UNIVERSITY OF APPLIED SCIENCES UTRECHT

Measuring Numeracy Skills Mismatch with PIAAC Data

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Introduction

- Numeracy: one of the crucial skills in a digitalised 21-century world
- Adequate numeracy level determines succes and participation in society
- Skills mismatch has a number of negative effects
  - Lower job satisfaction and wages, higher staff turn over, inefficiences, unemployment, lower productivity, and lower economic growth
- In this study:
  - Measuring mismatch in numeracy skills using PIAAC data of the OECD
  - Using the method of Brun-Schamme & Rey, 2021
  - Intention is to use data of all countries: results for five countries are ready
- Aim: to inform policy makers on lifelong learning w.r.t. numeracy skills and mismatch

Key concepts

- Numeracy skills (OECD, 2013): "the ability to access, use, interpret, and ***communicate mathematical information and ideas*** to engage in and manage the ***mathematical demands*** of a range of situations in adult life"
- Skills mismatch: possessed skills does not adequately meet the required skills at workplace
  - Over-skilled or under-skilled

Why is measuring skills mismatch important?

- Human capital is formed by the skills and education an individual gains over time
  - positively affects an individual's success, and productivity.
- In order to put skills to effective use, it is important that they are aligned with the required skills at work
- When skills are not used effectively, we think of them as being mismatched
  - Consequences: skill depreciation, slow adaptation to technological progress, job dissatisfaction, lower earnings
- One of the core challenges in the labour market - European Union's Agenda for New Skills and Jobs (European Commission, 2010)

Measuring mismatch

- Self reported measures
- Direct measures
  - Job Requirement Approach
    - the use of skills in a job as a proxy for the required skill level
  - Realized matches approach
    - the average or median skill level in an occupation as the required skill level
- Direct measures require data on actual skills
  - PIAAC data – proficiency in literacy, numeracy, and problem solving skills
    - Actual skills possessed by individuals

Data and method

- The PIAAC dataset: an international comparable survey conducted by the OECD in over 40 countries in three rounds (2012, 2015, 2017)
- Sample size per country around 5000 people; multistage clustered design
- Measuring skills mismatch (Brun-Schamme & Rey, 2021)
    1. Calculate the median score within each double digit occupation
    2. Overskilled if the score for numeracy skills is higher than the median + 1 SD
    3. Underskilled if the score is lower than the median – 1 SD
- Method: Binary logistic regression of being over-skilled on
    - gender, age-group, education level (alternated by area of study), migrant status, occupation, working part-time or not, firmsize, and numeracy use at work, and country

Table 1: Descriptive statistics

Variable (in percent)	Total	Belgium	Chile	Italy	Netherlands	USA
Over-skilled	14.13	13.56	15.49	14.29	13.18	14.6
Under-skilled	16.37	17.35	16.43	16.66	16.24	14.76
Gender (% of women)	50.64	49.76	50.84	48.69	50.6	53.87
Education level						
• Lower secondary or less	19.86	11.42	24.38	27.53	25.68	7.63
• Upper secondary	42.13	41.64	44.8	49.78	40.31	34.02
• Post-secondary, non-tertiary	2.16	3.87		1.29		
• Tertiary – professional degree	12.32	26.29	17.77	0.25	4.34	7.25
• Tertiary – bachelor degree	14.93	1.84	11.5	18.69	20.42	11.9
• Tertiary – master/research degree	8.61	14.95	1.55	2.47	9.25	24.77
Area of study						
• General programmes	12.23	13.1	21.4	8.35	9.31	7.48
• Teacher training and education science	8.96	9.67	10.15	4.64	7.71	13.27
• Humanities, languages and arts	8.76	7	11.41	16.63	3.39	8.87
• Social sciences, business and law	20.23	16.62	10.48	21.54	29.47	22.22
• Science, mathematics and computing	12.01	10.94	11.84	20.08	6.44	14.97
• Engineering, manufacturing and construction	17.44	24.94	16.27	13.19	16.89	11.42
• Agriculture and veterinary	2.3	1.95	2.13	2.32	3.34	1.23
• Health and welfare	12.82	12.26	7.81	6.76	19.48	15.9
• Services	5.25	3.52	8.52	6.49	3.98	4.63

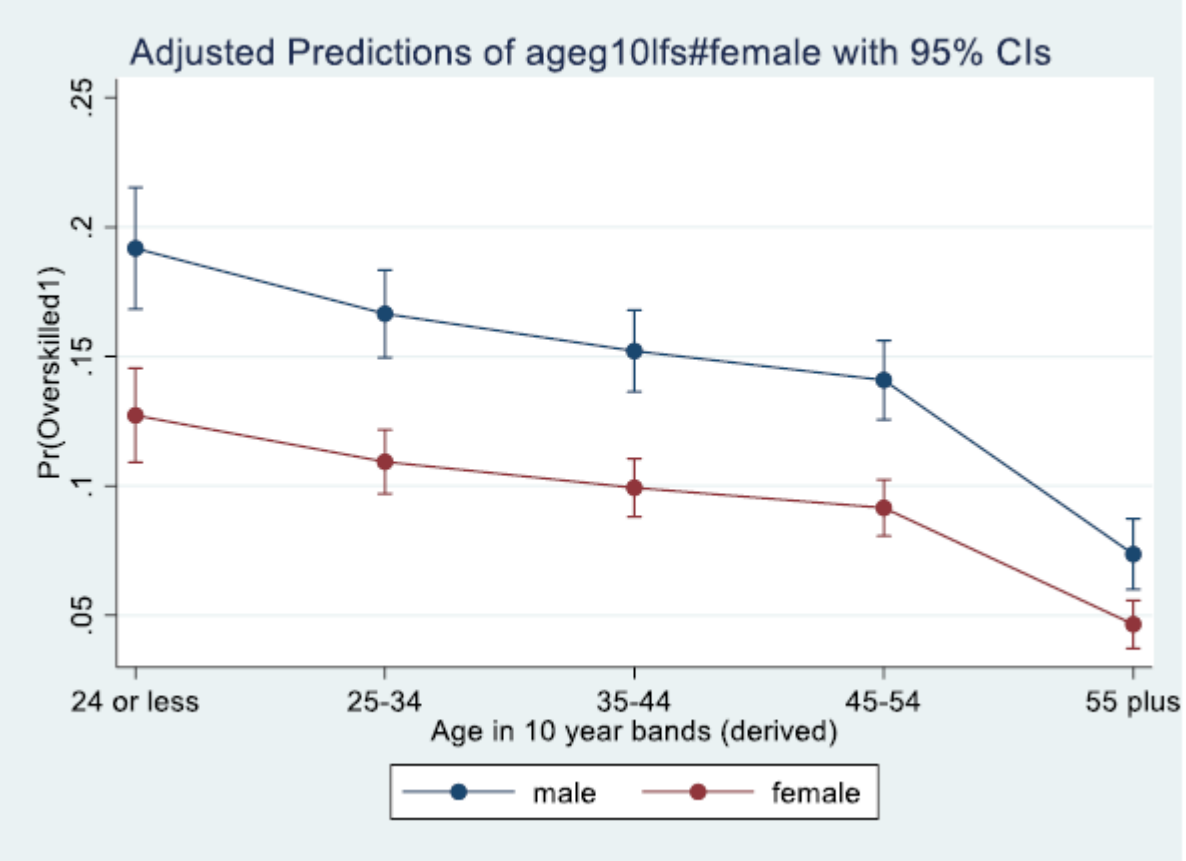
Table 1: Descriptive statistics

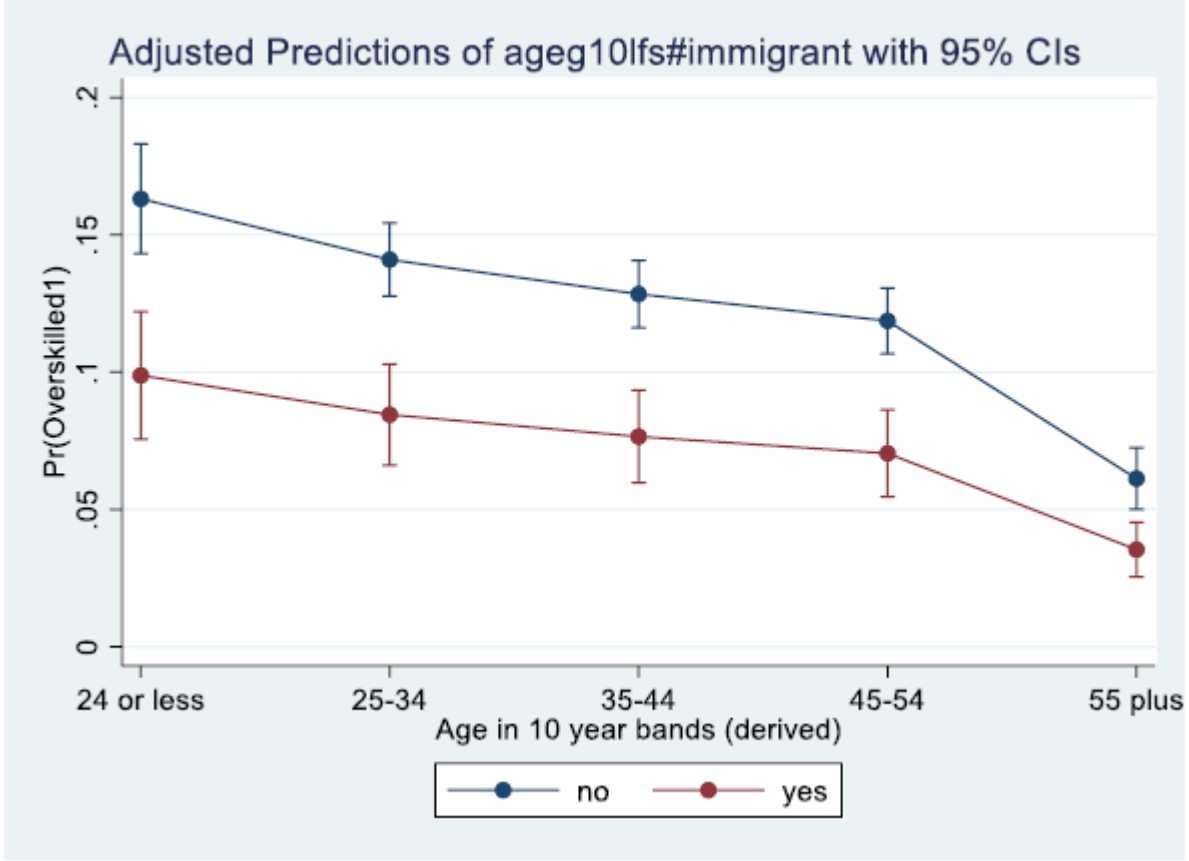
Variable (in percent)	Total	Belgium	Chile	Italy	Netherlands	USA
Age group						
• 24 or less	12.77	9.99	15.61	5.44	16.77	14.12
• 25-34	22.78	24.11	28.29	20.66	18.63	23.04
• 35-44	24.93	25.65	20.79	33.71	22.81	23.42
• 45-54	24.97	29.06	22.05	27.63	25.08	19.85
• 55 plus	14.55	11.19	13.25	12.56	16.71	19.58
Occupation						
• Armed forces	6.99	7.85	2	1.09	11.08	11.84
• Legislators, senior officials and managers	19.46	23.21	11.86	15.22	22.44	23.69
• Professionals	17.54	16.15	13.29	21.5	17.62	20.71
• Technicians and associate professionals	11.73	13.48	11.5	13.64	12.78	5.62
• Clerks	18.12	13.59	22.38	17.1	17.81	20.66
• Service workers and shop and market sales workers	0.89	0.3	2.65	0.69	0.66	
• Skilled agricultural and fishery workers	8.62	10.78	10.64	10.43	6.8	4
• Craft and related trades workers	6.02	6.57	7.17	10.03	2.52	5.3
• Plant and machine operators and assemblers	10.62	8.07	18.51	10.28	8.31	8.17
• Elementary occupations						

Table 1: Descriptive statistics

Variable (in percent)	Total	Belgium	Chile	Italy	Netherlands	USA
Immigrant (born abroad)	8.65	8.15	2.61	9.74	7.9	17.47
Working part-time (Less than 30 hours a week)	23.05	18.83	17.53	18.34	38.67	15.04
Firmsize						
• 1-10 people	26.18	19.56	37.75	37.12	20.23	18.6
• 11-50 people	29.16	27.79	28.09	27.09	32.47	29.15
• 51-250 people	24.54	29.67	19.53	19.77	26.68	25.37
• 251-1000 people	11.53	14.53	8.68	8.3	11.93	13.85
• More than 1000 people	8.58	8.45	5.95	7.71	8.68	13.03
Numeracy use at work						
• All zero response	26.62	27.22	27.03	36.73	25.93	15.31
• Lowest to 20%	15.85	18.02	15.65	13.3	17.43	13.03
• More than 20% to 40%	13.77	14.12	13.7	13.84	13.72	13.36
• More than 40% to 60%	14.75	14.98	14.76	10.73	15.58	17.36
• More than 60% to 80%	14.05	12.09	14.51	12.41	13.47	19.04
• More than 80%	14.98	13.56	14.35	13	13.88	21.9

Figure 1: The probability of being over-skilled in numeracy skills by gender, age-group, and migrant status



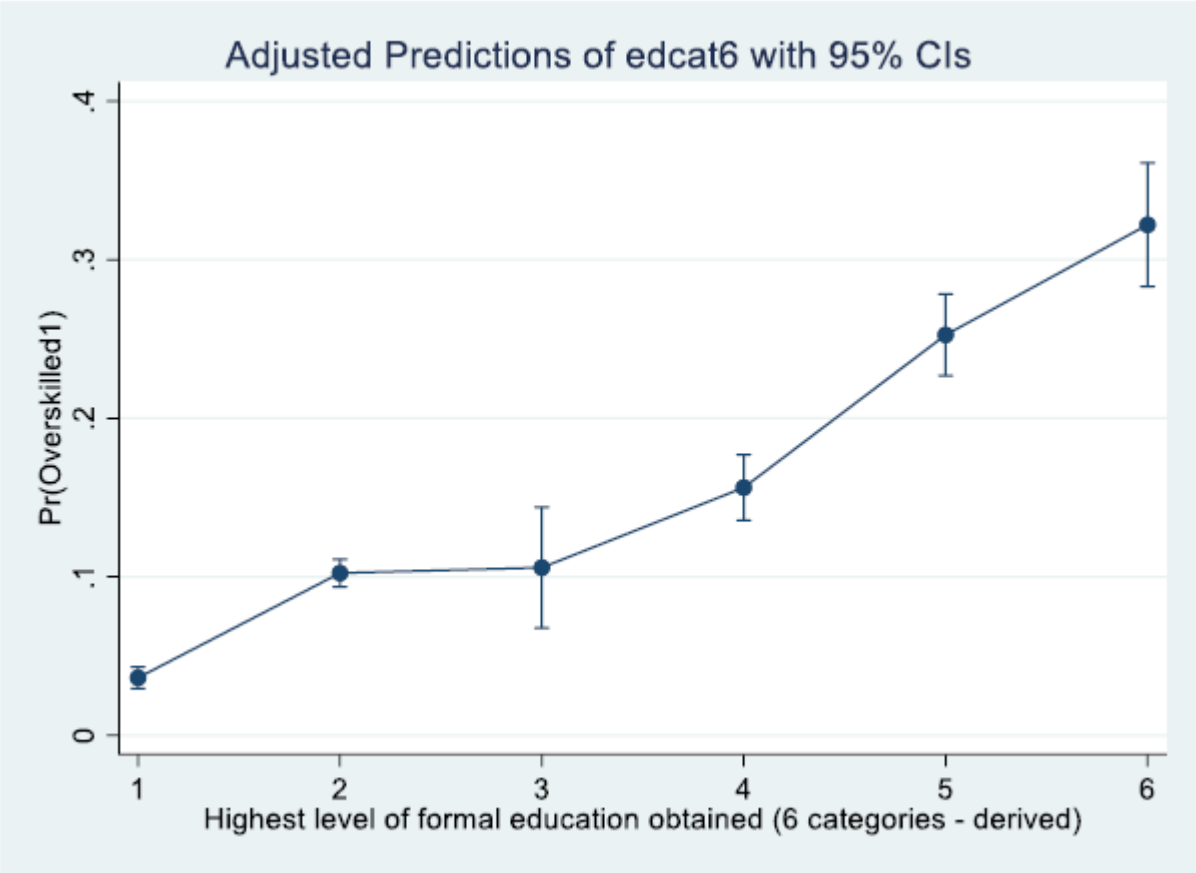


Young people more likely to be over-skilled; more likely to be in temporary or entry-level jobs. Overtime: more experience and more information on the job market

Females less likely to be over-skilled (one might think that they are more likely to be overskilled due to family constraints or preference for better work-life balance)

Immigrants are less likely to be overskilled; a lot of heterogeneity in this group; preliminary research (not presented here: more likely to be under-skilled)

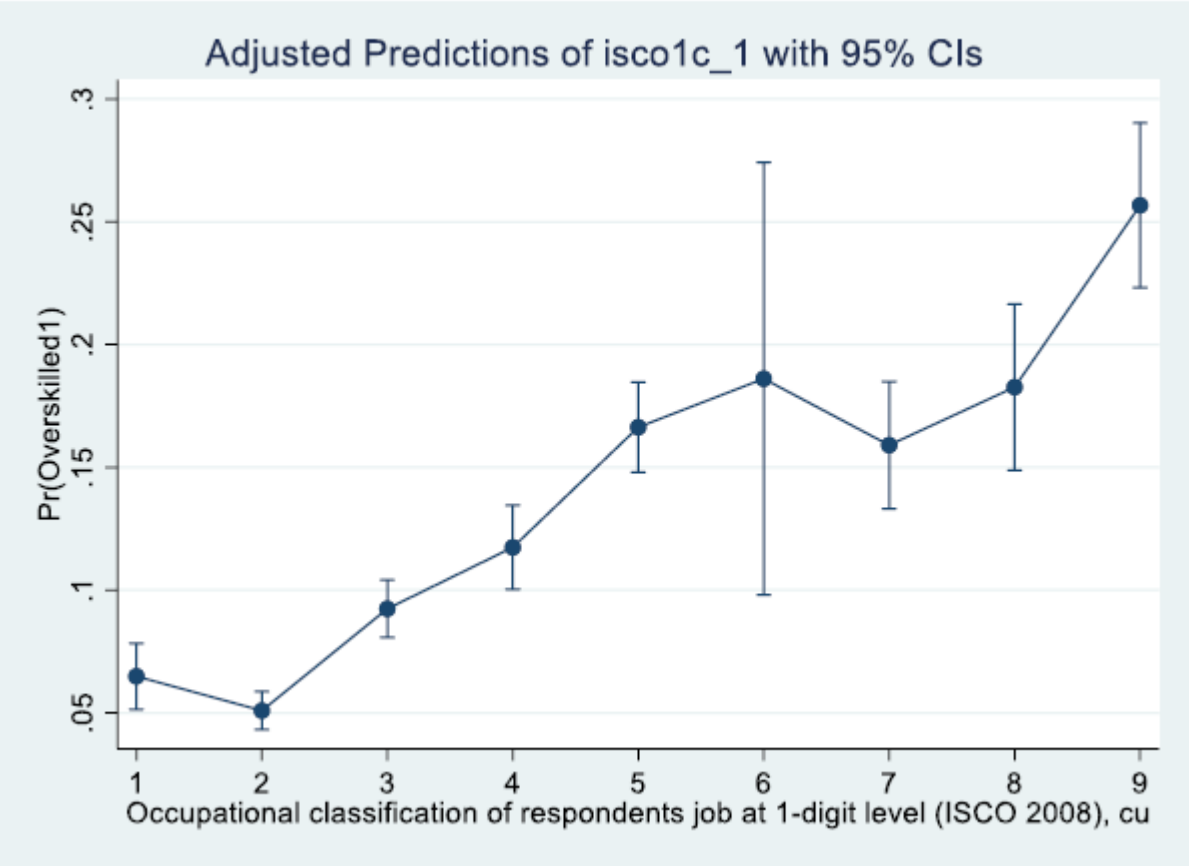
Figure 2a: The probability of being over-skilled in numeracy skills by education level[4]



Being higher educated has a significant positive association with being over-skilled, controlling for other factors.

Legenda: 1 = Lower secondary or less (ISCED 1,2, 3C short or less), 2= Upper secondary (ISCED 3A-B, C long), 3 = Post-secondary, non-tertiary (ISCED 4A-B-C), 4 = Tertiary – professional degree (ISCED 5B), 5 = Tertiary – bachelor degree (ISCED 5A), 6= Tertiary – master/research degree (ISCED 5A/6)

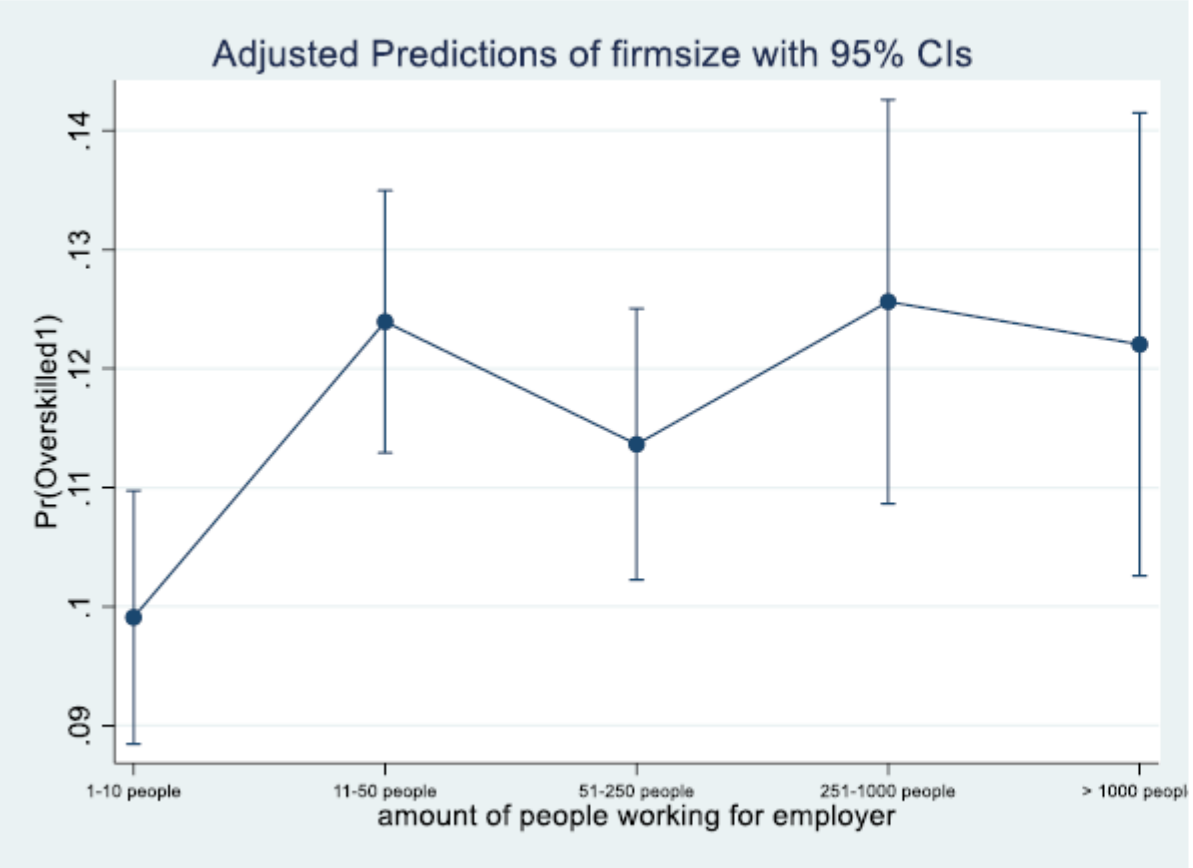
Figure 2b: The probability of being over-skilled in numeracy skills by occupational classification

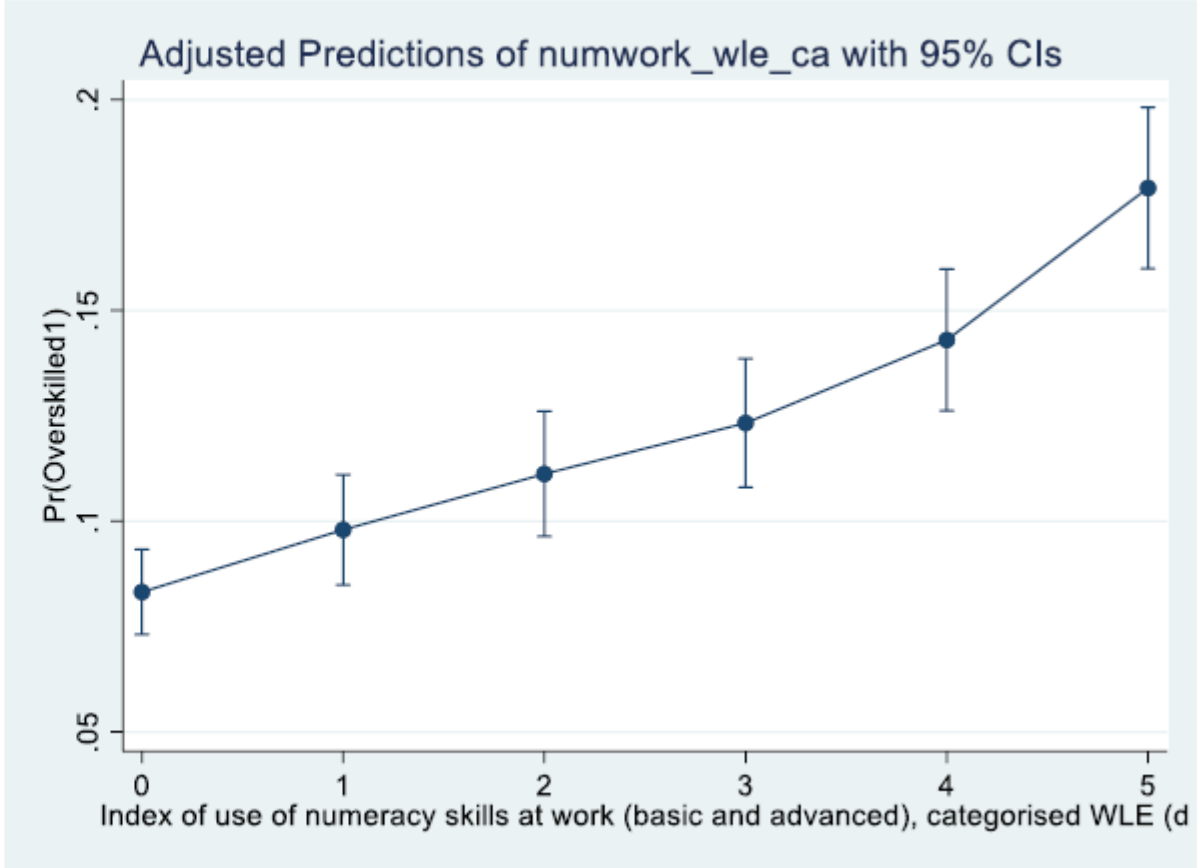


Elementary occupations – more likely to be overskilled; perhaps something to do with the type of contract (part-time or temporary workers more likely to be over-skilled);
Occupational choices in part-time work could be more limited, raising the probability of over-skilling and a switch from full-time to part-time employment could entail occupational downgrading.

Legenda: 0 = Armed forces, 1 = Legislators, senior officials and managers, 2 = Professionals, 3 = Technicians and associate professionals, 4 = Clerks, 5 = Service workers and shop and market sales workers, 6 = Skilled agricultural and fishery workers, 7 = Craft and related trades workers, 8 = Plant and machine operators and assemblers, 9 = Elementary occupations

Figure 3: The probability of being over-skilled in numeracy skills by firm-size and use of numeracy skills[6]





Larger firms > complexity > bureaucratic administrative procedures > more difficult to achieve a good match.
Smaller firms by contrast are in a position in which they can quickly observe when a worker is not well-matched to the job

Conclusion

- The study gives us insight into what direction policies should be steered in order to reduce skills mismatch.
- Being over-skilled is more likely for men, younger age-groups, higher education, and for people who use their numeracy skills often at work. Also, people who studied science, mathematics and computing are significantly more likely to be over-skilled.
- Results largely in line with what earlier studies showed, although we used a different measure and other sample set.
- Further studies needed on causal factors of being over-skilled and on improving the measure for mismatch.