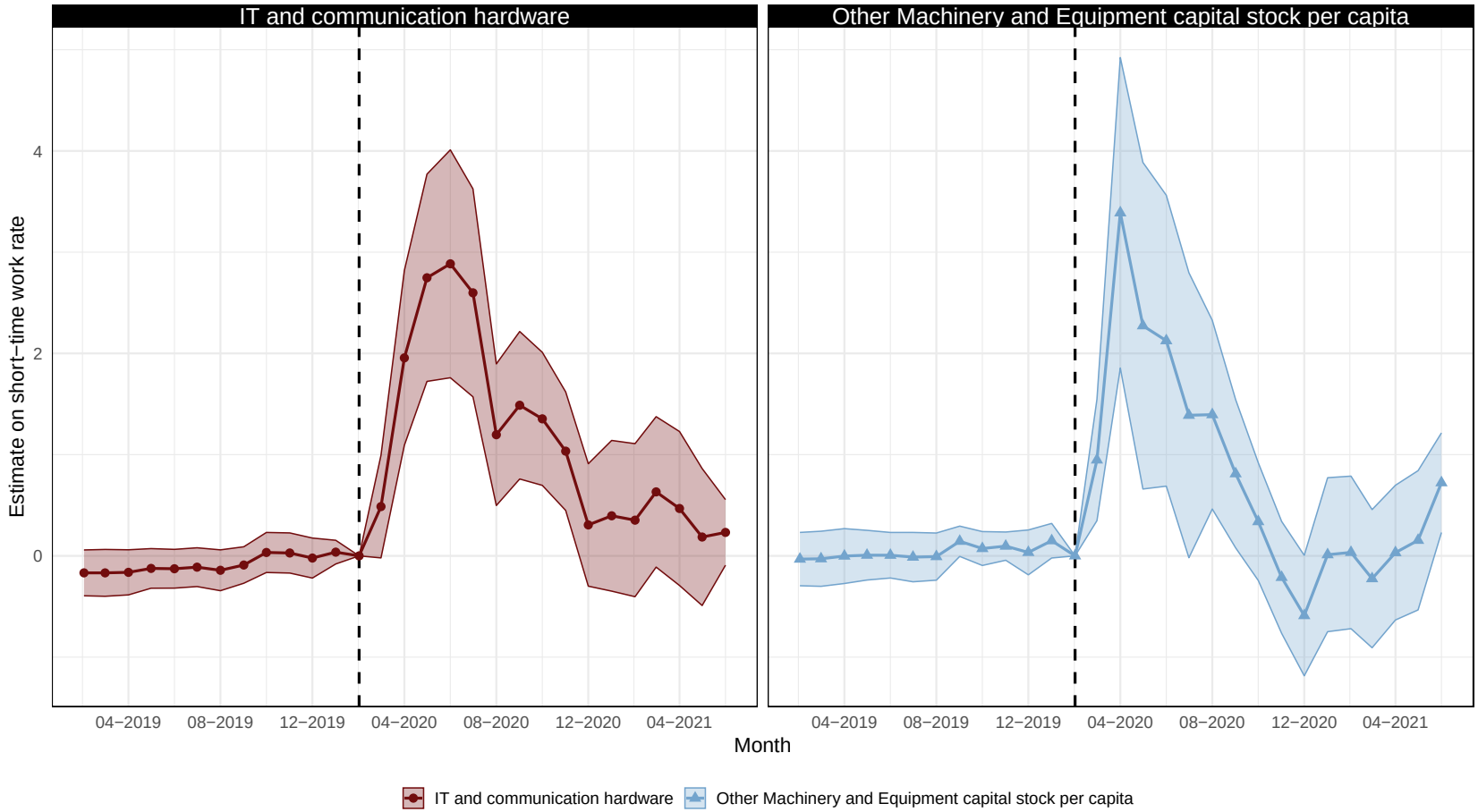
- Low-IT capital regions: bottom quintile

$$\text{STW-RATE}_{lt} = \sum_{t=1, t\neq 0}^{T} \beta_t \text{Low IT Capital}_l \times \text{Time}_t + \sum_{t=1, t\neq 0}^{T} \gamma_t \text{Time}_t + \alpha_l + \varepsilon_{lt}.$$

Low digital capital led to more short-time work



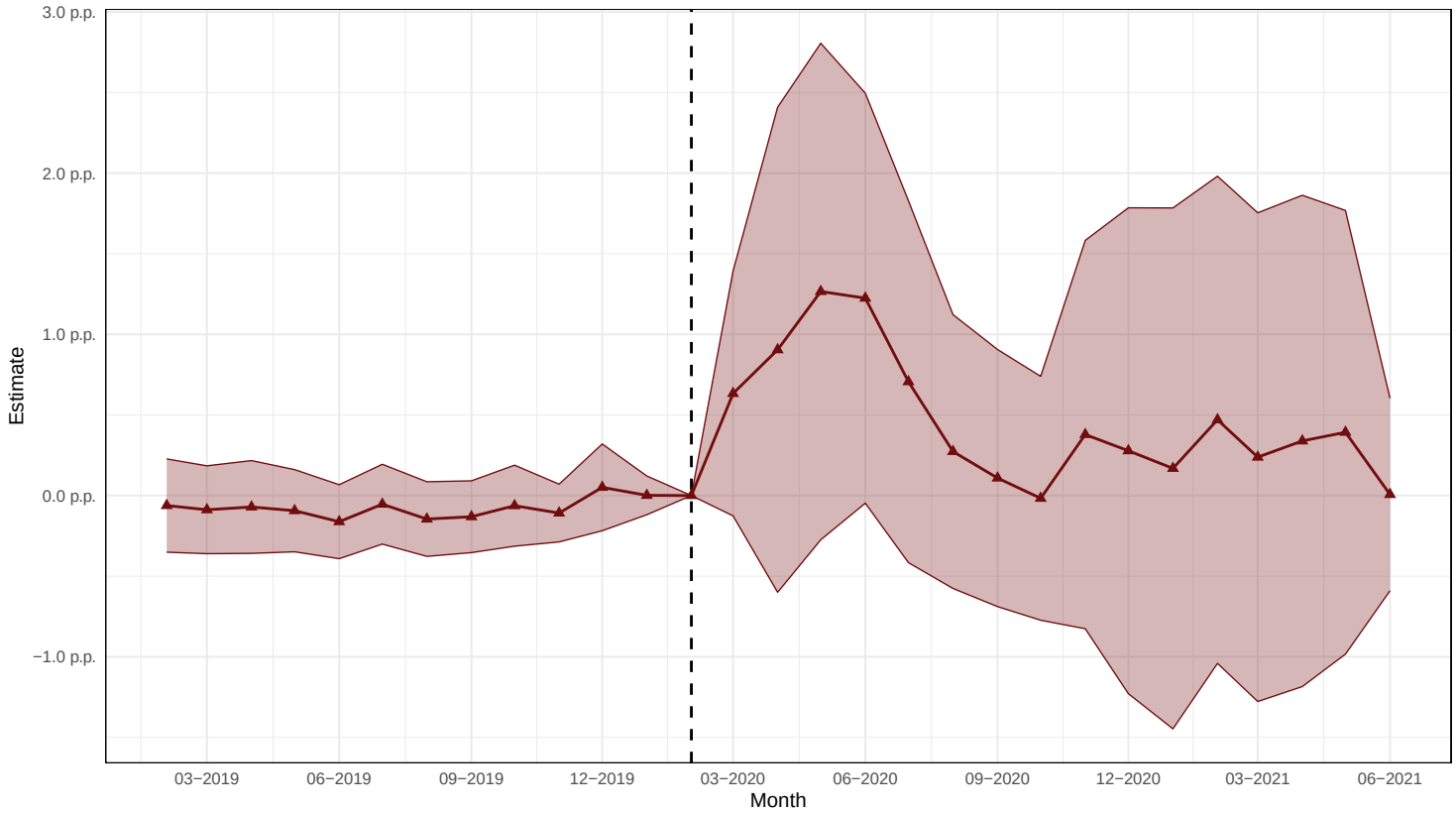
Low digital capital led to more short-time work



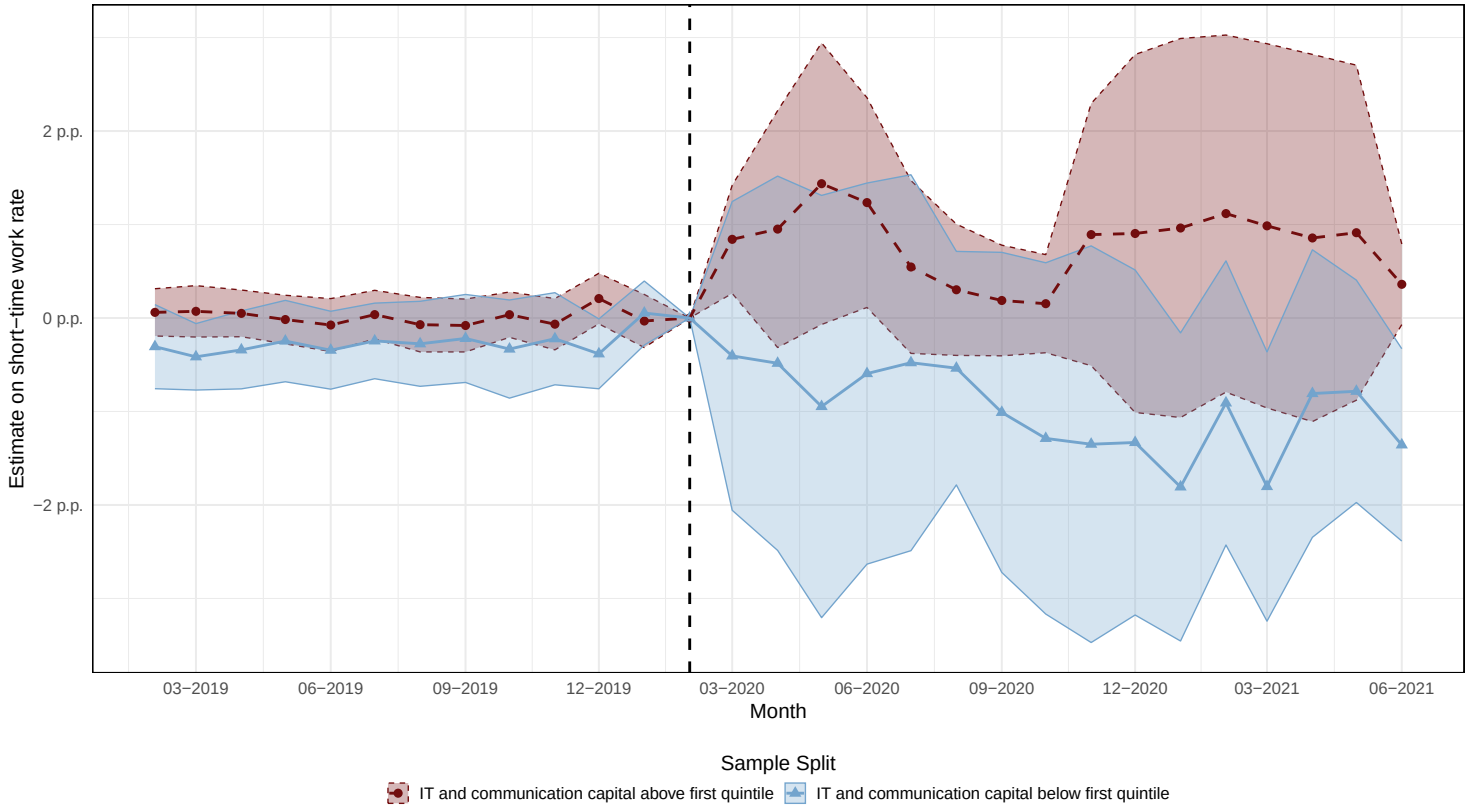
Channels of impact

- Possibility to work remotely
- Organisational flexibility and faster adaptation
  - faster sharing of information
  - improve decision-making within organisations
  - Reshaping supply chains
- Move (part) business online

Low WfH potential led to more short-time work in the short run



Digital capital necessary for WfH potential to affect STW



Other results

- Pre-crisis digital capital predicts actual working-from-home more than a year after the pandemic Actual WfH
- even if digital capital and working-from-home do not affect employment rates anymore.

- Digital capital reduced firm exit rates over the first year of the pandemic
- but even so did not affect unemeployment rates.

Take-away

Digital capital was

- essential for employment during the pandemic
- necessary for working-from-home to help reduce short-time work enabled to save jobs
- smoothed the employment shock beyond the ability to work remotely.
- Other likely channels similar to the ones linking ICT and productivity.
- Effect in the short/medium run: 8 months after outbreak
- Effect diminished when labour markets started to recover.

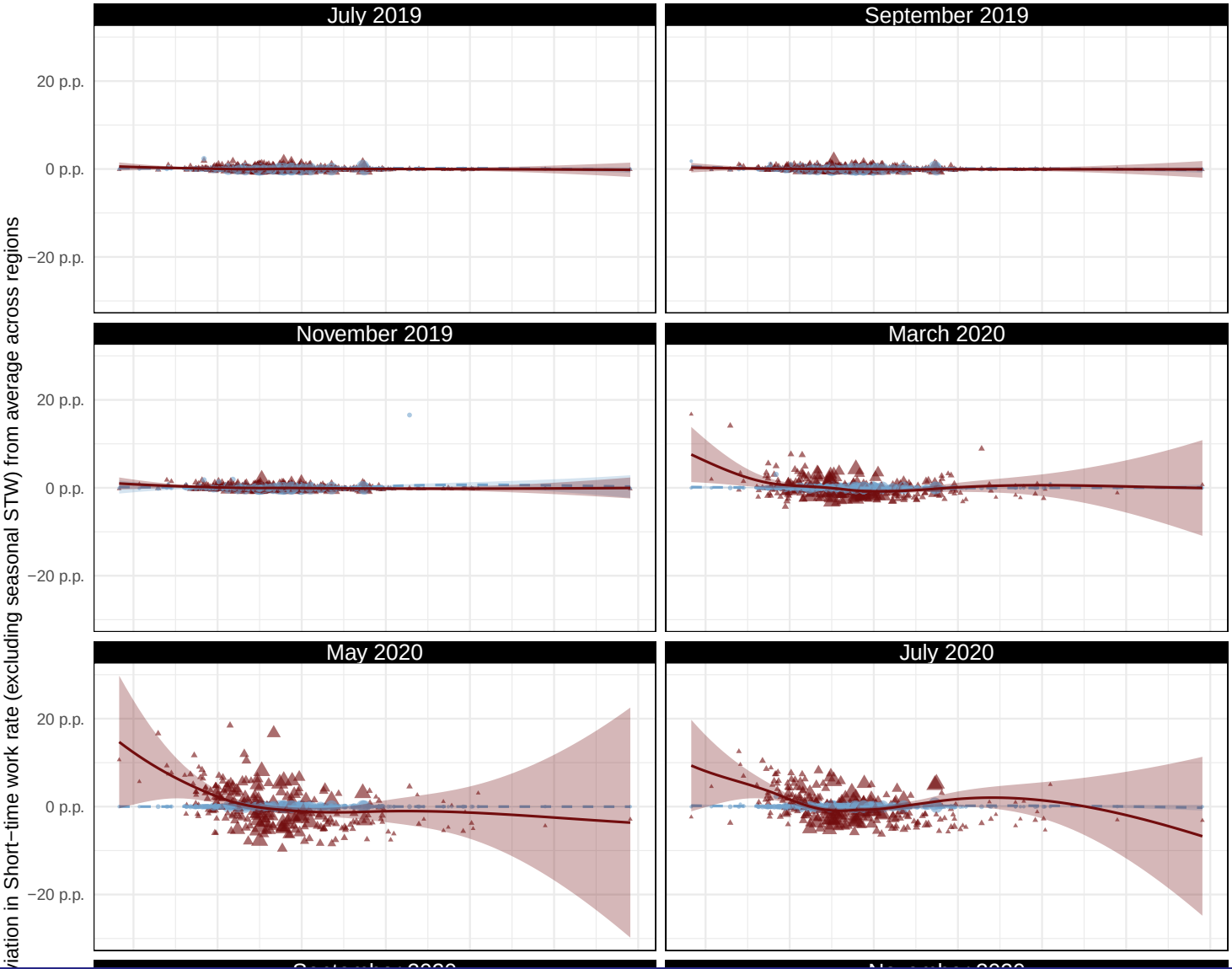
Discussion

- Spatial digital divide brought further employment inequalities with the pandemic but only in the short to medium run.
- Short-time work likely powerful in cushoning negative shock in local labour markets with low digital capital.
- Consistent with literature on STW (Giupponi et al., 2022; Kopp and Siegenthaler, 2021, Giupponi and Landais, 2022)
- Despite higher firm exit rates, no higner unemeployment in low digital local labour markets.
- Job transitions out of hardly hit sectors (Arntz et al., 2023)

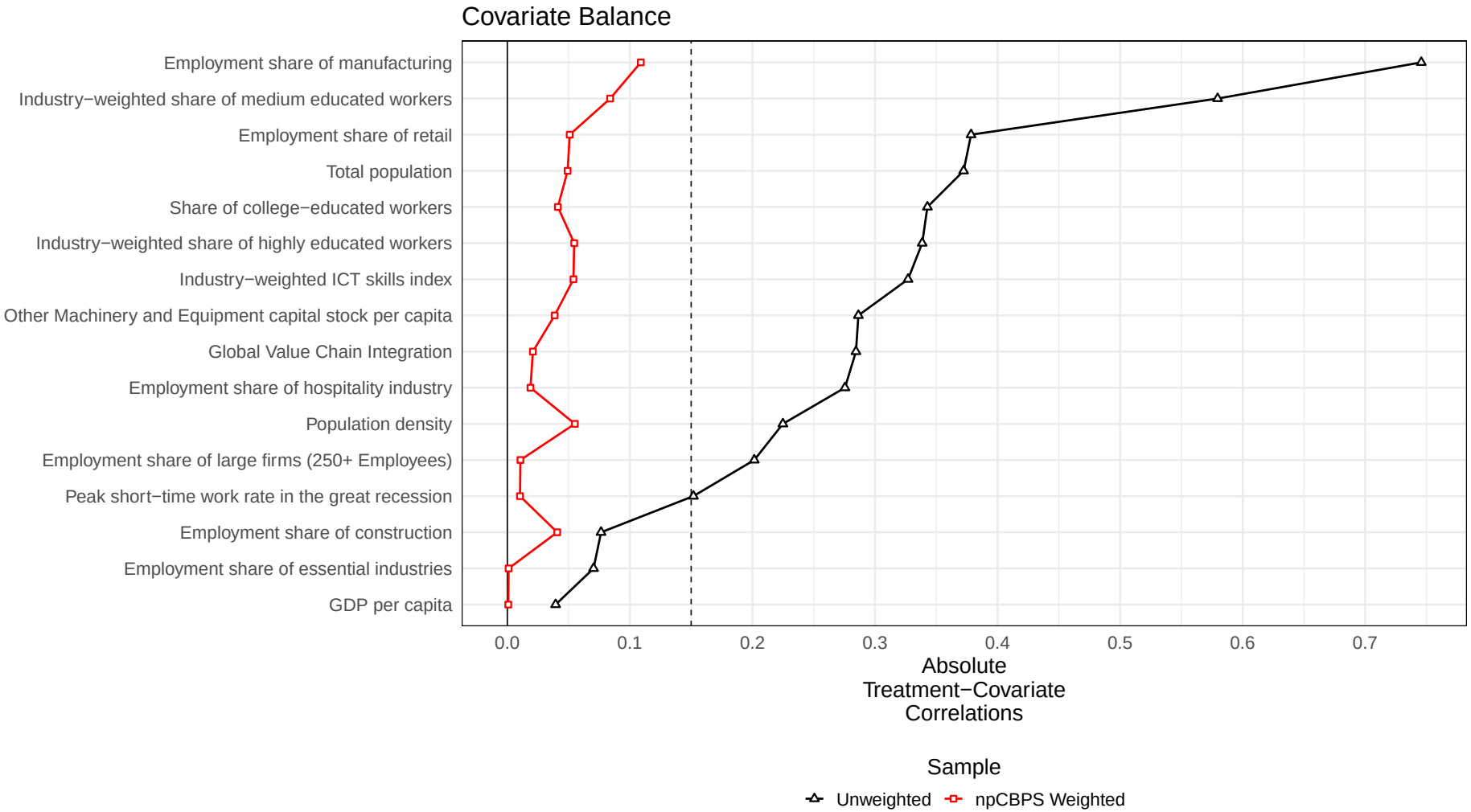
Discussion

- No persistent effect of digitalisation after a year
- Adoption of ICT during the pandemic & heterogeneity across space.
- Firm heterogeneity in ICT adoption (Gathmann et al., 2023, Barth et al., 2022, Rückert et al., 2020)
- Regional data on digital capital : regional convergence during/after the pandemic ?
- Firm data : how the dispersion in firms' adjustments will affect spatial inequality?

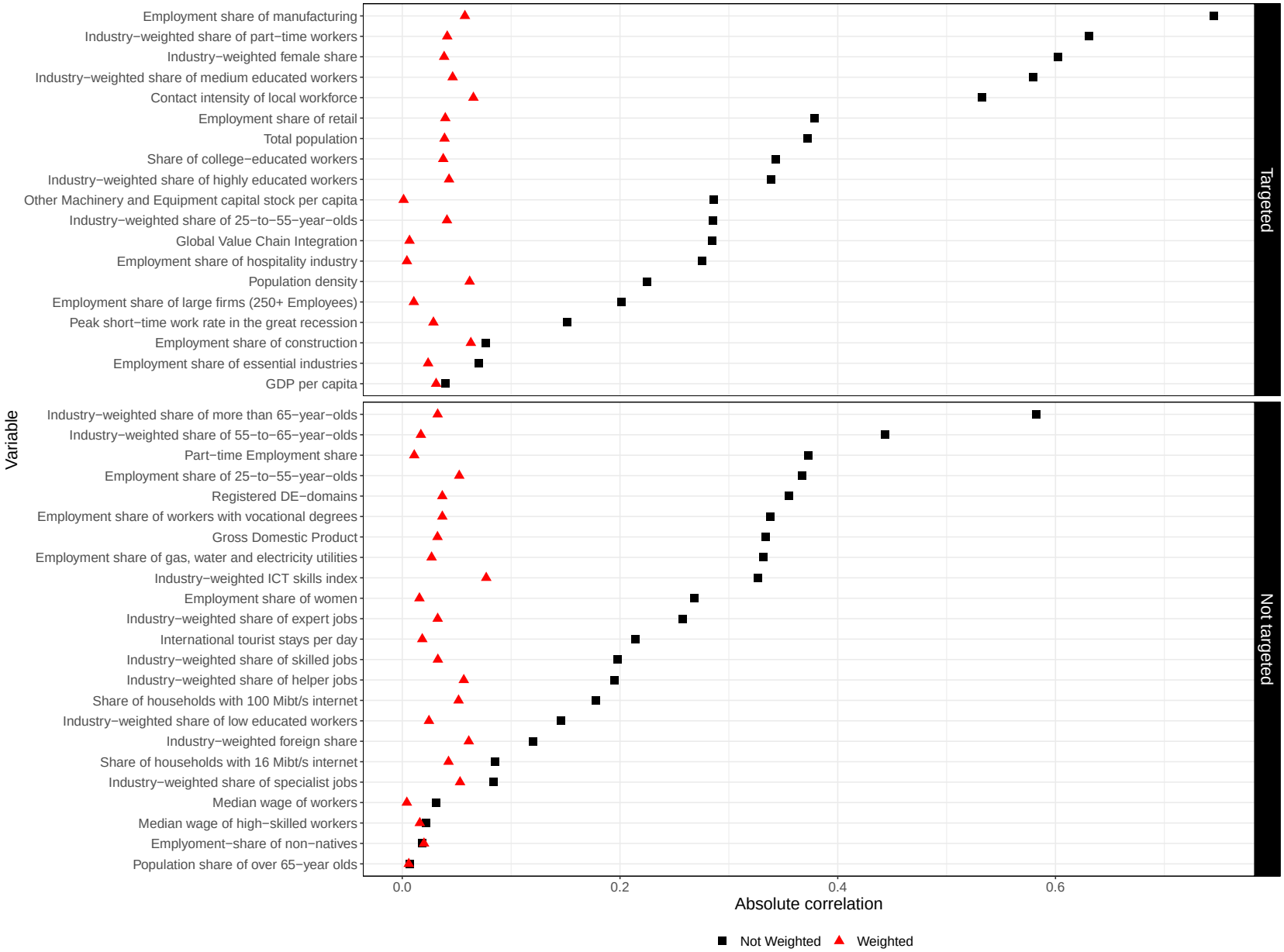
Identification strategy



Identification strategy

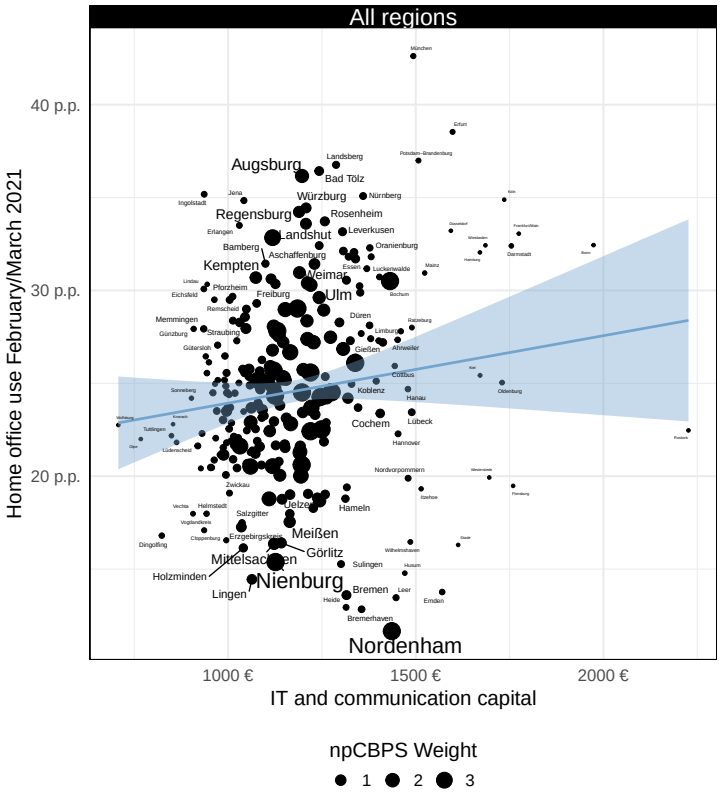


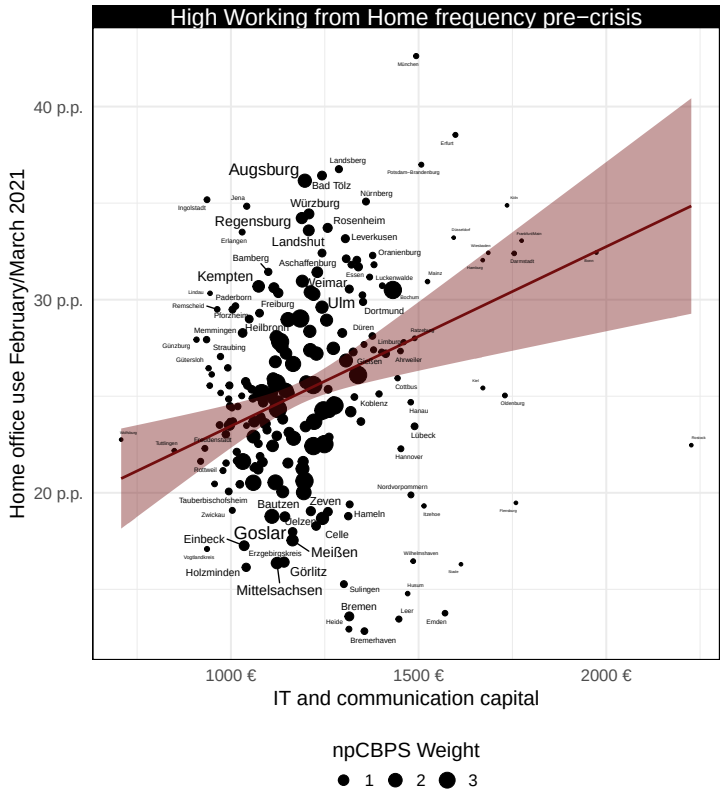
Back


Employment share of manufacturing
Industry−weighted share of part−time workers
Industry−weighted female share
Industry−weighted share of medium educated workers
Contact intensity of local workforce
Employment share of retail
Total population
Share of college−educated workers
Industry−weighted share of highly educated workers
Other Machinery and Equipment capital stock per capita
Industry−weighted share of 25−to−55−year−olds
Global Value Chain Integration
Employment share of hospitality industry
Population density
Employment share of large firms (250+ Employees)
Peak short−time work rate in the great recession
Employment share of construction
Employment share of essential industries
GDP per capita
Targeted
Industry−weighted share of more than 65−year−olds
Industry−weighted share of 55−to−65−year−olds
Part−time Employment share
Employment share of 25−to−55−year−olds
Registered DE−domains
Employment share of workers with vocational degrees
Gross Domestic Product
Employment share of gas, water and electricity utilities
Industry−weighted ICT skills index
Employment share of women
Industry−weighted share of expert jobs
International tourist stays per day
Industry−weighted share of skilled jobs
Industry−weighted share of helper jobs
Share of households with 100 Mibt/s internet
Industry−weighted share of low educated workers
Industry−weighted foreign share
Share of households with 16 Mibt/s internet
Industry−weighted share of specialist jobs
Median wage of workers
Median wage of high−skilled workers
Emplyoment−share of non−natives
Population share of over 65−year olds
Not targeted
Variable
0.0
0.2
0.4
0.6
Absolute correlation
Not Weighted
Weighted

Back

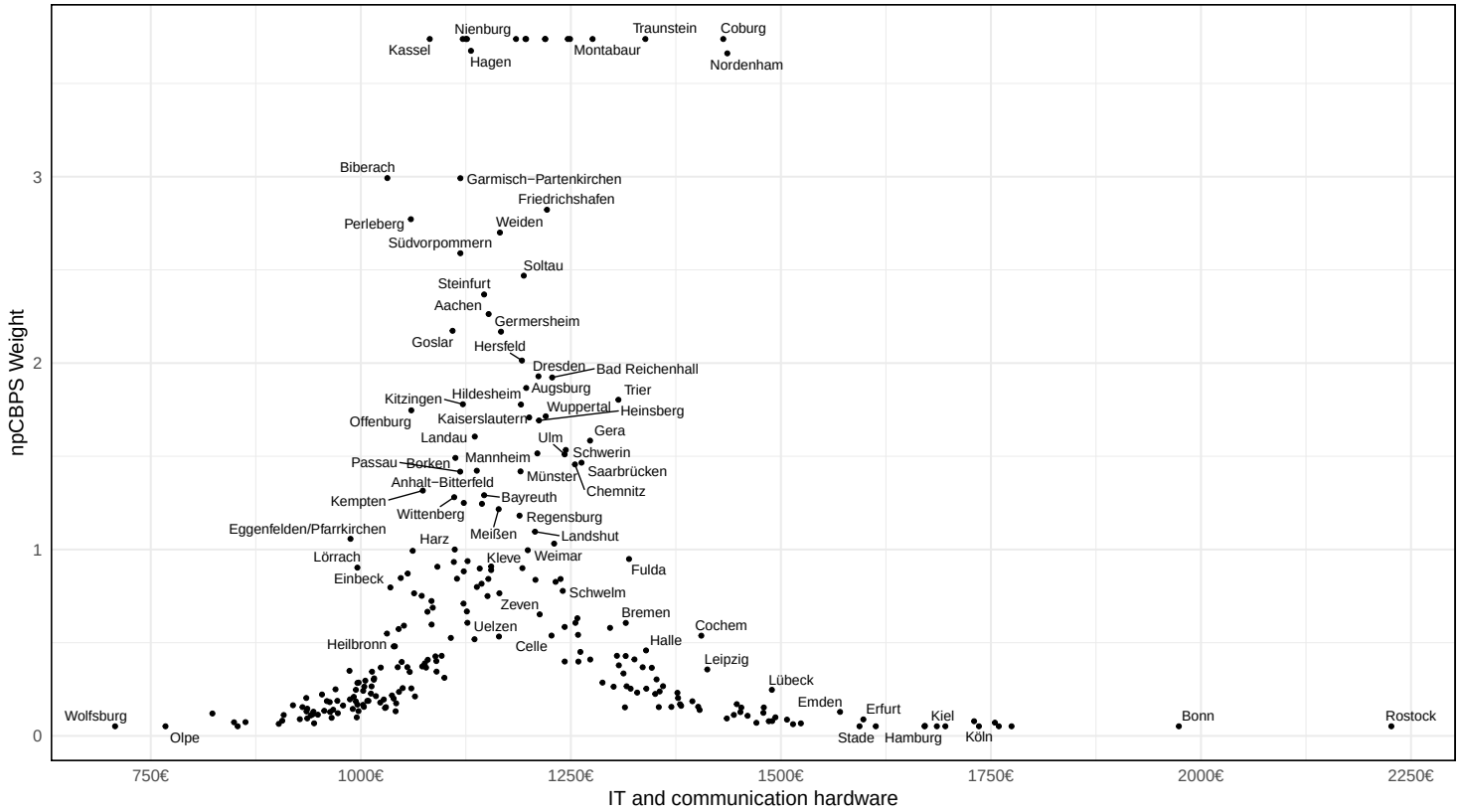
Pre-crisis digital capital predicts actual working-from-home





back

Weight distribution for the Digital capital exposure



Weight distribution for the Working from Home frequency