

Role Of Higher Education In The Era Of Automation: A Task-Based Approach

Hannah Massenbauer

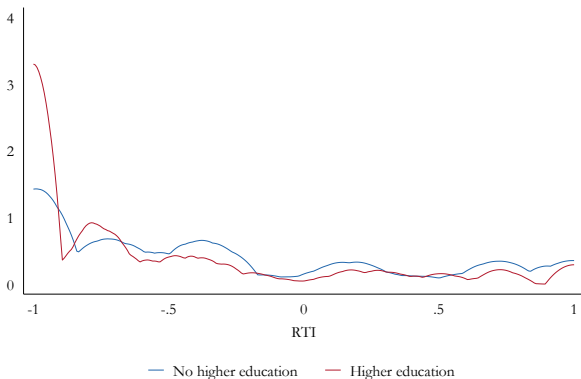
University of Zurich

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Motivation

- New technologies affect our work
- Impacts on inequality across individuals and countries

Distribution of RTI depending on education level



Research question

How important is higher education in the era of automation?

Definitions:

- Higher education = tertiary education¹
- Task-based approach: Analyzing the tasks executed in a job

Data:

- European Social Survey, Eurostat & O*NET
- Focus on 18 European countries (2012-2018)

¹Tertiary short-term programs, Bachelor's / Master's / Doctoral programs

Theory

Skill-biased technology change

Technologies are biased toward high-skill workers

- Acemoglu (1998)
- Acemoglu & Autor (2011)

Routine-biased technology change

Technologies are biased toward non-routine work

- Autor, Levy and Murnighan (2003)
- Hardy, Keister and Lewandowski (2018)
- Spitz-Oener (2006)

Methodology I

Task-based approach:

$$T_{j,k}(i) = \frac{\text{Number of activities } j \text{ in task category } i}{\text{Total number of activities performed in occupation } k} \quad (1)$$

for $i \in [1 : 5]$

$$T_{j,k} \in [0, 1] \quad (2)$$

Routine task intensity (Mihaylov & Tijdens, 2019):

$$RTI = RM + RC - NRM - NRI - NRA^2 \quad (3)$$

²Routine manual / cognitive

- Non-routine manual / interactive / abstract

Methodology II

- Individual level regressions analysis

$$RTI = \alpha + \beta \text{Heduc} + \theta X_{\text{Individual}} + \gamma X_{\text{Country}} + \epsilon \quad (4)$$

- Country level regressions analysis

$$RTI = \alpha + \beta \text{Heduc} \cdot \text{Country} + \theta \text{Individual} + \gamma X_{\text{Country}} + \epsilon \quad (5)$$

Education, gender and income matters

	(1)	(2)	(3)	(4)
Higher Education	-0.2319*** (0.0047)	-0.2018*** (0.0056)	-0.2052** (0.0186)	-0.1454** (0.0176)
Age		-0.0005* (0.0003)	-0.0007 (0.0005)	0.0001 (0.0004)
Gender		0.1078*** (0.0051)	0.1059** (0.0150)	0.1705*** (0.0107)
Mother's Education		-0.0481*** (0.0064)	-0.0479* (0.0084)	-0.0389** (0.0066)
Birthplace		-0.0168* (0.0082)	-0.0174 (0.0153)	-0.0263 (0.0146)
Income Decile		-0.0091*** (0.0010)	-0.0098** (0.0015)	-0.0123** (0.0013)
Macro Controls		✓	✓	✓
Country-Year FE			✓	✓
Industry FE				✓
Constant	-0.3600*** (0.0032)	-0.2419*** (0.0218)	-0.6346 (0.2210)	-0.6509* (0.1923)
<i>N</i>	70476	59231	59231	56372

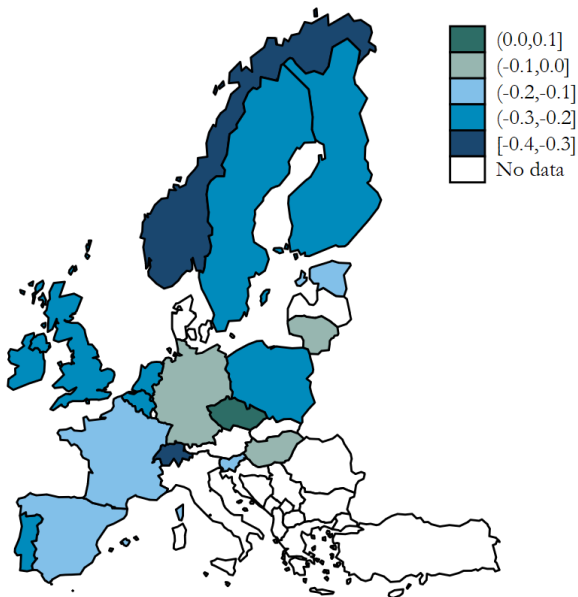
Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

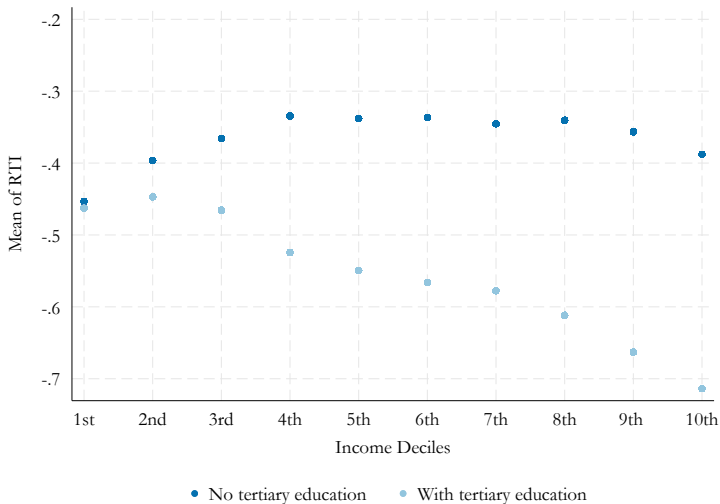
Interpretation of results

- The outcome variable ranges from -1 to 1
- Tertiary education decreases the routine intensity by $-0,20$
→ 10% less routine tasks
- Women work in jobs with a higher routine task content Figure
- Household net income correlates negatively with routine task intensity
- Routine task intensity varies across industries Figure

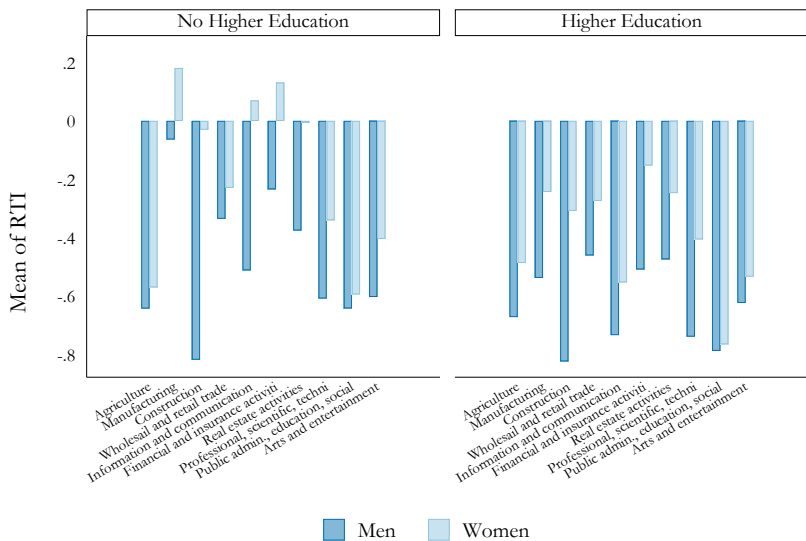
The effect of education varies within EU



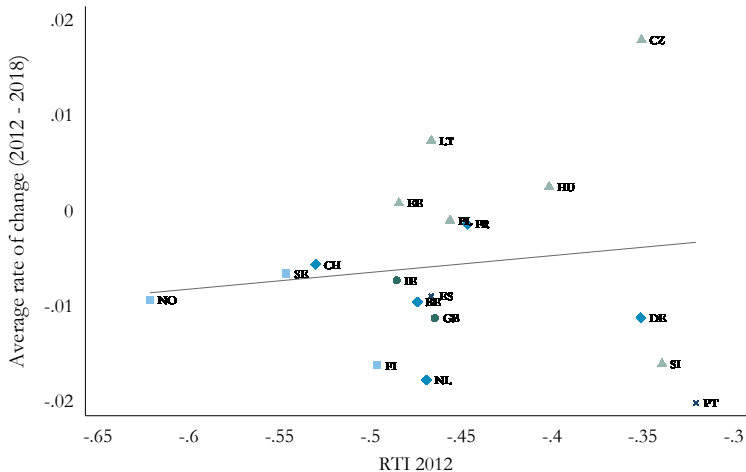
RTI decreases for higher educated with increasing income



Marginal returns



Divergence of RTI within EU



× South ♦ West ■ North ▲ East ● Islands — Fitted values

Discussion

1. Employment and wage will be affected
 - (Wage) Polarization
2. Divergence in RTI within EU-labor market challenges cohesion of EU
 - Production- vs. service-industry
 - Investments in (tertiary) education sector
3. New technologies likely to aggravate these developments as more and more tasks can be substituted
 - complementary skills will be even more in demand

Conclusion

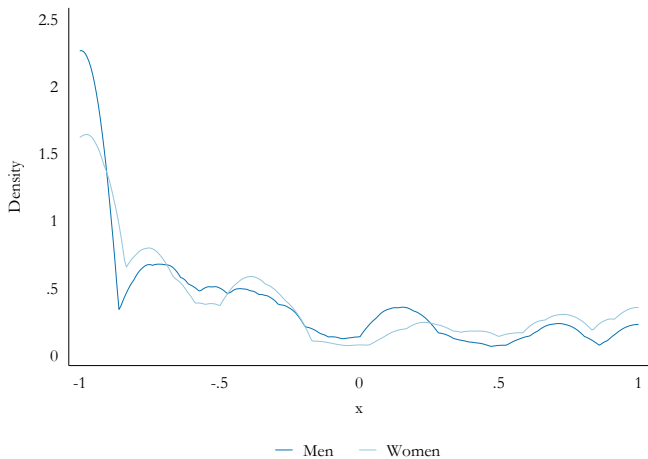
How important is higher education in the era of automation?

- Education reduces individual's risk of automation by 7 - 11%
- Especially, women can profit from higher education
- Income plays a role for highly educated → glass ceiling for lower educated
- Structural differences across countries

Literature

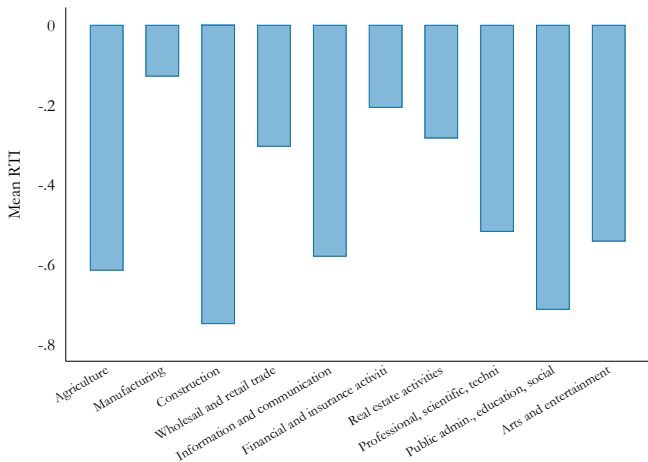
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- Spitz-Oener, A. (2006). Technical change, job tasks, and rising educational demands: Looking outside the wage structure. Journal of labor economics, 24(2), 235-270.

RTI Distribution by Gender



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RTI across industries



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Coefficients per Country

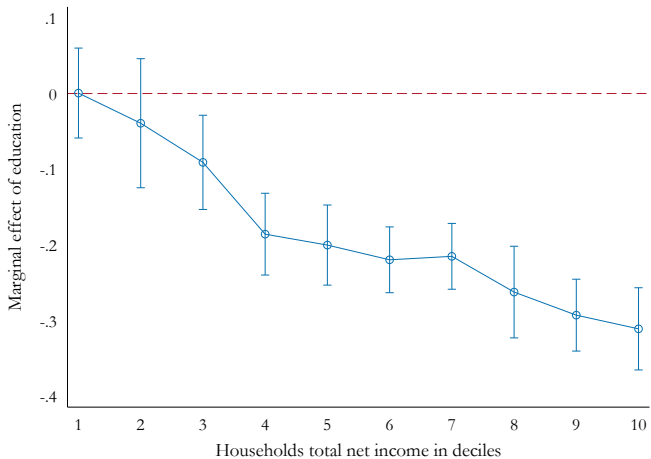
Belgium (BE)	-0.2196*** (0.0140)	Finland (FI)	-0.2382** (0.0226)
Switzerland (CH)	-0.3353* (0.0895)	France (FR)	-0.1813** (0.0278)
Czech Republic (CZ)	0.0805 (0.0931)	United Kingdom (GB)	-0.2253** (0.0231)
Germany (DE)	-0.0929 (0.0445)	Hungary (HU)	-0.0521 (0.1273)
Estonia (EE)	-0.1823* (0.0555)	Ireland (IE)	-0.2183* (0.0381)
Spain (ES)	-0.1342 (0.0611)	Lithuania (LT)	-0.0604 (0.0691)
Netherlands (NL)	-0.2615** (0.0328)	Poland (PL)	-0.2563 (0.1024)
Norway (NO)	-0.3788** (0.0335)	Portugal (PT)	-0.2005 (0.1084)
Sweden (SE)	-0.2493** (0.0388)	Slovenia (SI)	-0.1008 (0.0906)
Observations	59231	Observations	59231

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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Marginal Effects



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