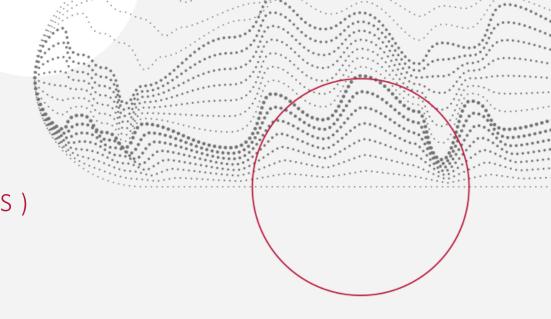# Overeducation and wages: assessing the role of cognitive skills and personality traits

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This paper

- Shows that personality plays a significant role for selection into overeducation among younger workers (aged 18-29) but not among people aged 30-68

- Demonstrates that accounting for personality and cognitive skills does not significantly change the estimate of overeducation wage penalty

Motivation

- Educational mismatches cause wage penalties (e.g. Rubb, 2003; Chiswick & Miller, 2010) and job dissatisfaction (Rubb, 2003)

- Concern that the observed characteristics of individuals may not be enough to properly address potential selection bias

- Limited evidence on the role of personality in the selection into overeducation and overeducation wage penalty

Theoretical explanations of wage differentials

- Human capital theory (Schultz 1961) - wages are solely determined by the productivity of workers

- Job competition theory (Thurow 1972) - wages are determined by the characteristics of the job

- Assignment models (Sattinger 1993, 2012) - solution to allocation problem of heterogeneous workers to heterogeneous jobs

- Heterogeneity of workers with a given level of education (e.g. Green & McIntosh 2007)

The role of cognitive skills and personality traits

- Higher cognitive skills lead to better employment prospects adjusting for education (e.g. OECD 2013)

- Personality traits are as important as cognitive skills for labour market outcomes (Almlund et al. 2010; Borghans et al. 2008)
  - Impact on wages (Nyhus &Pons 2005, Mueller & Plug 2006, O'Connell & Sheikh 2011, Drago 2011)
  - Selection into being overeducated
    - Probability of entering overeducation influenced by personality (Blázquez & Budría 2012)
    - Personality has impact on job search effort (Caliendo et al. 2015, McGee 2014)

Identification strategies of wage penalty

- Fixed effects (Bauer 2002, Dolton & Silles 2008, Verhaest & Omey 2012)

- Instrumental variables (Korpi & Tahlin 2009)

- Proxies of skills (Allen & van der Velden 2001, Chevalier 2003, Green & McIntosh 2007)

- Direct cognitive and non-cognitive skills measures (Sohn 2010)

- Matching estimation (McGuinness 2008, McGuiness & Sloane 2011, Lamo & Messina 2010)

Data

Data sources:

- OECD Survey of Adults Skills (PIAAC)

- Polish Follow-up Study on PIAAC (postPIAAC)

Time: PIAAC-OECD 2011/2012, postPIAAC 2014/2015

Sample: Paid workers excluding self-employed, 18-68 years old, working at least 12 h a week (n = 1605)

Mismatch measure: worker self-assessment

Cognitive skills & personality traits

- Literacy: 'the ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential'

- Numeracy: 'the ability to access, use, interpret and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life' OECD (2013)

- Big Five Inventory - Short (BFI-S) (John et al. 1991, Gerlitz & Schupp 2005)
  - Openness to Experience
  - Conscientiousness
  - Extraversion
  - Agreeableness
  - Neuroticism (opposite of Emotional Stability)

Methodology

$$ATT = E(Y_1 | D = 1) - E(Y_0 | D = 1)$$

- Y_1 - hourly wages among overeducated
- Y_0 - hourly wages among matched controls
- D - dummy for overeducation

- **Propensity score model**: logit
- **Matching algorithms**: Nearest Neighbour with replacement (NN=1 & NN=4) and Kernel (bw=0.02, bw=0.06, bw=0.2)
- **Specifications**: base & full

Incidence of educational mismatch

	Total	18-29	30-68	Age 18-29		Age 30-69	
				ISCED 0-4	ISCED 5-6	ISCED 0-4	ISCED 5-6
Undereducated	14%	11%	15%	17%	2%	24%	1%
Matched	53%	46%	55%	43%	51%	48%	65%
Overeducated	33%	43%	30%	40%	47%	28%	34%
N	2601	1666	935	924	742	561	374

Working sample: excluding undereducated, self-employed, working less than 12 h a week, listwise deletion of missings

	Total	18-29	30-68	Age 18-29		Age 30-69	
				ISCED 0-4	ISCED 5-6	ISCED 0-4	ISCED 5-6
Matched	60%	52%	63%	53%	51%	63%	63%
Overeducated	40%	48%	37%	47%	49%	37%	37%
N	1605	1096	509	543	553	276	233

Selection into overeducation (logit coefficients)

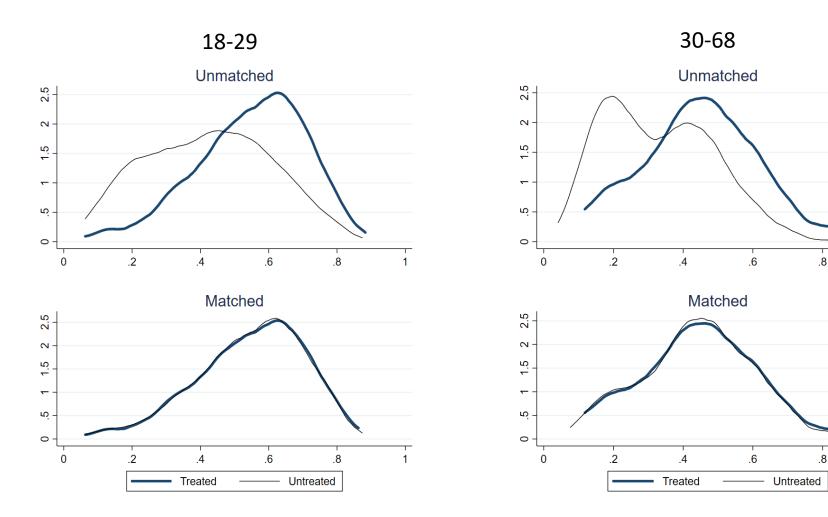|	Total	18-29	18-29 (ISCED 0-4)	18-29 (ISCED 5-6)	30-68
Numeracy	-0.187[+]	-0.037	-0.121	0.046	-0.221
B5: Conscientiousness	-0.029	**-0.447[*]**	-0.169	**-0.629[*]**	0.182
B5: Extraversion	-0.134	-0.14	-0.077	-0.178	-0.153
B5: Agreeableness	0.081	**0.468[+]**	0.184	**0.634[*]**	-0.084
B5: Openness	-0.101	-0.09	-0.21	-0.05	-0.134
B5: Neuroticism	0.084	-0.004	0.111	-0.13	0.102
N	1605	1096	543	553	509

Matching quality: MSB

Mean standardized bias - MSB (Rosenbaum & Rubin 1985)

$$SB(x) = \frac{100(\bar{x}_c - \bar{x}_t)}{\sqrt{(s_{xc}^2 + s_{xt}^2)/2}}$$

		Base				Full			
		MSB_bef	MSB_aft	r2bef	r2aft	MSB_bef	MSB_aft	r2bef	r2aft
Total	NN_1	11.2	7.0	0.081	0.027	10.6	6.2	0.086	0.024
	Kernel_0.06	11.2	5.7	0.081	0.015	10.6	5.3	0.086	0.019
18-29	NN_1	11.0	5.5	0.087	0.019	9.9	4.9	0.093	0.015
	Kernel_0.06	11.0	2.9	0.087	0.005	9.9	3.2	0.093	0.007
18-29 (ISCED 0-4)	NN_1	16.0	6.8	0.135	0.031	13.5	7.6	0.139	0.037
	Kernel_0.06	16.0	4.6	0.135	0.012	13.5	5.0	0.139	0.016
18-29 (ISCED 5-6)	NN_1	10.6	6.6	0.058	0.022	10.3	6.4	0.070	0.028
	Kernel_0.06	10.6	4.4	0.058	0.007	10.3	4.5	0.070	0.010
30-68	NN_1	9.5	5.7	0.083	0.023	10.1	5.1	0.095	0.031
	Kernel_0.06	9.5	3.9	0.083	0.006	10.1	3.2	0.095	0.007

Matching quality: propensity scores

Notes: Kernel bw=0.06

Overeducation wage penalty

	Total		18-29		18-29 (ISCED 0-4)		18-29 (ISCED 5-6)		30-68	
	base	full	base	full	base	full	base	full	base	full
OLS	-0.167***	-0.159***	-0.126***	-0.120***	-0.107*	-0.098+	-0.144***	-0.141***	-0.171***	-0.163***
PSM			-0.144	-0.139	-0.119	-0.112	-0.160	-0.150	-0.138	-0.144

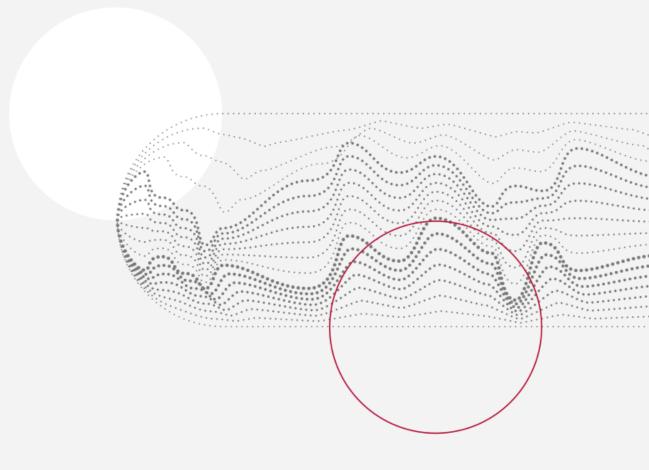Notes: PSM: kernel matching estimator (bw=0.06)

Conclusions

- Personality plays a significant role for selection into overeducation among younger workers (aged 18-29) but not among people aged 30-68.
  - Among younger workers agreeable individuals are more likely to be overeducated while conscientious ones are less likely.

- Cognitive skills are unrelated to being overeducated in neither of the age groups.

- Accounting for personality and cognitive skills does not significantly change the estimates of overeducation wage penalty.

Thank you!
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Differences in mean characteristics between overeducated and matched individuals

	Mean (overeducated) – Mean (matched)				
	Total	18-29	18-29 (ISCED0-4)	18-29 (ISCED5-6)	30-68
Hourly wages (in PLN)	-2.783***	-1.999***	-1.229+	-2.891***	-2.675**
Hourly wages (in PLN) log	-0.158***	-0.126***	-0.085+	-0.176***	-0.149**
Cognitive skills					
Literacy	0.012	0.071	0.137	-0.014	-0.032
Numeracy	-0.062	-0.01	-0.001	-0.037	-0.094
Personality traits					
B5: Conscientiousness	-0.087	-0.093*	-0.06	-0.129*	-0.046
B5: Extraversion	-0.164*	-0.091	-0.076	-0.107	-0.196*
B5: Agreeableness	-0.106	-0.027	-0.017	-0.038	-0.104
B5: Openness	-0.173*	-0.086	-0.118	-0.054	-0.190+
B5: Neuroticism	0.053	-0.033	0.042	-0.11	0.065