

Does personality impact the returns to cognitive skills?

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Abstract

This paper provides evidence on the relationship between individuals' cognitive abilities, their personality measured by the Big Five inventory and earnings. Using data from the Polish Follow-up Study to the Programme for International Assessment of Adult Competencies (postPIAAC) I find that the returns to cognitive skills depend on the personality of an individual: neurotic individuals experience significantly lower returns to their cognitive skills. Results also indicate that agreeableness and neuroticism are penalized significantly in the Polish labour market and that there is a positive relationship between conscientiousness and wages. Moreover, unlike previous literature, I find no substantial gender discrepancies in the personality associations with wages.

Keywords: cognitive skills, personality, earnings

JEL Classification: J24, J31

1 Introduction

There is a common consensus that cognitive skills have important effects on labour market outcomes (e.g. Herrnstein and Murray 1994). However, much of the variance of individual wages remains unexplained (Bowles, Gintis, and Osborne 2001). Thus, recently economists became increasingly interested in non-cognitive skills, e.g. traits such as personality, motivation or interests, as potential predictors of life outcomes, including wages (for reviews, see Almlund et al. 2011; Borghans et al. 2008).

Substantial attention has been devoted to the concept of personality which is believed to provide the most complete description of an individual non-cognitive skills. Roberts (2009, p.7) defines personality traits as “the relatively enduring patterns of thoughts, feelings, and behaviours that reflect the tendency to respond in certain ways under certain circumstances.” The most widely used personality model is the Big Five model. It organizes personality according to five dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Costa and McCrae 1985; John and Srivastava 1999; McCrae and Costa Jr 1999). Personality traits are considered to be stable during the adulthood (Cobb-Clark and Schurer 2012; Rantanen et al. 2007) and mostly uncorrelated with cognitive skills (Costa and McCrae 1992), and thus can be seen as a distinct factor explaining differences in the labour market outcomes.

My analysis adds to the literature in two ways. First, while most studies exploit data from high-income countries, it provides evidence on the personality-wages relationship from Poland while using well-established measures of cognitive skills and personality and showing the effects separately for women and men. Second, it explores the possibility that the effects of cognitive skills on wages might vary depending on the personality of an individual.

The paper is organised as follows. In the next section, I describe the potential channels of influence and empirical literature on the personality-wage relationship. Then, I describe the data set and the methodology used. This is followed by the investigation of the relationship between cognitive and non-cognitive skills and wages. The last section concludes.

2 Previous findings and expectations

The theoretical and empirical literature indicates that personality affects wages via numerous channels other than education (Almlund et al 2011). Conscientious individuals tend to be organized, responsible, and hardworking. Conscientiousness has been shown to be related to higher productivity (Cubel et al. 2016), impact performance in on-the-job training (Barrick and Mount 1991) and supervisors’ rating of workers’ performance (Caligiuri 2000).

Neuroticism is related to individual’s emotional instability, vulnerability to stress and a lack of self-confidence. Traits associated with neuroticism, such as self-esteem and locus of control, predict job search behaviour. Individuals with greater internal locus of control send more job applications and have higher reservation wage (Caliendo et al. 2015; McGee 2014). These results suggest that the wage gaps between neurotic and emotionally stable individuals may already arise during recruitment process.

Additionally, the motivation theory supports the idea that neuroticism is related to lower use of skills and, thus, mitigates the effect of cognitive skills on wages. The motivation theory assumes that individuals have imperfect knowledge of their own ability and ability

and effort are complements; thus higher self-confidence leads to higher motivation and use of skills (Bénabou and Tirole 2002). Accordingly, the more neurotic individual, the lower his or her use of skills. Also, the results of experimental studies suggest that neuroticism affects use of skills and, thus, the return to cognitive skills. Müller and Schwieren (2012) and Cubel et al. (2016) examined the relationship between personality and productivity measured in the laboratory. The productivity task used was very simple and thus the performance in it was assumed to be unrelated to cognitive skills. Both studies found negative association between neuroticism and productivity. This result suggests that neurotic individuals use the opportunities to put their cognitive skills into productive use less often.

There is also a growing literature providing evidence that competitiveness, typically measured experimentally through a classic paradigm based on Niederle and Vesterlund (2007), is important for economic outcomes (Buser, Niederle, and Oosterbeek 2014; Buser et al. 2017; Reuben, Sapienza, and Zingales 2015). Reuben et al. (2017) showed that competitiveness is associated with higher expected future earnings. So far, only Muller and Schwieren (2012) studied the association between personality and competitiveness. They found that neurotic individuals are less likely to compete. However, one can expect that in competitive environment cognitive skills yield higher returns. In sum, neurotic individuals are less productive and less competitive which may result in lower returns on their cognitive skills.

Agreeableness defined as the tendency to act in a cooperative, unselfish manner may be valued in some occupations which require client service or team work. However, there are other channel than productivity operating in the opposite direction. Agreeableness is shown to negatively affect the selection into managerial and professional occupations (Cobb-Clark and Tan 2011) and also the wage bargaining outcomes. Nguyen et al. (2011) and Hilbig et al. (2013) found experimentally that agreeable individuals accept unfair offers more often. On contrary, openness to experience positively affects the selection into managerial and professional occupations (Cobb-Clark and Tan 2011). Open individuals are typically curious, imaginative, with wide interests which may be rewarded in some occupations but may not play a role in others.

Previous empirical research documented the relationship between personality and different aspects of labour market success. Barrick and Mount (1991) find that conscientiousness is positively related to job performance and training proficiency, while openness - to training proficiency only. Various studies have shown that there is a wage penalty for neuroticism and agreeableness (Mueller and Plug 2006; Nyhus and Pons 2005; O'Connell and Sheikh 2011). Also Drago (2011) and Heineck and Anger (2010) confirmed the negative relationship between wages and traits related to neuroticism. Studies on the US and UK populations report also a wage premium for openness (Mueller and Plug 2006; O'Connell and Sheikh 2011; Heineck 2014). Recently, Rammstedt, Danner, and Lechner (2017) using German data reported negative link between earnings and openness. Most of the literature examines the effects in the United States and Western Europe. The study by Cunningham et al. (2016) is one of the exceptions. Using Peruvian data, they find that openness is positively linked to wages and agreeableness and neuroticism negatively. In Eastern Europe, Semykina and Linz (2007) showed the importance of personality measured by locus of control and the need for challenge or affiliation for earnings in Russia and Palczyńska and Świst (2016) evaluated this relationship on the Polish labour market. The latter show that conscientious individuals earn more while agreeable and neurotic ones earn

less. In the studies controlling for individual and job differences extraversion is not related to wages.

Various studies find heterogeneous effects of personality on wages for men and women but the results differ between the countries analysed. Nyhus and Pons (2005) show that the negative effect of agreeableness on income holds only for women Netherlands while Judge et al. (2012) find that agreeableness is significantly associated with lower wages for men. Also, the findings on neuroticism are not conclusive: some studies indicate the relationship only for men (Mueller and Plug 2006) while the other for both men and women (Nyhus and Pons 2005). Judge et al. (2012) indicate that gender differences in the personality-income relationships stem from different social expectations towards genders. Counterstereotypic behaviour is often subject to social and economic sanction (e.g. Rudman and Fairchild 2004). The sanctions may include limited opportunities for promotion, reduced recognition (Rudman and Phelan 2008) and also worse interpersonal relations (Parks-Stamm, Heilman, and Hearn 2008). Accordingly, e.g. as men are expected to be more disagreeable, they are penalized more for agreeableness than women who are expected to behave in this way.

Given the evidence above, I expect to find that

- 1 agreeableness and neuroticism are negatively associated with wages;
- 2 conscientiousness is rewarded;
- 3 openness may or may not be related to wages;
- 4 extraversion is not related to wages;
- 5 there might be differences in the personality – wages relationships by gender;
- 6 neurotic individuals have lower returns to their cognitive skills.

3 Data and methods

This study employs the data from the Polish follow-up to the Programme for the International Assessment of Adult Competencies (postPIAAC), conducted by the Educational Research Institute in 2014-2015. The dataset includes longitudinal information on PIAAC respondents in Poland and additional background information. Data includes cognitive skills measures from PIAAC (Burski et al. 2013; OECD 2013) conducted in 2011-2012. The combined database is representative of the Polish working-age population and contains a number of measures of cognitive abilities, personality and effects on the labour market (Palczyńska and Świst 2016).

The final sample comprises 2022 dependent employees aged 19-67. The dependent variable is logarithm of gross hourly wage. Summary statistics for the final sample are provided in Appendix Table A.2.

a. Measures of cognitive skills

Cognitive skills measured in PIAAC are the basic information processing skills: literacy and numeracy. Literacy is defined as “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.” (OECD 2013) Numeracy refers to “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)

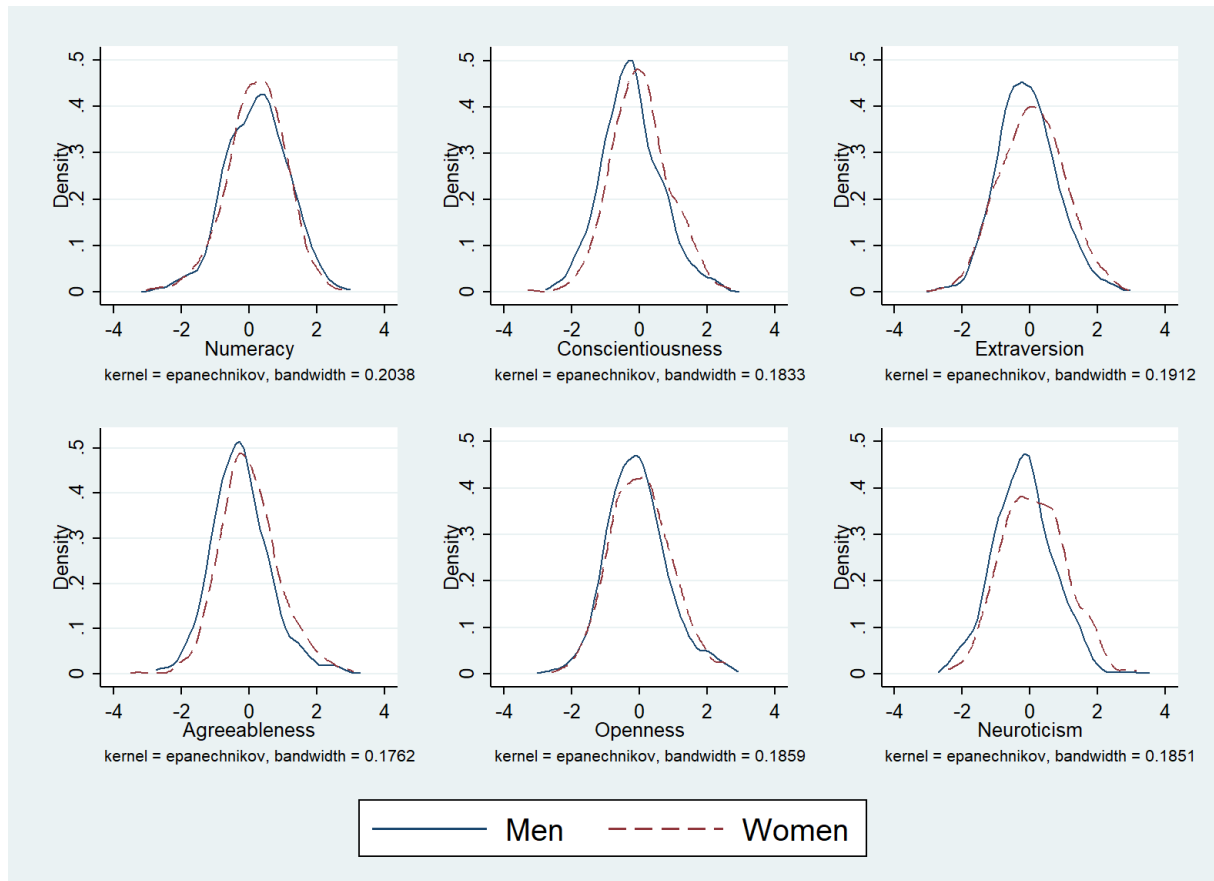
Both domains are measured on a 500-point scale. For analytical purposes, I standardize scores in the subsequent analyses to have a mean of zero and a standard deviation of one. Although intended to measure different skills, PIAAC literacy and numeracy scales are strongly correlated (0.85). I focus on numeracy skills in the subsequent analyses but the results do not depend on the choice of the cognitive skill analysed (the results for literacy available from author upon request).

The analysis is based on the assumption that literacy and numeracy do not change substantially during a three-year period among adults. There are indirect evidence that skills analysed are relatively stable over such a period. Hill et al. (2008) showed that for school children average annual gains in literacy and numeracy decline with age and are already marginal by the age of 17. Cross-sectional findings on adults show that proficiency peaks around the age of 30 and then declines steadily (Paccagnella 2016). However, the longitudinal research on the development of literacy and numeracy skills shows that the age profiles are less steep or even that literacy is fixed early in life (Desjardins and Warnke 2012).

b. Measures of personality

The analysis exploits the most widely used personality model - the Big Five model. It organizes personality according to five dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. The Big Five personality model is measured by the Polish version of the Big Five Inventory-Short (BFI-S) (Gerlitz and Schupp 2005) which contains 15 self-reported items (see Appendix Table A.1 for the list of items). Respondents answered on 7-point Likert type scales (1 — “disagree completely” to 7 — “agree completely”). The study uses the factor scores from the best fitted model obtained in the detailed psychometric analysis of the scale (Palczyńska and Świst 2016). The scores for subscales are standardized with a mean of zero and a standard deviation of one.

Figure 1 shows distributions of personality traits and cognitive scores for males and females. Kolmogorov-Smirnov tests indicate that all personality traits are differently distributed for males and females with females having higher levels of each personality trait. In contrast, numeracy has the same distribution across gender.



Notes: N=2022. First PV (plausible value) for numeracy.

Figure 1 Distribution of personality traits and cognitive abilities by gender

c. Estimation method

I examine the returns to cognitive skills and personality traits using semi-logarithmic model of the typical form:

$$\ln y_i = \beta \text{COG}_i + \delta \text{PT}_i + \alpha \text{COG}_i * \text{PT}_i + \theta X_i + u_i,$$

where y_i is individual i 's gross hourly wage, COG_i is the level of cognitive skills, PT_i is the vector of respondent's personality traits and X_i is a vector of individual and job characteristics related to earnings, and u_i denotes the error term. I include interactions between personality and cognitive skills in order to capture if personality moderates the effect of cognitive skills on wages. In line with previous research which found substantial differences by gender, I estimate models for men and women separately.

Since wages are observed only for employed individuals, I use Heckman's selection model to account for sample selection bias (Heckman 1979). The model is fitted with maximum likelihood; all models use weights accounting for survey design. The exclusion restriction, that is the additional variable included in the employment equation, is a dummy for whether respondent lives with a partner. While it is plausible to assume that living with a partner is related to a respondent's employment probability, it is unlikely that it will affect the respondent's wage itself. However, there is no evidence of a sample selection problem in estimating wage equation neither for women nor for men (Table A. 3). I also checked alternative exclusion restrictions suggested by the literature: whether respondent's female

and male guardians were working when he or she was sixteen years old and a dummy on having children 6 years old or younger. These results also do not support the existence of the selection bias into employment, thus I show the results from the OLS estimation throughout the article.

Although this study uses cross-sectional data showing correlations and not revealing causal mechanisms, empirical evidence on this topic from longitudinal studies (e.g. Heckman, Pinto, and Savelyev 2013; Heckman et al. 2010; Roberts et al. 2007) supports the hypothesis that personality traits have causal impact on wages. Moreover, personality is shown to be stable in adulthood (Cobb-Clark and Schurer 2012; Rantanen et al. 2007) which also suggests that personality is antecedent to wage.

d. Alternative specifications

I examine the sensitivity of the results using a variety of specifications that include different sets of control variables. The baseline specification controls for age, age squared, years of education, experience and experience squared. The second specification includes additionally a set of employment characteristics: a dummy on whether respondent works for public employer, tenure on current job and number of hours worked per week, nine occupation dummies (International Standard Classification of Occupations 2008, ISCO-08) and eight industry dummies (International Standard Industrial Classification, ISIC). The change in personality coefficients between specifications informs about the extent to which individual's personality affects selection into specific jobs (e.g. Mueller and Plug 2006).

Next, I examine the sensitivity of the results with respect to possible non-linear effects of personality. It has been argued that in case of personality "more" does not necessarily mean "better" (Lee et al. 2011). To test the possible non-linear associations between personality and wages I follow Rammstedt et al. (2017) and estimate additional regressions with quadratic term of each personality trait. Finally, as it is sometimes argued that the personality is revealed to employer only after some time (Heiner and Anger 2010; Nyhus and Pons 2005), I estimate models with interaction terms between employees' tenure with the current employer and their personality traits.

4 Results

Table 1 provides estimates from the OLS models. There are three overall findings. First, there is no evidence on the self-selection into jobs based on personality traits as the coefficients actually increase and partially gain statistical significance once job and occupation dummies are controlled for¹. This result is on contrary to the earlier literature (Filer 1986; Mueller and Plug 2006; Heineck 2014) and may indicate that personality traits impact wages not in all the occupations and industries in Poland². However, I do observe self-selection into jobs based on cognitive skills. Once the job and occupation dummies are controlled for the returns to cognitive skills are not significant.

¹ Similar change in the coefficients is observed when we include job characteristics (tenure, hours worked per week, public sector dummy) in the baseline specification and compare the results to the full specification with occupation and industry dummies.

² The sample size does not allow for by occupation / by industry analysis.

Second, the results on personality relationship with wages are in line with the literature and earlier expectations in the specification with the full set of control variables. There is a wage premium for a one-standard-deviation increase in conscientiousness of 10% for both men and women. Agreeableness is strongly related to wages: there is a wage penalty of about 12% for women and almost 15% for men. A one-standard-deviation increase in neuroticism is associated with wages that are 3-4% lower but the effect is marginally significant for men. Unlike studies in the US and UK there is no wage premium for openness (Mueller and Plug 2006; O’Connell and Sheikh 2011; Heineck 2014). However, openness moderates the returns to cognitive skills in case of men. More open men have higher returns to numeracy. The possible explanation would be that being open (which means curious, imaginative, with wide interests) is complementary to having high cognitive skills: more open individuals can put their cognitive skills into productive use more effectively. Extraversion is also unrelated to wages. No gender differences for the relationships between personality traits and wages, contradict findings of earlier research where especially the impact of agreeableness and neuroticism on wages differs by gender (e.g. Nyhus and Pons 2005; Judge, Livingston, and Hurst 2012).

Table 1 Log-hourly wage estimates

	Men (1)	Women (2)	Men (3)	Women (4)
Numeracy	0.066*	0.045 ⁺	0.042	0.027
Conscientiousness	0.108 ⁺	0.090	0.104*	0.105*
Extraversion	0.010	0.007	0.010	0.011
Agreeableness	-0.132*	-0.085	-0.149**	-0.121**
Openness	0.018	-0.021	0.038	-0.021
Neuroticism	-0.022	-0.028	-0.033 ⁺	-0.045*
Numeracy # Con	-0.040	-0.049	0.024	0.021
Numeracy # Ext	-0.030	0.009	-0.044	0.000
Numeracy # Agr	-0.025	0.016	-0.060	-0.041
Numeracy # Opn	0.100 ⁺	-0.022	0.084 ⁺	0.007
Numeracy # Neu	-0.042	-0.029	-0.054*	-0.044*
Individual controls	+	+	+	+
Job / Occupation controls			+	+
R ²	0.303	0.306	0.467	0.497

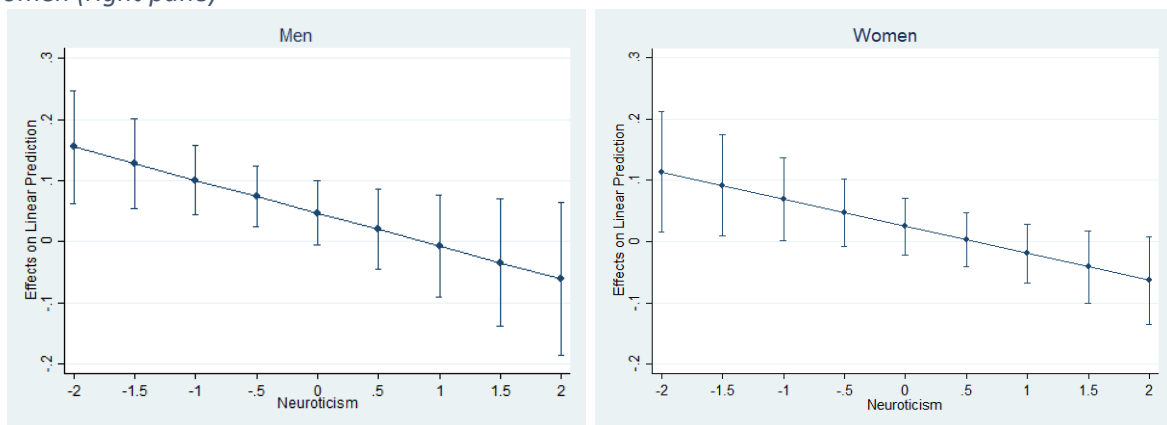
Notes: N=937 (females)/1085 (males); Individual controls: age, age squared, years of education, experience, experience squared; job / occupation controls: tenure, hours worked per week, public sector dummy, 1-digit ISCO, industry (ISIC); ISCO=0 excluded; top and bottom 1% of wage distribution excluded. First PV (plausible value) for numeracy. Logarithm of wages. Numeracy and non-cognitive skills are standardised. ⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Finally, the results confirm the hypothesis that the more neurotic individuals are, the lower their returns to cognitive skills are³. The relationship holds for both women and men.

³ Earlier literature suggests that potential channels underlying this relationship include lower skill-use and self-selection into less competitive tasks even within occupations related to neuroticism (Bénabou and Tirole 2002; Muller and Schwieren 2012). Additional analysis shows that, after adjusting for the whole set of sociodemographic and job specific controls, neuroticism is not related to the use of information-processing skills at work (reading, writing, numeracy, ICT) but is related to other generic skills and job characteristics among men: neurotic men work to tight deadlines and cooperate with others less often and spend more time planning their own work. However, once included in the wage regression these characteristics are not significant.

Figure 2 illustrates the changes in wages with a one-standard-deviation change in numeracy at different values of neuroticism. The returns to numeracy are significantly different from zero for values of neuroticism around the mean or below. This result suggests that the individuals with the above average neuroticism level do not benefit from higher cognitive skills. Among the emotionally stable individuals men have higher returns to cognitive skills than women. A one-standard-deviation increase in numeracy is related to 10% higher wages for former and 7% higher wages for the latter assuming an equal level of neuroticism at 1 SD below the average.

Figure 2 Average marginal effects of numeracy on wages by neuroticism level for men (left pane) and women (right pane)



Note: 95% Confidence intervals.

Non-linearities

The results discussed so far are consistent with the expectations based on earlier research: there are wage penalties for agreeableness and neuroticism while conscientiousness is positively linked to wages. However, as has been shown with respect to some Big Five traits and economic outcomes (e.g. Le et al. 2011), it is possible that the personality–income relationship is non-linear. To account for possible non-linearities I run additional models which include a quadratic term of each trait (Table 2). The results did not replicate previous findings on a U-shaped relationship between agreeableness and wages reported by Rammstedt, et al. (2017) or a hump-shaped association between conscientiousness and wages (Heineck 2014). The results suggest that a linear representation is an accurate approximation of these relationships. As noted above, openness is not linearly related to wages; however, our data confirm a hump-shaped relationship between openness and wage observed by Rammstedt et al. (2017), but only for men. The results for neuroticism support the linear representation of its relationship with wages.

Table 2 Log hourly wages and non-linearities in cognitive skills and personality traits and the effects of tenure

	Men (1)	Women (2)	Men (3)	Women (4)
Numeracy	0.033	0.03	0.034	0.049
Conscientiousness	0.101+	0.108*	0.097	0.099 ⁺
Extraversion	0.013	0.007	0.046	-0.011

Agreeableness	-0.143**	-0.119*	-0.156*	-0.086
Openness	0.043	-0.013	0.046	-0.013
Neuroticism	-0.035*	-0.041*	-0.041 ⁺	-0.059*
Numeracy # Con	0.012	0.027	0.023	0.039
Numeracy # Ext	-0.045	-0.006	-0.049	0.002
Numeracy # Agr	-0.048	-0.043	-0.056	-0.049
Numeracy # Opn	0.079 ⁺	0.002	0.083 ⁺	0.001
Numeracy # Neu	-0.060*	-0.047*	-0.050*	-0.045*
Num # Num	0.004	-0.006		
Con # Con	-0.025	0.018		
Ext # Ext	0.022	-0.016		
Agr # Agr	0.026	-0.002		
Opn # Opn	-0.048*	-0.017		
Neu # Neu	-0.018	0.005		
Tenure in years	0.007**	0.005*	0.005*	0.007**
Tenure # Num			0.001	-0.003
Tenure # Con			0.001	-0.001
Tenure # Ext			-0.005*	0.002
Tenure # Agr			0.000	-0.002
Tenure # Opn			-0.000	-0.001
Tenure # Neu			0.001	0.002
Individual controls	+	+	+	+
Job / Occupation controls	+	+	+	+
R ²	0.478	0.502	0.471	0.504

Notes: N=937 (females)/1085 (males); Individual controls: age, age squared, years of education, experience, experience squared; Occupation controls: 1-digit ISCO, industry (ISIC), public sector dummy, tenure, hours worked weekly; ISCO=0 excluded, top and bottom 1% of wage distribution excluded. First PV (plausible value) for numeracy. Logarithm of wages. Numeracy and non-cognitive skills are standardised. ⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Overall, my findings are in line with Mueller and Plug (2006) who found no overly convincing evidence for non-linearity in personality-income relationship and Heineck and Anger (2010) whose results also did not support a nonlinear association between personality and wages (except for extraversion for men).

Tenure Effect

As pointed out by Nyhus and Pons (2005) and Heineck and Anger (2010) it is possible that both cognitive skills and personality traits are unobserved during recruitment process and only over time employer becomes aware of employee's traits and potentially rewards them. Tenure with the current employer can potentially moderate the impact of personality traits on wages also when the mechanism behind the personality-income relationship is not based strictly on productivity but e.g. more successful bargaining, as is often argued about the agreeableness-wages association. With tenure there are potentially more occasions to negotiate wages and to increase the wage gap between agreeable and disagreeable individuals.

However, there is limited empirical evidence on the moderating role on tenure. Openness / autonomy tends to be rewarded more among men as tenure increase (Heineck and Anger 2010; Nyhus and Pons 2005). Additionally, Nyhus and Pons (2005) also showed

that the premium for conscientiousness decreases with tenure. As in Heineck (2014), these moderation effects could not be replicated in our data (Table 2 Log hourly wages and non-linearities in cognitive skills and personality traits). Only the relationship of extraversion with wages for men is moderated by tenure. The penalty for extraversion increases with tenure among men.

5 Conclusions

The present study aims at evaluating the impact of personality traits on wages and on the returns to cognitive skills. It employs the Big Five personality model as a comprehensive framework organizing individuals' personality in five dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. The cognitive skills are measured by a competence test used in PIAAC survey.

The results show that personality matters for the labour market success in Poland, also when individual characteristics, including cognitive skills, are controlled for. In particular, the findings suggest that conscientiousness is rewarded while agreeableness and neuroticism penalized. The association between openness and wages is more complicated. In the main specification it is not different from zero. Once the non-linearities are allowed for, there is significant hump-shaped relationship for men indicating that individuals with the intermediate level of openness have the highest average wages. Present analysis did not replicate previous findings on the heterogeneous main effects of personality on wages across genders.

In terms of the moderation effect of personality on returns to skills, I found that emotional stability and cognitive skills are complementary: neurotic individuals have lower returns to cognitive skills. This finding suggests that in order to get unbiased estimates of the returns to cognitive skills one needs to account for personality traits. The findings highlight the importance of including personality measures in large-scale competence surveys such as PIAAC. Possible theoretical explanation of this relationship assumes that, as neuroticism is related to lower self-esteem, neurotic individuals underestimate their ability and expend less effort which result in lower return to cognitive skills. Alternative or complementary mechanism predict that neurotic individuals engage in less competitive task which also yield lower returns. This sorting can take place also within occupations. Mechanisms behind this relationship need further research.

Given the fact that non-cognitive skills are believed to be more malleable in adulthood than cognitive skills (Almlund et al. 2011; Heckman and Kautz 2014) the results may be relevant for policy makers designing future interventions to address social problems. However, the choice which traits should be fostered poses difficult dilemmas as e.g. disagreeableness is rather considered a character flaw. As suggested by Judge et al. (2012) agreeable individuals could start adopting their behaviour to the situation, instead of changing their behaviour completely. This would be possible if we had in-depth understanding of the mechanisms linking personality traits and wages. However, there are only very limited evidence on the role of productivity, self-selection into occupations and engagement in training. More research, also using experimental methods would be desirable.

No substantial gender discrepancies in the personality associations with wages suggest that standards of evaluation with respect to personality traits do not differ between sexes in Poland. Thus, it is rather distributional differences in traits generating wage inequalities than the different evaluation of a specific trait by supervisors.

It has to be stressed that these empirical findings should be interpreted with caution. The data do not allow to rule out the endogeneity concerns. Despite that I believe that exploratory studies like this one contribute to extending our knowledge on the psychological determinants of wages and, thus, help to design further research on the topic. Future studies could therefore concentrate on eliciting causal mechanisms between personality traits and wages. Moreover, following the recommendation of Möttus (2016) further research could investigate if reported trait-wage associations are driven by a specific facet or holistically by the trait as each of Big Five traits is a multifaceted construct.

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Appendix

Table A.1 BFI-S items

Agreeableness	sometimes a bit rude to others* forgiving considerate and kind to others
Conscientiousness	a thorough worker somewhat lazy* effective and efficient in completing tasks
Extraversion	communicative, talkative outgoing, sociable reserved*
Neuroticism	a worrier nervous relaxed, able to deal with stress*
Openness	original, someone who comes up with new ideas someone who values artistic, aesthetic experiences imaginative

*reverse-worded item.

Table A.2 Summary statistics

Variable	Men		Women	
	Mean	Std. Dev.	Mean	Std. Dev.
Hourly wages (in PLN)	18.10	10.85	16.48	9.79
Numeracy	274.9	45.07	270.3	44.67
Years of education	13.28	2.78	14.49	2.64
Age	38.21	12.11	39.60	11.64
Experience	16.25	12.30	16.03	11.65
Occupation (ISCO)				
Managers	0.08	0.27	0.07	0.25
Professionals	0.16	0.37	0.31	0.46
Technicians and Associate Prof.	0.10	0.30	0.15	0.36
Clerical Support Workers	0.05	0.22	0.11	0.32
Services and sales workers	0.11	0.31	0.19	0.39
Skilled Agric., Forestry and Fishery Workers	0.00	0.07	0.00	0.06
Craft and Related Trades Workers	0.22	0.42	0.02	0.14
Plant and Machine Operators and Assemblers	0.18	0.38	0.04	0.19
Elementary occupations	0.09	0.29	0.12	0.32
Industry (ISIC)				
Agriculture	0.02	0.15	0.02	0.13
Industry	0.48	0.50	0.19	0.39
Traditional services	0.26	0.44	0.28	0.45
Modern services	0.07	0.26	0.11	0.31
Public administration	0.06	0.24	0.06	0.23
Education	0.07	0.25	0.23	0.42
Health	0.01	0.10	0.09	0.28
Other	0.03	0.16	0.04	0.20
Public sector	0.24	0.43	0.42	0.49
Tenure with current company	8.16	9.25	9.10	9.52
Weekly hours worked	43.9	11.6	38.8	10.0

Living with a partner	0.69	0.46	0.68	0.47
Having kids aged 0-6	0.24	0.43	0.23	0.42
Paid work of mother when 16	0.75	0.43	0.74	0.44
Paid work of father when 16	0.86	0.35	0.88	0.33
Observations	1085		937	

Notes: ISCO-08: The International Standard Classification of Occupations 2008; *Armed Forces Occupations*; self-employed excluded in the analysis resulting in small proportion of *Skilled Agric., Forestry and Fishery Workers*. Industry: grouping of the International Standard Industrial Classification (ISIC): Agriculture: A; Industry: B, C, D, E, F; Traditional services: G, H, I, N; Modern services: J, K, L, M; Public administration: O; Education: P; Health: Q; Other: R, S, T.

Table A. 3 Heckman selection model

	Men (1)	Women (2)	Men (3)	Women (4)
Hourly wages				
Numeracy	0.043	0.027	0.039	0.027
Conscientiousness	0.105 ⁺	0.106 [*]	0.104 [*]	0.112 [*]
Extraversion	0.009	0.011	0.013	0.014
Agreeableness	-0.149 ⁺	-0.121 ^{**}	-0.150 ^{**}	-0.127 ^{**}
Openness	0.038	-0.022	0.035	-0.024
Neuroticism	-0.033	-0.046 [*]	-0.032 ⁺	-0.049 ⁺
Numeracy # Con	0.025	0.021	0.019	0.024
Numeracy # Ext	-0.043	0.000	-0.046	0.002
Numeracy # Agr	-0.060	-0.041	-0.057	-0.046
Numeracy # Opn	0.083	0.007	0.087 ⁺	0.004
Numeracy # Neu	-0.054	-0.044 [*]	-0.055 [*]	-0.044 [*]
Age	-0.014	-0.027	-0.018	-0.024
Age # Age	0.000	0.000	0.000	0.000
Years of education	0.038	0.029 [*]	0.035 ^{***}	0.032
Experience	0.037	0.024 [*]	0.035 ^{***}	0.026 ⁺
Experience # Experience	-0.001 [*]	-0.000 [*]	-0.001 ^{***}	-0.001 [*]
Managers	0.000	0.000	0.000	0.000
Professionals	-0.202 [*]	-0.190 [*]	-0.201 [*]	-0.189 [*]
Technicians and Associate Prof.	-0.435 ^{***}	-0.451 ^{***}	-0.434 ^{***}	-0.451 ^{***}
Clerical Support Workers	-0.631 ^{**}	-0.530 ^{***}	-0.631 ^{***}	-0.529 ^{***}
Services and sales workers	-0.652 ^{***}	-0.741 ^{***}	-0.651 ^{***}	-0.740 ^{***}
Skilled Agric., Forestry and Fishery Workers	-0.400	-1.264 ^{***}	-0.406 [*]	-1.255 ^{***}
Craft and Related Trades Workers	-0.481 ^{***}	-0.654 ^{***}	-0.481 ^{***}	-0.651 ^{***}
Plant and Machine Operators and Assemblers	-0.420 ^{***}	-0.648 ^{***}	-0.420 ^{***}	-0.647 ^{***}
Elementary occupations	-0.527 ^{***}	-0.743 ^{***}	-0.525 ^{***}	-0.744 ^{***}
Agriculture	-0.045	0.548 [*]	-0.042	0.543 [*]
Industry	0.080	-0.007	0.080 ⁺	-0.009
Traditional services	0.000	0.000	0.000	0.000
Modern services	0.239 [*]	-0.147	0.238 ^{**}	-0.146
Public administration	0.204 ⁺	-0.046	0.204 [*]	-0.047
Education	0.025	-0.060	0.024	-0.061
Health	-0.067	-0.101	-0.068	-0.100
Other	0.001	-0.241 ^{**}	0.006	-0.243 ^{**}
Public sector=0	0.000	0.000	0.000	0.000

Public sector=1	-0.010	-0.070	-0.009	-0.069
Tenure	0.005*	0.005*	0.005*	0.005 ⁺
Hours worked weekly	-0.008	-0.010 ^{***}	-0.008 ^{***}	-0.010 ^{**}
Constant	2.997	3.410 ^{***}	3.108 ^{***}	3.299 ^{***}
<hr/>				
select				
Having kids aged 0-6	0.317	-0.731 ^{***}		
Work of mother when 16	-0.421*	-0.066		
Work of father when 16	0.109	0.172		
Living with partner			0.433 ^{**}	-0.327*
Numeracy	0.185 ^{**}	-0.006	0.146*	0.016
Conscientiousness	0.100	0.305*	0.090	0.324*
Extraversion	-0.159	0.158 ⁺	-0.161 ⁺	0.139 ⁺
Agreeableness	-0.017	-0.236 ⁺	0.003	-0.260 ⁺
Openness	0.150	-0.195*	0.123	-0.155
Neuroticism	-0.044	-0.152 ^{**}	-0.040	-0.161 ^{**}
Numeracy # Con	0.286	0.074	0.329*	0.109
Numeracy # Ext	0.127	0.033	0.140 ⁺	0.032
Numeracy # Agr	-0.158	-0.221	-0.214	-0.254
Numeracy # Opn	-0.160 ⁺	-0.093	-0.162 ⁺	-0.114
Numeracy # Neu	0.025	-0.009	0.016	-0.002
Age	0.099 ⁺	0.142 ^{***}	0.080 ⁺	0.154 ^{***}
Age # Age	-0.002 ^{***}	-0.003 ^{***}	-0.002 ^{***}	-0.003 ^{***}
Years of education	0.102*	0.133 ^{***}	0.091 ^{***}	0.114 ^{***}
Experience	0.115 ⁺	0.103 ^{***}	0.100 ^{***}	0.100 ^{***}
Experience # Experience	-0.001	-0.001	-0.001	-0.001
Constant	-1.544	-3.520 ^{***}	-1.320	-3.565 ^{***}
<hr/>				
athrho	0.035	0.011	-0.133	0.144
Insigma	-0.997 ⁺	-1.053 ^{***}	-0.994 ^{***}	-1.048 ^{***}
<hr/>				
Observations	1482	1583	1482	1583

Notes: ⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; number of observations includes censored and uncensored observations jointly.