Discussion of

How Broadband Internet Affects Labor Market Matching
by Bhuller, Kostøl, and Vigtel

15th joint ECB/CEPR 2019 Labour Market Workshop

Benedikt Herz
benedikt.herz@ec.europa.eu

European Commission

3 December 2019

Important contribution:

1 (arguably) exogenous variation
2 excellent data
3 interesting question

Remarks and suggestions:

► estimating equation
► "career concerns:" Does broadband allow workers to find jobs that better fit their human capital?
► broadband adoption

Estimating equation

Equation (1):

$$y_{m,t} = \delta z_{m,t-1} + x'_{m,t}\beta + \kappa_m + \tau_t + \epsilon_{m,t}$$

$y_{m,t}$: *outcome*

$z_{m,t-1}$: (lagged) broadband availability

κ_m: municipality m fixed effects

τ_t: year fixed effects

Estimated on individual/firm level:

$$y_{i,m,t} = \delta z_{m,t-1} + x'_{m,t}\beta + \kappa_m + \tau_t + \epsilon_{i,m,t}$$

- ▶ Why no individual/firm controls (or even individual/firm fixed effects)?
- ▶ Why *lagged* broadband availability?

Akerman, Garder, Moogstad (2015):

$$y_{i,m,t} = \delta_0 x'_{i,m,t} + z_{m,t} x'_{i,m,t}\delta_1 + w_{i,m,t}\theta_1 + \eta_m + \tau_t + u_{i,m,t}$$

Functional form: logs vs. levels

Table 7: Employment outcomes after an unemployment spell.

Dependent Variable:	A. Re-employment	B. Wage in First Job		C. Tenure in First Job	
		Un-conditional	Conditional	Un-conditional	Conditional
	(1)	(2)	(3)	(4)	(5)
Broadband Availability	0.016***	990***	803***	0.397***	0.234**
(Standard Error)	(0.006)	(274)	(262)	(0.088)	(0.112)
[p-value]	[0.006]	[0.001]	[0.001]	[0.000]	[0.043]
Dep. Mean	0.659	16,485	22,026	7.3	9.8
Obs. ($N \times T$)	1,339,779	1,339,779	882,569	1,191,827	734,617

- ▶ "starting monthly wage in new job following unemployment measured in 2014-NOK"
- ▶ "tenure length in the first job measured in months"

Functional form: logs vs. levels

Table 9: Unemployed Workers' Re-Employment – Distance to Employer and Recall Hiring.

Dependent Variable:	A. Re-employment	B. Distance to the Employer (Conditional)	C. Employed With New Employer	D. Employed With Previous Employer (Recall Hire)
	(1)	(2)	(3)	(4)
Broadband Availability	0.016***	0.227**	0.015*	0.001
(Standard Error)	(0.006)	(0.107)	(0.009)	(0.006)
[*p*-value]	[0.006]	[0.039]	[0.092]	[0.864]
Dep. Mean	0.659	8.7	0.460	0.199
Obs. ($N \times T$)	1,339,779	691,541	1,339,779	1,339,779

▶ "The result is presented in Panel B, and shows that broadband internet increases the distance by 227 meters on average."

Functional form: growth rates

Table 6: Firms' Hire, Separation and Net Employment Growth.

Dependent Variable:	A. Hire Growth	B. Separation Growth	C. Net Employment Growth
	(1)	(2)	(3)
Broadband Availability	0.006***	0.005*	0.000
(Standard Error)	(0.002)	(0.003)	(0.002)
[p-value]	[0.003]	[0.053]	[0.884]
Dep. Mean	0.129	0.114	0.015
Obs. ($B \times T$)	1,821,902	1,821,902	1,821,902

Human capital

- large empirical literature: large and persistent reductions in wages after layoffs
- wage-costs mostly associated with losing human capital, proxied by switching industry (e.g., Neal, 1995)
- broadband might help to stay within career, avoid "wasting" human capital

Human capital

Table 11: Decomposing Firms' Hire Growth By Workers' Past Industry.

Dependent Variable:	A. Hire Growth	B. Hire Growth from Different Industry	C. Hire Growth from Same Industry
	(1)	(2)	(3)
Broadband Availability	0.006***	0.002*	0.003***
(Standard Error)	(0.002)	(0.001)	(0.001)
[p-value]	[0.003]	[0.089]	[0.001]
Dep. Mean	0.129	0.092	0.037
Obs. ($B \times T$)	1,821,902	1,821,902	1,821,902

- ▶ "Panel C shows a stronger increase in hiring of workers with relevant background"
- ▶ this is not a formal test (also: most likely difference not significant)

Human capital

Why not do this from worker-side?

- ▶ sample of workers who were displaced and found new jobs

$$hired\_in\_same\_industry_{i,m,t} = \delta z_{m,t-1} + x'_{m,t}\beta + \kappa_m + \tau_t + \epsilon_{i,m,t}$$

- ▶ estimated δ provides formal test

Literature following Neal (1995): evidence that wage costs associated with changing *occupation*, not industry (Kambourov and Manovskii, 2009; Herz, 2019)

- ▶ use *hired_in_same_occupation*$_{i,m,t}$ as dependent variable

- ▶ also interesting: look at "skill-distance" between pre- and post-displacement occupation (e.g., Gathman and Schoenberg, 2010)

Human capital

Why not do this from worker-side?

- ▶ sample of workers who were displaced and found new jobs

$$hired\_in\_same\_industry_{i,m,t} = \delta z_{m,t-1} + x'_{m,t}\beta + \kappa_m + \tau_t + \epsilon_{i,m,t}$$

- ▶ estimated δ provides formal test

Literature following Neal (1995): evidence that wage costs associated with changing *occupation*, not industry (Kambourov and Manovskii, 2009; Herz, 2019)

- ▶ use *hired_in_same_occupation*$_{i,m,t}$ as dependent variable
- ▶ also interesting: look at "skill-distance" between pre- and post-displacement occupation (e.g., Gathman and Schoenberg, 2010)
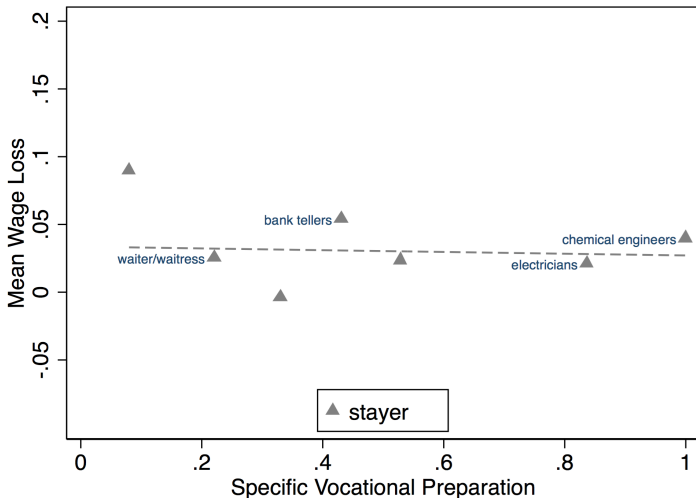
Human capital

Evaluate directly: does broadband lead to smaller loss of human capital (wage) after layoff?

$$\log \text{wage}_{i,m,t}^{post} - \log \text{wage}_{i,m,t}^{pre} = \delta z_{m,t-1} + x_{m,t}'\beta + \kappa_m + \tau_t + \epsilon_{i,m,t}$$
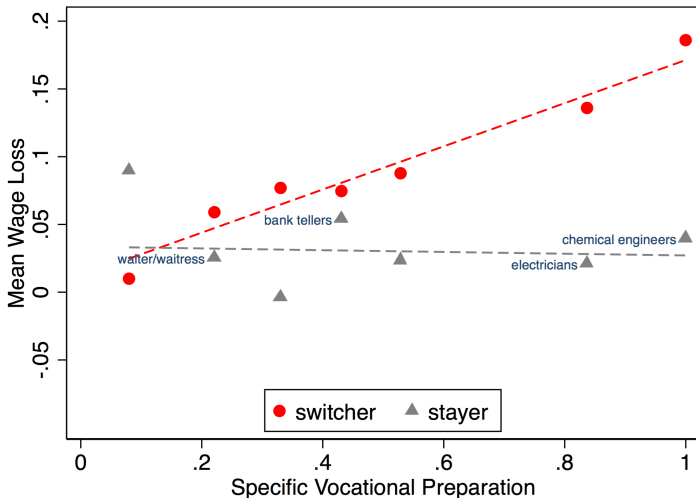
Human capital

Wage-losses of displaced workers (Herz, 2019; JoLE):

Human capital

Wage-losses of displaced workers (Herz, 2019; JoLE):

Human capital

Triple differences:

$$\log \text{wage}_{i,m,t}^{post} - \log \text{wage}_{i,m,t}^{pre} = \delta z_{m,t-1} + \gamma[years\_of\_training_i \times z_{m,t-1}]$$
$$+ x'_{m,t}\beta + \kappa_m + \tau_t + \omega_i + \epsilon_{i,m,t}$$

- hypothesis: $\gamma > 0$

municipality-by-time fixed effects:

$$\log \text{wage}_{i,m,t}^{post} - \log \text{wage}_{i,m,t}^{pre} = \gamma[years\_of\_training_i \times z_{m,t-1}]$$
$$+ \kappa_{m,t} + \omega_i + \epsilon_{i,m,t}$$

- identification from within municipality-by-time
- would alleviate remaining concerns regarding exogeneity of broadband rollout

Human capital

Triple differences:

$$\log \text{wage}_{i,m,t}^{post} - \log \text{wage}_{i,m,t}^{pre} = \delta z_{m,t-1} + \gamma[\textit{years\_of\_training}_i \times z_{m,t-1}]$$
$$+ x'_{m,t}\beta + \kappa_m + \tau_t + \omega_i + \epsilon_{i,m,t}$$

- ▶ hypothesis: $\gamma > 0$

municipality-by-time fixed effects:

$$\log \text{wage}_{i,m,t}^{post} - \log \text{wage}_{i,m,t}^{pre} = \gamma[\textit{years\_of\_training}_i \times z_{m,t-1}]$$
$$+ \kappa_{m,t} + \omega_i + \epsilon_{i,m,t}$$

- ▶ identification from within municipality-by-time
- ▶ would alleviate remaining concerns regarding exogeneity of broadband rollout

Broadband adoption

Table 3: Firms' and Workers' Internet Access and Online Activities.

	A. Firms in the ICT Use Survey		B. Working-age Individuals in the Media Use Survey	
	(1) Baseline	(2) Controls	(3) Baseline	(4) Controls
Dependent Variable:	1. Has Broadband Internet Access		1. Has Broadband Internet Access	
Broadband Availability	0.301***	0.294***	0.282***	0.282***
(Standard Error)	(0.025)	(0.022)	(0.027)	(0.026)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]
Base Dep. Mean	0.380	0.380	0.059	0.059
Obs. ($B{\times}T/N{\times}T$)	50,269	50,269	10,959	10,959

"These estimates show that firms and workers are more likely to use broadband internet *from one year to the next* as a consequence of an increase in broadband availability in their municipality."

- ▶ speed of adoption would be interesting

Broadband adoption

Dynamic partial adjustment model (Nerlove, 1958)

$$adoption_{i,m,t} = \alpha + \delta z_{m,t} + (1 - \lambda) \times adoption_{i,m,t-1} + \tau_t + \epsilon_{i,m,t}$$

Short-run adoption: δ
Long-run adoption: $\frac{\delta}{\lambda}$

Small remarks

- find higher separation rate *and* longer tenure?
- "we assume that ... size of the labor force is independent of broadband internet"
  - what about effect of broadband on *labor force participation*, see Table 10 Panel B.
- broadband definition: download speed>256 kbit/s=.031 megabyte/s