Heineck, Guido; Anger, Silke

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The Returns to Cognitive Abilities and Personality Traits in Germany

Guido Heineck[a]   Silke Anger[b]

[a] *Institute for Employment Research (IAB), Nuremberg, Germany*

[b] *German Institute for Economic Research (DIW), Berlin, Germany*

Abstract

We provide the first joint evidence on the relationship between individuals' cognitive abilities, their personality and earnings for Germany. Using data from the German Socio-Economic Panel Study, we employ scores from an ultra-short IQ-test and a set of measures of personality traits, namely locus of control, reciprocity and all basic items from the Five Factor Personality Inventory. Our estimates suggest a positive effect of so-called fluid intelligence or speed of cognition on males' wages only. Findings for personality traits are more heterogeneous. However, there is a robust wage penalty for an external locus of control for both men and women.

Corresponding author:

Guido Heineck, Institute for Employment Research (IAB), Weddigenstr. 20-22, 90478 Nuremberg, Germany, guido.heineck@iab.de

1. Introduction

It is common knowledge that cognition and personality are related to individuals' behavior and socio-economic outcomes such as educational attainment or labor market participation. However, most of the literature on wages and other labor market outcomes for long concentrated mainly on traditional human capital predictors such as education, experience or job-specific training. In addition, there is growing research on the effects of cognitive abilities arguing that ability differentials result in productivity differences which then may lead to better promotion prospects or higher earnings potential. This strand of the literature is still small because there so far is only a limited range of surveys such as the National Longitudinal Survey of Youth (NLSY) in the US or the National Child Development Study (NCDS) in the UK which provide information from standardized achievement or general aptitudes tests.[1] Scores from these tests then are typically used to approximate individuals' cognitive abilities (for a summary of evidence see Cawley et al., 2001).

On top of that, there is an even smaller literature on the link between individuals' personality and labor market outcomes. While this type of research is well-established in industrial and organizational psychology,[2] economists have examined the importance of personality for labor market success much less than the impact of cognitive abilities. Personality traits were for a long time not considered particularly relevant for labor market success compared to the intelligence of a person, which was supposed to be directly related to individual productivity. It moreover was difficult to analyze the issue of personality due to the lack of appropriate data. In contrast to cognitive skills, of which measures were included in some datasets as outlined above, labor economists had barely any information on individuals' personality traits. The great variety of psychometric measures on personality

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furthermore needs some familiarity with the relevant psychological literature which usually is not the case for the mainstream trained economist.

Yet, similar to cognitive skills, individuals' personality may likewise result in job performance differentials. Behavioral characteristics such as perseverance or trustworthiness are traits that may be helpful in both employer-employee and customer relationships while other traits such as aggression or passivity might be undesirable and hence not be rewarded or even be punished in the labor market. Bowles et al. (2001) take up a demand side point of view and argue in what they call an incentive-enhancing framework that employers may reward employee characteristics that enable them to elicit effort at low costs. From the individuals', i.e. supply side point of view, Mueller und Plug (2006) as well as Heckman et al. (2006) and Borghans et al. (2008) argue that differences in skills and differences in preferences may exert direct and indirect effects on productivity: a) Directly, personality – and thereby implicitly assuming its effects on behavior – might be thought of as part of an individual's set of productive traits just as general or specific education or job-related training. b) Individuals' personality may furthermore affect labor market success indirectly through the type of schooling and occupation chosen. It consequently is unsurprising that the existing evidence suggests a non-trivial relationship between individuals' personality traits and labor market success as measured by earnings. Depending on the particular personality trait measure, the magnitude of this association is comparable to or even greater than the effects of cognitive abilities (Bowles et al., 2001; Heckman et al., 2006; Mueller and Plug, 2006).

While the effect of either intelligence or personality on earnings have so far mainly been examined for the US and the UK, our study adds to the literature providing evidence for Germany. There are only three prior studies that similarly address the impact of either cognitive skills (Anger and Heineck, 2008) or personality (Flossmann et al., 2007; Dohmen

et al., 2009) using German data. In addition to these studies, our paper provides the first joint evidence on the relationship between cognitive abilities, personality and earnings in Germany. Accounting for both intelligence and personality is important, since they have been shown to be related to each other (e.g., Sternberg and Ruzgis, 1994; Furnham et al., 1998). Until now, the impact of both cognitive and non-cognitive skills on labor market outcomes has been addressed only by a few studies on the UK and mainly the US (Osborne Groves, 2005; Heckman, et al., 2006; Mueller and Plug, 2006, Cebi 2007). In addition to previous analyses, which are based on only one or few dimensions of personality, our study uses a greater variety of personality measures. We are therefore able to directly compare different personality indicators which have been analyzed only separately until now. Moreover, complementing prior research on the UK and the US, our study examines whether the link between cognition, personality and labor market success can be found also in Germany, which has a more regulated labor market and a less meritocratic society. It might moreover be the case that the mainly free access to schooling (at no or very low cost) in Germany has other implications for the returns to cognitive and non-cognitive skills relative to the returns to education than in anglo-saxon countries.

2. Background, previous findings and expectations

Conceptual considerations

A gradient between individuals' cognitive abilities and their behavior on the job may be expected since it is plausible to assume that individuals with higher cognitive abilities are able to process new information more quickly. They may likewise be expected to perform better if challenged with more complex tasks than individuals with fewer cognitive skills. The existing evidence on the impact of cognitive skills on labor market success however is

far from unanimous (see below) and partially depends on the particular measure of intelligence or cognitive abilities.

The impact of personality on labor market success is even more complex. In contrast to cognitive abilities, for which there is the uni-dimensional concept of "g" (Jensen, 1998), individuals' personality is a multi-faceted construct for which there is a large and somewhat heterogeneous battery of psychometric measures which are to capture different aspects. What is included in empirical analyses therefore is to some extent data-driven. There for example is research that employs personality dimensions such as achievement-related traits (O'Connell and Sheikh, 2007), self-esteem (Goldsmith et al., 1997), aggression-withdrawal (Osborne, 2005), or challenge-affiliation (Semykina and Linz, 2007).

The Five Factor Model

Other studies and the analysis below employ indicators related to the so-called Five Factor Model (FFM) (McCrae and Costa, 1996, 1999) which aims to be a unifying framework to describe an individual's personality. According to the FFM, personality traits can be linked to one of the following five basic characteristics: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (emotional instability). While there is a large number of theoretical conjectures regarding the relationship between each personality trait and labor market success, Judge et al. (1999) point to a consensus in the organizational psychology literature that out of these five traits conscientiousness, extraversion, and neuroticism are most relevant to career success.

To start with, neuroticism describes the attribute of for example being tense, anxious, or moody, and is related to activation theory (Gardner and Cummings, 1988) which suggests that neurotic individuals may experience either too much or too little external stimulation which may then lead to poor task performance. As a consequence, neurotic individuals may

be less suited to higher level jobs that are more complex and supply more stress (Spector et al., 1995).

Extraversion is a broad construct that includes a range of factors but is typically thought to consist of sociability. As Judge et al. (1999, p. 624) point out, "extraverts tend to be socially oriented (outgoing and gregarious), but also are urging (dominant and ambitious) and active (adventuresome and assertive)". Furthermore, extraverts are more likely to take on leadership roles and to have a greater number of close friends which are qualities that are of advantage in business environments.

Conscientiousness is related to an individual's degree of self-control, the need for achievement, order, and persistence. Put differently, conscientiousness refers to one's willingness to work hard, to be responsible and careful, and planful and organized (Costa et al., 1991). It is thus unsurprising that conscientiousness has previously been shown to be a valid predictor of job performance.[3]

While the above mentioned personality traits more or less allow distinct hypotheses regarding labor market success, the remaining facets, openness to experience and agreeableness, may be related either way to job performance and other labor market outcomes. For example, individuals who are open to new experiences typically are flexible, creative, and intellectually orientated. This may on the one hand be advantageous to career success. On the other hand, openness is also related to autonomy and non-conformity which may be a hindrance to labor market success. Similarly, agreeable individuals who are more likely cooperative and likeable may benefit from these characteristics in teamwork settings or in occupations with a higher frequency of customer contacts. There however is also a flip side of agreeableness since, as Judge et al. (1999, p. 625) put it, "extremely agreeable individuals may sacrifice their success in pleasing others".

Locus of Control and Reciprocity

Another indicator of individuals' personality is based on the concept of locus of control (LOC) which goes back to the work of Rotter (1966). It refers to the individual's perception of the relation between her own behavior and its consequences. Conceptually, an internal LOC relates to individuals who believe that the outcomes they experience are determined by their own skills and behavior. In contrast, individuals with an external LOC are prone to believing that chance or other factors beyond their control is the main determinant of the outcome they experience. Since an internal LOC is related to personal initiative which then may result in a higher willingness to work hard, it is unsurprising that this personality dimension has been found to be positively related to labor market success compared to the outcomes of individuals with an external LOC.

A further measure on individual's personality is reciprocity which means that "… in response to friendly actions, people are frequently much nicer and much more cooperative than predicted by the self-interest model. Conversely, in response to hostile actions they are frequently much more nasty and even brutal" (Fehr and Gächter, 2000, p. 159). Clear-cut hypotheses with regard to individuals' labor market success are difficult to establish, since similar to openness and agreeableness, reciprocal behavior may work in either direction. Furthermore, there is evidence that reciprocity and the FFM traits – in particular agreeableness and neuroticism – are associated with each other (Ashton et al., 1998). Fehr and Gächter (2000) provide mainly experimentally based evidence on the importance of reciprocity in individuals' economic behavior. In line with experimental results, Dohmen et al. (2009) provide survey evidence on the relevance of reciprocity for labour market success and overall life outcomes.

Previous findings

As for the existing evidence on the relation between cognitive and non-cognitive abilities we restrict ourselves to a short and selective review of more recent research. First, findings for the relation between cognitive skills and labor market outcomes are - as mentioned above - somewhat ambiguous:

On the one hand, there is a large number of studies that reveal substantial returns to cognitive abilities in the US and Great Britain. For example, Cameron and Heckman (1993), Blackburn and Neumark (1993), and more recently, Green and Riddell (2003) as well as Bronars and Oettinger (2006) provide evidence for a positive relationship between cognitive skills and earnings. On the other hand, there are as many studies suggesting that cognitive ability has barely any effect on earnings (Bound et al., 1986, or Murnane et al., 1995). Cawley et al. (2001), and Zax and Rees (2002) conclude that cognitive ability is a poor predictor of earnings compared to a direct measure of education, family background, and environment.

Using scores from two ultra-short tests of cognitive ability that are included in the German Socio-Economic Panel Study (SOEP), the results of Anger and Heineck (2008) suggest that speed of cognition is positively related to wages of West German workers even when educational attainment is controlled for. Verbal fluency on the other hand is not related to earnings. They furthermore find that ability and education are inseparable determinants of earnings which is in line with previous studies for other countries (e.g. Cawley et al. 2001).

As for individuals' personality, there is evidence that some personality traits are rewarded on the labor market while others are punished. Based on Russian data, Semykina and Linz (2007) find a positive association between an internal LOC and females' earnings. Heineck (2007) examines data from the BHPS for the UK and finds a negative relation between wages and agreeableness whereas openness to experience is rewarded. Furthermore, there is a nonlinear gradient for wages and individuals' conscientiousness. Other studies that

also employ the FFM taxonomy of personality are by Nyhus and Pons (2005) and by Mueller and Plug (2006), the latter being of further relevance, since it is one of the few analyses that examine both cognitive and non-cognitive abilities. Nyhus and Pons use data from the Dutch DNB Household Survey (DHS). Their findings suggest that emotional stability, i.e. inverse neuroticism, is positively associated with wages of both males and females but that agreeableness is negatively related to females' wages. Furthermore, men benefit from conscientiousness at the beginning of an employment relationship but from autonomy as tenure increases.

As for Germany, there is only scarce evidence on the relationship between individuals' personality and earnings: Using the SOEP, Flossmann et al. (2007) examine the role of personality traits for labor market success by focusing on the LOC measures. They find that personality matters even when controlling for different aspects such as education and professional experience. They conclude that labor market success is influenced by early childhood since the formation of personality occurs during the first years of life under the influence of the parents and the educational system. Dohmen et al. (2009) also use SOEP data in their cross-sectional study to investigate the relevance of personality for labor market outcomes and overall life success in Germany. They focus on measures of reciprocity and show that positive reciprocity is rewarded with higher wages, whereas negative reciprocity increases the probability of unemployment. However, the existing studies for Germany neither include additional personality indicators, which are presumably associated with reciprocity, e.g. the FFM traits, nor measures of cognitive abilities. It therefore remains an open question whether locus of control or reciprocity affect earnings when other personality traits and cognitive skills are taken into account.

Evidence on the joint relationship between cognitive abilities, personality and labor market outcomes at the same time is only provided by a few studies on the US and the UK.

Using the LOC scale, Osborne Groves (2005) show that the earnings of US females is negatively related to externality and that aggression and withdrawal negatively affects the wages of British women. At the same time, cognitive abilities are positively associated with the earnings of women in the US but not for women in the UK, once personality traits are included in the model.

The results of Mueller and Plug (2006), who use data from the Wisconsin Longitudinal Study (WLS), indicate that non-agreeableness, openness, and to a somewhat lesser extent emotional stability are positively related to men's earnings. Furthermore, women receive a wage premium for being more conscientious and open. Their findings also suggest that returns to non-agreeableness or, as they put it, antagonism are quite different for males and females. They further account for cognitive skills including test scores from the Henmon-Nelson Test of Mental Ability which is a measure of general intelligence. Across all specifications, their estimates indicate a positive linear relationship between intelligence and earnings.

Cebi (2007) uses the Rotter-scale and achievement test scores from the AFQT provided by the NLSY to analyze the determinants of education as well as of labor market outcomes for men and women in the US. While she finds that educational outcomes are not significantly determined by LOC once cognitive ability scores are included, her results show that internal LOC is rewarded in the labor market. She concludes that "… locus of control is in fact capturing a distinct aspect of ability not related to cognitive ability as measured by the AFQT." (Cebi, 2007, p. 930).

The NLSY is also used by Heckman et al. (2006) whose study relies on measures of LOC and self-esteem, and on achievement test scores from the AFQT in order to analyze the determinants of educational and labor market outcomes, and to explain risky behavior of young adults. They find evidence that both cognitive and non-cognitive skills are important

for social and economic success. In their analysis, achievement test scores explain much more of the earnings variance but have similar effects as the measures of personality traits. They point out that "a change in noncognitive skills from the lowest to the highest level has an effect on behavior comparable to or greater than a corresponding change in cognitive skills." (Heckman et al., 2006, p. 412).

Expectations

The outline of the above noted conceptual considerations and findings from previous empirical research on cognitive abilities and personality traits as determinants of labor market outcomes enable us to set up expectations for the analyses of the present study. In line with prior research we expect that

- cognitive abilities either do not matter or are positively associated with earnings;

- an external locus of control is negatively associated with earnings, and

- positive reciprocity should be positively related to earnings.

With respect to the FFM traits we expect that

- openness and conscientiousness are rewarded, though there might be differences by gender,

- extraversion is not related to earnings, and

- agreeableness and neuroticism are negatively associated with earnings, again with possible gender differences.

3. Data and methods

The data used in this study are drawn from the German Socio-Economic Panel Study (SOEP). The SOEP is a representative longitudinal micro-database that provides a wide range of socio-economic information on private households and their individuals in

Germany. The yearly data were first collected from about 12,200 randomly selected adult respondents in West Germany in 1984. After German reunification in 1990, the SOEP was extended by about 4,500 persons from East Germany, and supplemented by expansion samples later on. Information on personality traits is provided mainly in 2005,[4] data on cognitive abilities is given in 2006. In order to include both East and West German individuals, we restrict our sample to the years 1991 to 2006. The final longitudinal sample comprises 13,048 person-year observations from 1,580 employed individuals in working age (20-60 years) for which there is information on both personality traits and cognitive abilities.[5]

Measures of cognitive ability

Since fully-fletched IQ tests cannot be implemented easily in a large-scale panel survey, two ultra-short tests of cognitive ability were developed for the SOEP (Lang, 2005, Lang et al., 2007), and introduced in 2006: a *symbol correspondence test* and a *word fluency test*. Both tests correspond to different modules of the Wechsler Adult Intelligence Scale (WAIS) which altogether comprises 14 modules, seven on verbal IQ and seven on performance IQ (Groth-Marnat, 1997, Kline, 1999).

The *word fluency test* as implemented in the SOEP is similar to a sub-module in the verbal section of the WAIS and has been developed after the animal-naming-task (Lindenberger and Baltes, 1995): Respondents name as many different animals as possible within 90 seconds. The *symbol correspondence test* (SCT) was developed after the symbol-digit-modalities-test (Smith, 1995) and corresponds to a sub-module in the non-verbal section of the WAIS. Using the distinction of fluid and crystallized intelligence (Cattell, 1987), the SCT is conceptually related to the mechanics of cognition or fluid intelligence. It comprises general and largely innate abilities and refers to the performance and speed of

solving tasks that are related to new material. The test was implemented asking respondents to match as many numbers and symbols as possible within 90 seconds according to a given correspondence list which is visible to the respondents on a screen.

Both tests were previously shown to produce outcomes which are sufficiently correlated with test scores of more comprehensive and well-established intelligence tests (Lang, 2005; Lang et al., 2007). However, we decided to employ the SCT scores only. We do not use test scores from the word fluency test since the nature of this test interferes with the concept of crystallized intelligence inasmuch as factors like for example working memory come into play because of the time constraint. Working memory however is related to executive function and thus to fluid intelligence rather than crystallized intelligence only. Therefore, in order to have a clean measure instead of a mixture of different concepts, we concentrate on the SCT as a pure measure of fluid intelligence. The focus on the SCT is further justified by the word fluency test being more affected by measurement error, as the interviewer has to identify instantly duplicate entries when counting the animal names stated by the respondent Moreover, this approach also allows us to include individuals with migration background who may have insufficient language skills and hence be disadvantaged compared to native speakers when taking the test.

Measures of personality

The 2005 wave of the SOEP provides several measures of individuals' personality. First, there are items that relate to the Five Factor Model (McCrae and Costa, 1996; 1999) comprising the five basic psychological dimensions as outlined above: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. Since extensive psychological questioning was not feasible in the SOEP,[6] the data provides a set of fifteen items (listed in Table A1 in the Appendix) of which three each are to capture the respective

personality dimension.[7] LOC is surveyed with ten items (cf. Table A1 in the Appendix) of which four measure internal LOC and six relate to external LOC.[8] Positive and negative reciprocity are asked for by three items respectively. The FFM indicators as well as the LOC and reciprocity items are to be answered on 7-point Likert type scales (1 – "disagree completely" (LOC) / "does not apply to me at all" (FFM, reciprocity) to 7 – "agree completely" (LOC) / "applies to me perfectly" (FFM, reciprocity)). The basis for the personality measures employed in this analysis are generated by standardizing the average score from the dimension-specific questions on FFM, LOC and reciprocity.[9]

Summarizing both personality trait scores and cognitive ability test scores, Figure 1 shows the distributions of age-standardized scores for both the cognitive ability measure and the personality traits for females and males separately.[10] The graphs show that a few of the traits are not normally distributed, most obvious for conscientiousness which is left-skewed. Furthermore, gender differences are visible with respect to agreeableness and neuroticism. Results from t-tests and KS-tests in addition indicate that the two mentioned traits as well as openness, extraversion, and the two reciprocity items are differently distributed for males and females. The scores for conscientiousness, external locus of control and cognitive abilities on the other hand have the same distribution function across gender.

[Figure 1 about here]

Estimation methods

In the following, we examine the returns to individuals' cognitive abilities and personality using augmented Mincer-type earnings regressions. The estimated earnings functions are based on the typical form:

$$\ln y_i = x_i'\beta + c_i'\gamma + u_i , \tag{1}$$

where y_i is individual i's gross hourly wage, x_i is a vector of individual characteristics assumed to be related to earnings, c_i is the vector that includes the respondent's personality trait sand intelligence test scores, β and γ are the corresponding parameter vectors to be estimated, and u_i denotes the idiosyncratic error term. Since wages are observable only for employed individuals, we account for sample selection bias using Heckman's correction procedure (Heckman, 1979).[11]

Problems and solutions

There are a range of potentially problematic aspects that are taken into account as follows: first, the relationship between personality and earnings might be endogenous. While previous research suggests that an individual's personality is partially inherited (Jang et al., 1996) and fairly stable for adults (Costa and McCrae, 1988, 1994) treating personality traits as exogenous may be misleading. Heckman et al. (2006) for example show for a sample of young individuals that parental background and the schooling level at the date of the test may affect test scores of both cognitive and non-cognitive abilities. Furthermore, while Costa and McCrae (1988, 1994) suggest that personality traits stop changing at age 30, recent research by Srivastava et al. (2003) show that an individual's (social and job) environment affects personality traits also in early and middle adulthood which is also pointed out by Borghans et al. (2008). In the context of earnings it may well be the case that there is a feedback of either low or high earnings on personality which then again may affect earnings through productivity differences by personality dimension. Consequently, empirical research that attempts to examine causal effects of personality on labor market outcomes has to deal with the issue of reverse causality.

In the present paper and similar to Semykina and Linz (2007), the possible endogeneity of personality and schooling should not matter much, since the respondents'

mean age is 38 years so that the interdependency between concurrent schooling level and test scores is not given. The possible interdependency between earnings and personality however is taken into account. Following the approach of Nyhus and Pons (2005) and Osborne Groves (2005), each personality trait is regressed on age and age squared. The residuals from these regressions then are free from age effects. While far from being perfect, this will to some extent pick up possible feedback effects of an individual's job (and social) environment on her personality. The standardized scores of the IQ-test are processed similarly a) to keep the results and interpretation consistent and b) to capture the negative age effects on fluid intelligence (Baltes et al., 1999). Since the resulting indicators of personality and cognition can be taken as age-free, i.e. are constant over time, this approach further allows matching this information to preceding waves of the SOEP and applying appropriate panel estimators (see below).

A further issue in the personality measures is that the variability in the resulting personality dimensions might arise from measurement error. To quantify this, and to be able to correct for it, Cronbach's alpha reliabilities (Cronbach, 1951) are calculated. For the FFM dimensions, these are: openness 0.64, conscientiousness 0.65, extraversion 0.73, agreeableness 0.54, and neuroticism 0.63. For LOC we get: internal LOC 0.22, and external LOC 0.61, and the reliability ratios for positive and negative reciprocity are 0.66 and 0.83 respectively. These reliability coefficients mainly are low compared to what is typically found in the literature (John and Srivastava, 1999), where they range between 0.70 and 0.90. However, given that only three items per personality trait are available in the SOEP, the ratios found are satisfactory: Employing the Spearman-Brown formula, Mueller and Plug (2006) show that the reliability ratios increase with an increasing number of items.[12] We however exclude internal LOC from the analyses, since the alpha of 0.22 clearly indicates a too large measurement error meaning that the surveyed items are not at all appropriate for

measuring the underlying scale. With the alphas at hand, we estimate an additional set of regressions to correct for the measurement error problem by imposing the reliability ratios in order to adjust both parameter estimates and standard errors (Kmenta, 1997, pp. 352-357).

Panel approach

Although our indicators of personality and cognition are taken from the 2005 and 2006 waves of the SOEP, it is still possible to exploit the longitudinal structure of the survey to further account for individual specific heterogeneity. Since we assume that the 'residualized' indicators of cognition and personality are constant over time, we match the cross-sectional indicators to all preceding waves to be able to exploit the longitudinal structure of the SOEP. While this excludes the use of fixed effects estimation, we estimate random effects (RE) regressions in addition to the pooled OLS estimator to account for unobservable heterogeneity. However, this comes at the price of assuming that individual specific heterogeneity is uncorrelated with cognition, personality, and the vector of control variables which might not be appropriate. As alternative to this 'all-or-nothing' choice between random effects or fixed effects models, we also employ the Hausman-Taylor IV (HTIV) estimator (Hausman and Taylor, 1981), which allows including time-invariant covariates that are either exogenous or endogenous.[13] The underlying model in the HTIV is as follows:

$$\ln y_{it} = \beta_0 + x'_{1,it}\beta_1 + x'_{2,it}\beta_2 + z'_{1i}\gamma_1 + z'_{2i}\gamma_2 + \alpha_i + u_{it} \tag{2}$$

where $x_{1,it}$ is a vector of time varying variables which are assumed to be uncorrelated with the individual effects α_i, $x_{2,it}$ is a vector of variables which also are time varying but need not be uncorrelated with α_i. z_{1i} and z_{2i} are vectors of time-invariant variables that again are assumed to be uncorrelated or which might be correlated with the individual specific effects,

and u_{it} is the remaining stochastic error term. Using the HTIV estimator comes with at least

two strong advantages. First, there is no need for model-external instruments: $x_{1,it}$ and z_{1i}

serve as their own instruments, $x_{2,it}$ is instrumented by its deviation from individual means,

$x_{2,it} - \bar{x}_{2i}$, and z_{2i} is instrumented by the individual average of $x_{1,it}$, $\bar{x}_{1i}$. If the model is

identified, i.e. as long as there are at least as many time-varying exogenous covariates as

there are time-invariant endogenous regressors, the resulting FGLS estimator is consistent

and efficient (Greene, 2008). The second advantage is that, as mentioned, this method allows

estimating the effects of time-invariant covariates that may be correlated with the individual

specific effects. This is not given in our case, since we assume that the vector of the

'residualized' personality and cognition indicators is time-invariant and exogenous. The fact

that we do not have time-invariant endogenous variables will only affect efficiency but not

consistency of the estimator. Using the HTIV is still justified because all other covariates are

to be treated as endogenous: A Hausman test after additional fixed effects regressions on the

set of time-varying covariates clearly rejects exogeneity. Year dummies finally are assumed

to be time-varying and exogenous.

Model sensitivity

*S*ensitivity of the results is examined using a variety of specifications that include

different sets of socio-economic control variables. First, the baseline specification comprises

a dummy on whether the individual is living in East Germany, a dummy for being married, a

dummy for not having German citizenship, the individual's years of education, and a set of

job-related regressors: tenure and tenure squared, a dummy on whether the respondent has a

public employer, whether she works in a firm with 2000 employees or more, whether she has

a temporary job, a part-time job, and another dummy on whether the respondent is a white-collar worker.[14]

To test for non-linearities in the relationship between cognitive and non-cognitive skills and earnings we follow Mueller and Plug (2006) and estimate regressions including dummies that indicate whether the individual's scores are in the top or bottom 25% of the distribution. This is because using linear scores may push the estimated average returns to zero if for example only moderate openness is rewarded on the labor market but both being too open or not being open at all is punished.

It might further be argued that an employee's cognition and personality are not observable to the employer at the beginning of an employment relationship but are revealed over time so that returns to these traits might vary with tenure (Nyhus and Pons, 2005). We hence estimate additional regressions including variables which interact cognition and personality indicators with workers' tenure. Accounting for the differences by gender found in previous research, we run our regressions separately for males and females.

4. Results

Pooled cross-sections

Estimates from the pooled OLS regressions as well as from the regressions that correct for measurement error are provided in Table 1.[15] These findings do not account for individual heterogeneity but are given as benchmark to compare our results with prior findings in the literature. The first issue worth noting is that, as expected, the results in the error-in-variables regressions that impose the reliability ratios in the estimation mostly indicate increases in the absolute values of the estimated coefficients and, if significant, also in the significance level (Table 1, column 2 and 4).

Substantially, the results indicate that some of our a priori expectations are met while others are not in line with our hypotheses or previous findings. We in particular suggested that both openness and conscientiousness would be positively related to earnings. While there are wage premiums for females of about 2% in the OLS regressions to about 6% in the EIV models for a one standard deviation increase in openness, the coefficients indicate a wage penalty of 2% to 4% for males. This is in contrast to the results of Mueller and Plug (2006). However, note again that the theoretical conjectures from the psychology literature allow for a negative effect on labor market success since openness is linked to autonomy and non-conformity (Judge et al., 1999). Another difference by gender is found for conscientiousness. The coefficients indicate a wage penalty for female workers but they are not statistically significant. Men on the other hand seem to gain from conscientiousness which is in line with our expectations. There is a wage premium of about 1.5% for a one standard deviation increase in conscientiousness.

There is also mixed evidence by gender with respect to extraversion. We find a negative wage differential of almost 4% for women but a 3% wage premium for males for a one standard deviation increase in extraversion (Table 1, columns 2 and 4). Based on prior evidence, our expectation was that extraversion would not be related to wages but note again that theoretical reasoning from the psychology literature allows for both positive and negative effects on job performance (Judge et al., 1999).

Agreeableness is not associated with males' wages in the error-correction model but negatively related to females' wages. The point estimates in the full specifications suggest for a wage penalty of 3% for 'being nice', i.e. a one standard deviation increase in agreeableness, which even increases to almost 7 % in the EIV regression (Table 1, columns 1 and 2). While this may seem implausible at first glance it is consistent with theoretical arguments above and with previous research (cf. Nyhus and Pons, 2005, or Mueller and

Plug, 2006). Agreeable individuals may be extremely cooperative and may hence sacrifice their career by being nice to others for example by avoiding conflicts.

[Table 1 about here]

In contrast to prior expectations we find no statistical relationship between neuroticism and wages. This may be because we control for an individual's attitude towards reciprocal behavior. Since neuroticism and reciprocity are linked (Ashton et al., 1998) it may well be that the results for neuroticism as found in previous research are reflected in the indicators of reciprocity here. These are in fact more robust inasmuch as there is statistical significance across all specifications with the exception of negative reciprocity which is not related to females' wages. Female workers who score high in positive reciprocity earn about 3% more, which increases to about 6% when adjusting for measurement error. Somewhat lower premiums of about 1% to 2% are found for males. These results are consistent with the findings of Dohmen et al. (2009) for their sample of male and female workers. While they do not find a statistical relationship between negative reciprocity and labor income, our results show that male workers' negative reciprocity is rewarded in the labor market. Interestingly though, females receive slightly lower wage premiums for negative reciprocity, and the coefficients are not statistically significant. This result may not appear plausible but, as outlined above, negative reciprocity and agreeableness (or rather inverse agreeableness) are probably measures of the same underlying personality trait. It hence may well be the case that, for males, the effect of this trait works through negative reciprocity rather than through agreeableness.

The remaining personality trait in our analysis, external locus of control, is the most robust and strongest predictor of wage differentials: Individuals who believe that the outcomes they experience are beyond their control have some 4% lower wages which increases to penalties of 10% for females and some 7% for males in the EIV models.

Turning to the estimates for cognitive abilities, we find further differences by gender: The coefficients for fluid intelligence are not statistically different from zero in the regressions for females. Yet, cognitive abilities are relevant for males' wages. The coefficients for the *symbol correspondence test* imply wage benefits of about 2% for a one standard deviation increase in the test score (Table 1, columns 3 and 4).

Panel results

One might be tempted to ask why one should use panel methods at all, since cognitive abilities or personality traits might serve as proxies for unobservable heterogeneity. However, this depends on the specific measures. Employing panel estimators might thus account for remaining individual specific heterogeneity. Our results in fact show that the FFM indicators and the ones on reciprocity are sensitive to accounting for further unobservable heterogeneity. In particular, with the exception of a wage penalty of about 3% for agreeableness for females, none of the FFM covariates is statistically different from zero anymore in the HTIV regressions (Table 2, column 2). The results also change dramatically for males inasmuch as none of the FFM covariates is statistically significant. Apart from that, there is no effect of negative reciprocity, but a wage benefit from positive reciprocity of about 2% for both males and females. Hence, the findings of Dohmen et al. (2009) for their cross-section of the SOEP can be confirmed using panel data techniques, even if additional personality indicators and cognitive skills are included.

[Table 2 about here]

The changes in the findings from OLS to panel estimates suggest that parts of individuals' unobservable heterogeneity are captured by FFM traits and reciprocity indicators. This however seems not to be the case for the remaining personality trait, the external locus of control i.e. the attitude to believe that the experienced outcomes are

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consequences from actions beyond the own behavior and control. It continues to be the strongest predictor for wage differentials among all personality traits included. In particular, an increase in worker's external locus of control by one standard deviation results in wage premiums of about 6% for females and even more than 7% for males (Table 2, columns 2 and 4).

Turning to the results for individuals' cognitive abilities, the findings from the panel regressions reinforce the above provided OLS results. Again, there is no statistical relationship between the scores from the symbol correspondence test and the wages of female workers. The wages of males however increase with fluid intelligence. The SCT coefficients are even slightly larger when compared to the coefficients in the baseline OLS estimations. The wage premiums now are at about 3% in both the RE and the HTIV regressions (Table 2, columns 3 and 4).

To further account for possible non-linearities in the relationship between cognitive abilities, personality and wages, we ran additional regressions that include dummies on whether the respondent scores either in the bottom or top 25% of the particular trait. The results from these exercises are given in Table 3 which includes the results from the pooled OLS and the HTIV estimations.[16] Judged by signs only, there are u-shaped gradients for conscientiousness, extraversion, and neuroticism in females' wages. However, this evidence is not overly strong in terms of statistical significance: only for the latter and only in the pooled cross-sectional model is there statistical significance for both the bottom and the top 25% covariates.

The findings are somewhat similar for males inasmuch as the signs of the coefficients hint towards non-linear effects. However, there are hump-shaped gradients for openness, extraversion, and neuroticism. Again, the evidence is statistically not very convincing except for extraversion in the pooled OLS model. This result indicates that scoring either in the

bottom or top of the extraversion distribution is associated with wage penalties of roughly 6% (Table 3, column 3), but the coefficients again turn statistically insignificant in the HTIV model.

Adding to the findings above, the results in this specification do not contrast a positive linear relationship between wages and (positive or negative) reciprocity for both females and males, between wages and conscientiousness for males, and an inverse linear relationship between workers' wages and agreeableness. While only a few of the coefficients are statistically significant at the 10%-level in the HTIV regressions, the findings from both OLS and HTIV estimations indicate some wage effects of FFM traits for males (Table 3, columns 3 and 4). In particular, being very conscientious relates to more than 5% higher wages, scoring low in either positive or negative reciprocity is associated with some 4% to 6% lower wages, and being very extraverted comes with a wage penalty of about 6%.

[Table 3 about here]

Beyond that, the most robust finding in these specifications is again found for individuals' external locus of control. Reinforcing the results above, the coefficients indicate an inverse relation with wages of both males and females so that an increase from the bottom 25% to the top 25% would be associated with a wage increase of some 17% for females and more than 20% for males (Table 3, columns 2 and 4). As for individuals' cognitive abilities, we find a hump-shaped relationship between females' wages and SCT and a positive linear relationship to males' wages. Statistical significance or rather the lack thereof is however again an issue here inasmuch as the coefficients for scoring in the bottom 25% are statistically different from zero only in the pooled OLS models, implying a wage differential of about 4%.

We argued above that a worker's cognitive ability and her personality become observable to the employer only over time. We therefore estimate additional regressions including variables that interact cognition or personality with tenure.[17]

With respect to openness, the HTIV results now suggest that the main effects are not different from zero but that the joint effects evolve with tenure (Table 4, columns 2 and 4). The finding for males indicates that in the presence of a significant negative main effect of being open to experience, this would be outweighed after approximately 5 years, after which openness would be rewarded in terms of higher wages. Apart from that, none of the remaining joint effects of FFM traits and tenure play a role once unobservable heterogeneity is accounted for.

[Table 4 about here]

Individuals' external locus of control is again penalizing inasmuch as the main effects imply wage differentials of about 7% for females and 5% for males in the panel models. On top of that, the results from the interaction terms, albeit not statistically significant, suggest for male workers that this penalty increases with tenure which might further reflect some kind of self-reinforcing psychological effects over time. For cognitive abilities, we find neither main effects nor joint effects with tenure for both males and females in the pooled OLS models. There however are positive main effects for males in the panel regressions, implying a wage premium of about 5%.

Robustness checks

We ran additional regressions as robustness checks but do not provide them in detail, since the results from these exercises are not substantially different from those given above. First, we estimated our models based on workers from West Germany only. The intention is to take into account that East Germans tend to have a higher external locus of control

(average of 3.8 in comparison to 3.5, *t*-value of -3.335) which might have to do with their historic experience of having been forced to live in an authoritarian regime. As pointed out, the results do not change. We further estimated models that included either IQ or personality indicators to control of possible interdependencies between cognition and personality traits. Again, by and large in line with Mueller and Plug (2006), there were no substantial changes in the results.[18]

Finally, since we are well aware of the risk of reverse causality we estimated earnings equations using data from the 2007 wave of the SOEP, i.e. regressing wages on socio-demographics and job characteristics from 2007 but including the indicators of cognition from 2006 and personality from 2005. The idea here is to eliminate any concurrent effects of wages on cognition or personality. Since the resulting sample size was rather small (roughly 1,300 observations), it is not surprising that only a few coefficients were statistically different from zero. In particular, we find no statistically significant coefficients in these cross-sectional wage regressions for females. The results for males are reinforced inasmuch as there are wage penalties for external locus of control. There finally is a wage premium for fluid intelligence in a most parsimonious baseline model, i.e. a model including only the set of socio-demographic controls, which however vanishes once job characteristics are included.

5. Conclusions

There is a consensus among labor economists that traditional human capital variables such as education or experience are not sufficient to predict wages and other labor market outcomes. At the same time, there is an increasing awareness of the importance of both cognitive abilities and personality traits as determinants of labor market success. Cognitive skills may result in better job performance and productivity differences which directly

translate into earnings differentials. Likewise, individuals' personality may result in job performance differentials. It is intuitively obvious that behavioral characteristics such as perseverance or trustworthiness are traits that may be advantageous in both employer-employee and customer relationships, while other personality traits might be unfavorable and hence not be rewarded or even be punished in the labor market. Since the existing literature is still small, there is a great need for empirical analyses to specify the relationship between intelligence and personality traits on the one hand, and labor market success on the other, in order to identify which skills are important and to quantify the effects.

We provide the first joint analysis of the relationship between cognitive skills, personality traits and earnings in Germany, and thus add to the scarce and merely US-based literature which deals with intelligence and personality at the same time. Using data from the SOEP, we employ one measure of cognitive abilities, the *symbol correspondence test*, and a range of indicators that capture individuals' personality. In particular, we use measures for individuals' external locus of control, reciprocity, and all basic items of the Five Factor Model: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism.

We examine the returns to cognitive abilities and personality using augmented Mincer-type earnings regressions and account for sample selection bias using Heckman's correction procedure. Since the variability in the personality dimensions might arise from measurement error, we correct for this by quantifying Cronbach's alpha reliability coefficients, and imposing the calculated reliability ratios to adjust both parameter estimates and standard errors. We explicitly take into account that an individual's ability and personality might change with age by employing predicted residuals from estimations of intelligence test scores and personality trait items that are regressed on age and age squared. This approach furthermore allows matching this information to prior panel waves that do not

provide information on cognition and personality. We are therefore able to apply appropriate panel estimators, random effects regressions and the Hausman-Taylor IV estimator.

Our results suggest for wage effects of personality and cognitive abilities with differences by gender and by specification. The results show that the FFM traits, locus of control and reciprocity are either linearly or non-linearly related to workers' wages, and do mainly not change with tenure. Cognitive abilities mainly affect the wages of males but not female workers. While the findings for the FFM indicators are sensitive to model specification and the respective estimator, there is one robust result across gender, all specifications and estimators applied: Individuals who score high in the external locus of control scale earn on average less than their counterparts who have lower scores. These differentials are substantial: In the linear models for males, the effects of external locus of control are twice as large as the effects of workers' cognitive abilities. Furthermore, compared to workers who score in the bottom 25% of the LOC scale, there is a wage penalty of up to 20% for workers who score in the top 25% of the scale.

To sum up, the results of our analysis reveal that personality is an important predictor of earnings also in Germany, even if a large set of socio-demographic and job-related characteristics and, more relevant, cognitive ability scores are included. Despite the more strongly regulated labor market and the less meritocratic society, the effect of locus of control is of comparable size if not larger than revealed by similar studies for the US. In contrast, cognitive abilities affect only the earnings of males. Quantitatively, these findings further suggest a relatively greater importance of particularly an external locus of control compared to cognitive abilities. While there a no simple straightforward policy implications, we conclude with Borghans et al. (2008) who claim that "…personality traits are more malleable than cognitive ability over the life cycle and are more sensitive to investment by parents and to other sources of environmental influences at later ages than are cognitive

traits" (Borghans et al., 2008, p. 4). Put differently, both prior research and our findings may

point to the necessity for social policy to put greater emphasis on abilities other than or in

addition to cognitive skills, and to effectively attain greater achievement by investing in

personality traits.

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Figure 1: Distribution of personality traits and cognitive abilities by gender
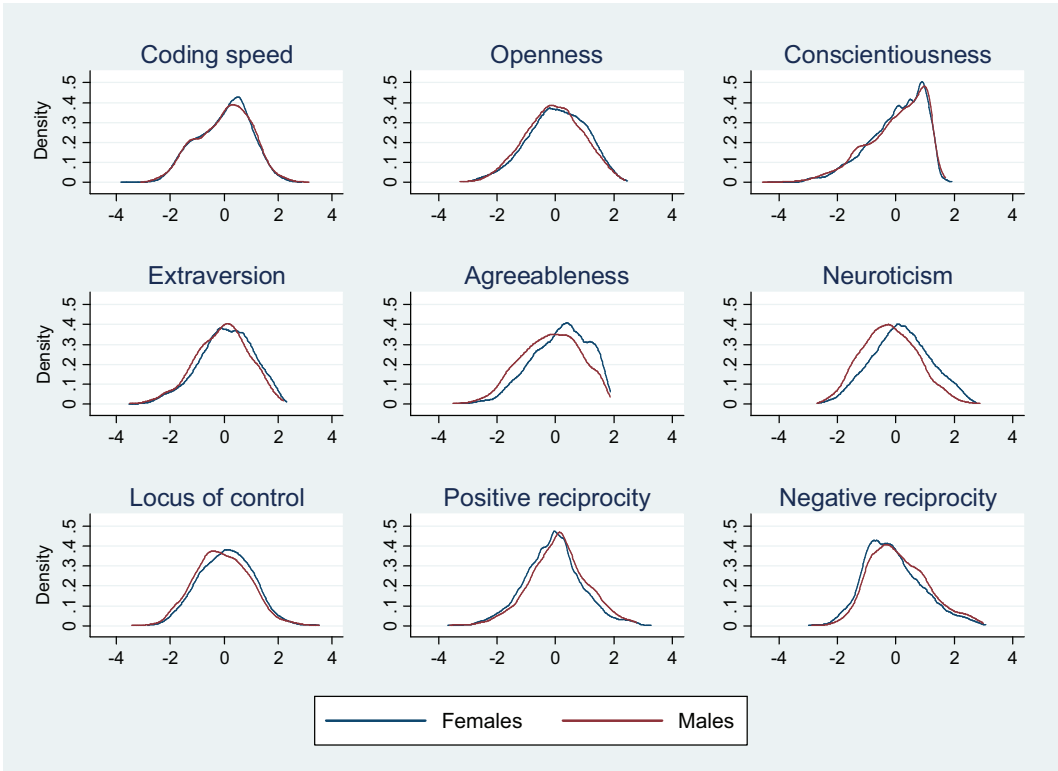
Notes: N=1580

Source: SOEP, 2005-06

Table 1: Log hourly wages regressed on cognitive abilities and personality traits, pooled cross-sections

	Females: OLS (1)	Females: EIV (2)	Males: OLS (3)	Males: EIV (4)
Personality traits				
FFM: Openness	0.023***	0.068***	-0.017***	-0.043**
	(0.007)	(0.016)	(0.006)	(0.018)
FFM: Conscientiousness	-0.002	-0.012	0.013**	0.015*
	(0.007)	(0.012)	(0.006)	(0.009)
FFM: Extraversion	-0.008	-0.037**	0.012**	0.027*
	(0.007)	(0.017)	(0.006)	(0.014)
FFM: Agreeableness	-0.033***	-0.066***	-0.008*	-0.016
	(0.006)	(0.015)	(0.005)	(0.012)
FFM: Neuroticism	-0.004	0.004	-0.002	0.005
	(0.006)	(0.011)	(0.005)	(0.009)
Positive reciprocity	0.027***	0.059***	0.011**	0.022**
	(0.006)	(0.011)	(0.005)	(0.010)
Negative reciprocity	0.002	0.013	0.021***	0.031***
	(0.006)	(0.008)	(0.005)	(0.007)
External locus of control	-0.049***	-0.100***	-0.042***	-0.072***
	(0.006)	(0.014)	(0.005)	(0.010)
Cognitive abilities				
SCT	0.003	0.002	0.023***	0.023***
	(0.006)	(0.007)	(0.005)	(0.005)
Individ. controls	+	+	+	+
IMR	-1.813***	-1.840***	-1.663***	-1.663***
	(0.133)	(0.138)	(0.141)	(0.140)
Chi^2 (FFM = 0)	48.14***	48.81***	15.69***	8.62*
Chi^2 (Personality var. = 0)	99.23***	93.21***	101.64***	99.03***
R^2	0.336	0.350	0.430	0.437

Notes: N = 6195 (females) / 6826 (males); IMR: Inverse Mills Ratio to correct for sample selection; standard errors (in parentheses) are derived from bootstrapping with 500 replications; *** $p<0.01$, ** $p<0.05$, * $p<0.1$
Source: SOEP, 1991-2006.

Table 2: Log hourly wages regressed on cognitive abilities and personality traits, panel estimates

	Females: RE (1)	Females: HTIV (2)	Males: RE (3)	Males: HTIV (4)
Personality traits				
FFM: Openness	0.019	0.026	-0.001	0.012
	(0.013)	(0.016)	(0.016)	(0.016)
FFM: Conscientiousness	0.001	-0.006	0.011	0.004
	(0.014)	(0.014)	(0.014)	(0.015)
FFM: Extraversion	-0.005	-0.001	0.007	-0.002
	(0.015)	(0.015)	(0.013)	(0.014)
FFM: Agreeableness	-0.021*	-0.031**	-0.019	-0.017
	(0.012)	(0.015)	(0.012)	(0.012)
FFM: Neuroticism	-0.009	-0.008	0.001	-0.002
	(0.014)	(0.014)	(0.012)	(0.013)
Positive reciprocity	0.022*	0.023*	0.019*	0.023*
	(0.013)	(0.012)	(0.011)	(0.014)
Negative reciprocity	-0.0002	-0.0001	0.018	0.013
	(0.013)	(0.013)	(0.013)	(0.013)
External locus of control	-0.052***	-0.061***	-0.060***	-0.075***
	(0.014)	(0.017)	(0.014)	(0.016)
Cognitive abilities				
SCT	0.008	0.011	0.030**	0.035**
	(0.014)	(0.016)	(0.013)	(0.014)
Individ. controls	+	+	+	+
IMR	-1.520***	-1.425***	-1.610***	-1.434***
	(0.193)	(0.270)	(0.219)	(0.274)
Chi^2 (FFM = 0)	5.09	8.11	3.22	2.31
Chi^2 (Personality var. = 0)	22.27***	21.31***	24.78***	27.27***
R^2	0.318	–	0.418	–

Notes: N = 6195 (females) / 6826 (males); IMR: Inverse Mills Ratio to correct for sample selection; standard errors (in parentheses) are derived from bootstrapping with 500 replications;
*** p<0.01, ** p<0.05, * p<0.1
Source: SOEP, 1991-2006.

Table 3: Wages and non-linearities in cognitive abilities and personality traits

	Females: OLS (1)	Females: HTIV (2)	Males: OLS (3)	Males: HTIV (4)
Personality traits				
FFM Openness				
Bottom 25%	-0.026*	-0.042	-0.002	-0.035
	(0.015)	(0.036)	(0.012)	(0.030)
Top 25%	0.011	0.002	-0.041***	-0.003
	(0.014)	(0.034)	(0.015)	(0.036)
FFM Conscientiousness				
Bottom 25%	0.0002	0.0001	-0.007	-0.034
	(0.017)	(0.036)	(0.013)	(0.036)
Top 25%	0.011	0.018	0.052***	0.075**
	(0.013)	(0.032)	(0.012)	(0.033)
FFM Extraversion				
Bottom 25%	0.031*	0.019	-0.059***	-0.040
	(0.017)	(0.037)	(0.012)	(0.031)
Top 25%	0.011	0.023	-0.058***	-0.064**
	(0.013)	(0.032)	(0.013)	(0.031)
FFM Agreeableness				
Bottom 25%	0.074***	0.054	0.028**	0.033
	(0.016)	(0.035)	(0.012)	(0.032)
Top 25%	-0.021	-0.027	-0.001	-0.001
	(0.013)	(0.033)	(0.012)	(0.029)
FFM Neuroticism				
Bottom 25%	0.048***	0.044	-0.021**	-0.039
	(0.014)	(0.033)	(0.011)	(0.031)
Top 25%	0.023*	0.014	-0.019*	-0.018
	(0.013)	(0.033)	(0.011)	(0.034)
Positive Reciprocity				
Bottom 25%	-0.058***	-0.033	-0.041***	-0.064*
	(0.015)	(0.032)	(0.012)	(0.037)
Top 25%	0.011	0.017	0.007	0.002
	(0.014)	(0.029)	(0.013)	(0.031)
Negative Reciprocity				
Bottom 25%	-0.001	-0.014	-0.059***	-0.062*
	(0.015)	(0.031)	(0.012)	(0.035)
Top 25%	0.026*	0.016	0.016	0.007
	(0.015)	(0.034)	(0.012)	(0.031)
External locus of control				
Bottom 25%	0.056***	0.073**	0.052***	0.109***
	(0.015)	(0.036)	(0.012)	(0.035)
Top 25%	-0.066***	-0.099***	-0.061***	-0.099***
	(0.015)	(0.033)	(0.012)	(0.033)
Cognitive abilities				
SCT				
Bottom 25%	-0.040***	-0.054	-0.041***	-0.044
	(0.014)	(0.033)	(0.013)	(0.036)
Top 25%	-0.022	-0.015	0.012	0.047
	(0.015)	(0.034)	(0.012)	(0.032)
Individ. controls	+	+	+	+
IMR	-1.802***	-1.407***	-1.671***	-1.430***
	(0.132)	(0.271)	(0.139)	(0.274)
Chi^2 (FFM = 0)	45.66***	8.25	79.39***	13.31
Chi^2 (Personality var. = 0)	105.95***	27.33**	181.41***	45.65***
Chi^2 (cognitive ability var. = 0)	8.24**	2.70	13.69***	5.29*
R^2	0.337	–	0.435	–

Notes: N = 6195 (females) / 6826 (males); IMR: Inverse Mills Ratio to correct for sample selection; standard errors (in parentheses) are derived from bootstrapping with 500 replications; *** p<0.01, ** p<0.05, * p<0.1

Source: SOEP, 1991-2006.

Table 4: Wages effects of cognitive abilities and personality traits by tenure

	Females: OLS (1)	Females: HTIV (2)	Males: OLS (3)	Males: HTIV (4)
Tenure	0.017***	0.006	0.017***	0.010***
	(0.002)	(0.004)	(0.002)	(0.003)
Tenure^2/100	-0.008	-0.004	-0.016***	-0.003
	(0.008)	(0.015)	(0.005)	(0.009)
Personality traits				
FFM: Openness	0.007	-0.011	-0.029***	-0.016
	(0.010)	(0.022)	(0.010)	(0.023)
IA: Openness*tenure	0.002**	0.005**	0.001*	0.003*
	(0.001)	(0.002)	(0.001)	(0.001)
FFM: Conscientiousness	0.006	-0.003	0.010	0.010
	(0.010)	(0.025)	(0.010)	(0.021)
IA: Conscientiousness *tenure	-0.001	-0.0003	0.0003	-0.001
	(0.001)	(0.003)	(0.001)	(0.002)
FFM: Extraversion	-0.019*	0.007	0.008	-0.012
	(0.010)	(0.026)	(0.009)	(0.026)
IA: Extraversion *tenure	0.002*	-0.001	0.0003	0.001
	(0.001)	(0.003)	(0.001)	(0.002)
FFM: Agreeableness	-0.012	-0.032	-0.016*	-0.005
	(0.009)	(0.021)	(0.008)	(0.021)
IA: Agreeableness *tenure	-0.003***	0.0004	0.001	-0.001
	(0.001)	(0.002)	(0.001)	(0.002)
FFM: Neuroticism	-0.007	-0.008	0.011	0.003
	(0.010)	(0.018)	(0.008)	(0.021)
IA: Neuroticism *tenure	0.001	0.0001	-0.001**	-0.0003
	(0.001)	(0.002)	(0.001)	(0.002)
Positive reciprocity	0.012	0.013	0.026***	0.017
	(0.010)	(0.020)	(0.008)	(0.019)
IA: Pos. reciprocity*tenure	0.002**	0.001	-0.001***	0.001
	(0.001)	(0.002)	(0.000)	(0.001)
Negative reciprocity	0.008	0.005	0.010	0.011
	(0.009)	(0.019)	(0.008)	(0.019)
IA: Neg. reciprocity*tenure	-0.001	-0.001	0.001**	0.0004
	(0.001)	(0.002)	(0.001)	(0.001)
External locus of control	-0.050***	-0.068***	-0.037***	-0.054**
	(0.010)	(0.022)	(0.008)	(0.021)
IA: Ext. LOC*tenure	0.0001	0.001	-0.001	-0.002
	(0.001)	(0.002)	(0.001)	(0.001)
Cognitive abilities				
SCT	0.009	0.009	0.008	0.053**
	(0.009)	(0.025)	(0.008)	(0.023)
IA: SCT*tenure	-0.001	0.0001	0.002***	-0.002
	(0.001)	(0.003)	(0.001)	(0.002)
Individ. controls	+	+	+	+
IMR	-1.801***	-1.446***	-1.676***	-1.462***
	(0.133)	(0.275)	(0.142)	(0.273)
R^2	0.340	–	0.433	–

Notes: N = 6195 (females) / 6826 (males); IMR: Inverse Mills Ratio to correct for sample selection; standard errors (in parentheses) are derived from bootstrapping with 500 replications;
Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Source: SOEP, 1991-2006.

Appendix Table A1: SOEP questions and personality traits (FFM, LOC, Reciprocity) used in the analysis (except where indicated)

Variable label	Personality trait
FFM: I see myself as someone who ...	
is original, comes up with new ideas	Openness to Experience
values artistic experiences	Openness to Experience
has an active imagination	Openness to Experience
does a thorough job	Conscientiousness
does things effectively and efficiently	Conscientiousness
tends to be lazy (*reversed*)	Conscientiousness [not used]
is communicative, talkative	Extraversion
is outgoing, sociable	Extraversion
is reserved (*reversed*)	Extraversion [not used]
is sometimes somewhat rude to others (*reversed*)	Agreeableness
has a forgiving nature	Agreeableness
is considerate and kind to others	Agreeableness
worries a lot	Neuroticism
gets nervous easily	Neuroticism
is relaxed, handles stress well (*reversed*)	Neuroticism [not used]
Locus of control	
How my life goes depends on me	Internal LOC [not used]
If a person is socially or politically active, he/she can have an effect on social conditions	Internal LOC [not used]
One has to work hard in order to succeed	Internal LOC [not used]
If I run up against difficulties in life, I often doubt my own abilities (*reversed*)	Internal LOC [not used]
Compared to other people, I have not achieved what I deserve	External LOC
What a person achieves in life is above all a question of fate or luck	External LOC
I frequently have the experience that other people have a controlling influence over my life	External LOC
The opportunities that I have in life are determined by the social conditions	External LOC
Inborn abilities are more important than any efforts one can make	External LOC
I have little control over the things that happen in my life	External LOC
Reciprocity	
If someone does me a favor, I am prepared to return it	Positive Reciprocity
I go out of my way to help somebody who has been kind to me before	Positive Reciprocity
I am ready to undergo personal costs to help somebody who helped me before	Positive Reciprocity
If I suffer a serious wrong, I will take revenge as soon as possible, no matter what the cost	Negative Reciprocity
If somebody puts me in a difficult position, I will do the same to him/her	Negative Reciprocity
If somebody offends me, I will offend him/her back	Negative Reciprocity

Appendix Table A2: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
FFM: Openness*	4.678	(1.121)	1	7
FFM: Conscientiousness*	4.825	(0.583)	2.33	7
FFM: Extraversion*	4.964	(0.774)	2	7
FFM: Agreeableness*	4.809	(0.723)	2	7
FFM: Neuroticism*	4.251	(0.863)	1.67	7
Positive reciprocity*	5.958	(0.855)	2	7
Negative reciprocity*	3.047	(1.433)	1	7
External locus of control*	3.563	(0.929)	1	7
Symbol correspondence test*	29.724	(9.175)	3	54
Male	0.524	(0.499)	0	1
Age	38.820	(9.503)	20	60
From East-Germany	0.136	(0.343)	0	1
Is married	0.646	(0.478)	0	1
Is Non-German	0.101	(0.302)	0	1
Years of education	11.952	(2.430)	7	18
Has a public employer	0.249	(0.432)	0	1
Firm size: >= 2,000	0.234	(0.423)	0	1
Is a white-collar worker	0.507	(0.499)	0	1
Has a part-time employment	0.183	(0.386)	0	1
Has a temporary job	0.174	(0.379)	0	1
Tenure	9.220	(8.794)	0	47.5

Notes: N = 13,021; * = 1,580
Source: SOEP 1991-2006, * 2005-06.

[1] The NLSY for instance includes indicators based on the Armed Forces Qualification Test (AFQT) which is derived from the Armed Services Vocational Aptitude Battery (ASVAB). The General Ability Test (GAT) which exists in the UK and in other Commonwealth nations is for example included in the NCDS.

[2] See e.g. Tett et al. (1991), Barrick and Mount (1991), Salgado (1997), or Tokar et al. (1998).

[3] For references, cf. Judge et al. (1999).

[4] Note that there is a small set of personality traits surveyed from 1994 to 1996. We did not use these indicators because the wording changes from the 1994/95 indicators to the 1996 items and, more severe, since it would result in further sample size reduction.

[5] The sample size is rather low since we have to restrict our sample to individuals who are SOEP respondents in both 2005 and 2006 and, which is more limiting, were CAPI surveyed in 2006, since only those were potential respondents of the ultra-short IQ-tests. That is, instead of the 22,358 observations available in the full sample we could work with only 5,545 observations of persons who took part in both tests and who could be matched to individuals who participated in the 2005 wave. This results in a drop of observations to 3,453 for which we then matched the preceding waves. The age restriction and further data cleaning result in an additional drop in sample size.

[6] Note that the full inventory, the NEO PI-R, comprises 240 questions (Costa and McCrae, 1985).

[7] See Dehne and Schupp (2007) for an overview of the implementation of the short version of the Big Five inventories in the SOEP. They show amongst other things the validity and reliability of the short version of the Big Five used in the SOEP.

[8] In general, separating external locus of control from internal locus of control is an advantage as this avoids a forced-choice format that would possibly lead to biased results if only one 'internal-external' scale would be used (Ray, 1984).

[9] Not all items are used to generate the indicators, since exploratory analyses showed that a few of the items resulted in low construct validity.

[10] Age-standardized scores are generated by calculating the scores' standardized value (deviation from the sample mean divided by the standard deviation) for every year along the age distribution.

[11] We calculate the Inverse Mills Ratio (IMR) by estimating a probit model for the employment participation equations separately for males and females with the following regressors: a dummy on whether the individual is living in East Germany, a dummy for being married, a dummy for not having German citizenship, the individual's years of education, age and age squared. The exclusion restrictions are dummies for the highest educational attainment of the respondent's mother and/or father.

[12] In particular, they show that changes in reliabilities can be computed as $R_1 = R_0 \cdot ((k_0 + \Delta k) / (k_0 + R_0 \cdot \Delta k))$, where R_0 is the given reliability and k are the number of items measuring the respective scale. For example, presume a fixed reliability of 0.54. If this ratio were obtained with 6 instead of 3 items, like the original agreeableness measure, the ratio would rise to 0.7 and thus reach the critical threshold.

[13] Note that there is another potential approach, the fixed effects vector decomposition, as introduced by Plümper and Tröger (2007). Their estimator is a three-stage procedure in which estimated unit effects from a fixed effects regression are decomposed in an explained and unexplained part. The latter is then included in a final pooled OLS regression that comprises both time-varying and –invariant regressors. They use Monte-Carlo simulations and try to demonstrate that their estimator outperforms the fixed effects, random effects and HTIV estimators in models that include either time-invariant or almost time-invariant variables that are correlated with unit effects. However, while they claim that their estimator is consistent if the unobserved unit effects are orthogonal to the time-invariant variables they do not provide any theoretical proof about the properties of their estimator so this should be dealt with caution. Experiments with this estimator in any case yield results that are qualitatively similar to the ones presented.

[14] In line with Mueller and Plug (2006), we ran additional regressions that include further controls for occupation and industry. The idea is that including occupation and industry should to some extent capture that workers who differ in cognitive skills and/or personality might self-select into specific jobs that either reward certain traits or off-set the lack of some traits (cf., e.g., Filer, 1986 or Jackson, 2006). However, these controls are potentially endogenous and including them will "over-control" and

bias the coefficients of interest downward. In fact, the results of the additional regressions are

qualitatively similar to the ones presented except that coefficients of some personality trait measures

are reduced and loose statistical significance.

[15] Note that the control variables yield expected findings. Full estimation results are therefore not

discussed but are available upon request.

[16] Results from the RE models are not given, since they are qualitatively similar to those from the

HTIV models.

[17] Results from the RE models are again not provided, as they are qualititatively similar to the HTIV

results.

[18] This is a valuable finding, since it indicates that analyses that are based on either personality

dimensions (Heineck, 2007) or cognitive abilities only (Anger and Heineck, 2008) do not suffer from

a severe omitted variable bias.