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ESTIMATING THE EFFECT OF PERSONALITY ON MALE-FEMALE EARNINGS

GERRIT MUELLER and ERIK J.S. PLUG*

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Abstract

This paper uses the Five-Factor Model of personality structure as a comprehensive organizing framework to analyze the effects of personality on earnings. Using data from a longitudinal survey of American high school graduates, we find that extroversion, agreeableness, conscientiousness, neuroticism and openness to experience are rewarded/penalized significantly and differentially across genders. Antagonistic, emotionally stable and open men enjoy substantial earnings advantages over otherwise similar individuals. In case of women, the labor market appears to value conscientiousness and openness to experience. We also find evidence of significant gender differences in personality traits. Decomposition of personality-based earnings differentials into trait and parameter effects suggests that, of the five traits, differences in agreeableness are the most important factor in explaining differences in male-female earnings.

JEL Classification: J16, J31
Keywords: personality and wages, gender wage gap

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I Introduction

It is clear that individuals' cognitive abilities play a vital role in generating labor market success. Almost all empirical studies that focus on cognition and earnings find that returns to cognitive ability, measured by standardized test scores, are positive and significant. But we know little about the role of noncognitive traits. Empirical studies that focus on noncognitive traits and earnings are relatively scarce, and those studies that are around focus on traits that are very different; Machiavellianism (Turner and Martinez 1977), self-esteem (Goldsmith, Veum and Darity 1997), aggression-withdrawal (Osborne 2003), to name just a few. Given the diversity of traits studied, their measures and corresponding returns, it is difficult to identify a consistent pattern and make any generalization about the role of noncognitive traits in the labor market.

This paper focuses on personality and earnings, and contributes by incorporating traits from the Five-Factor Model (FFM) of personality structure (Digman 1990; Goldberg 1990) into models of wage determination using data from the Wisconsin Longitudinal Study (WLS). The five personality traits composing the FFM are extroversion, agreeableness, conscientiousness, neuroticism and openness to experience. In addition to estimating how yet another five different personality traits affect earnings, this paper offers three advantages over previous studies.

The first advantage concerns the comprehensiveness in which we model and estimate the role of personality. Psychologists argue that virtually any personality construct can be mapped onto the FFM. Therefore, the five-factor taxonomy may also be of interest to an audience of economists. It may serve as an organizing framework for integrating the existing body of evidence, as well as for structuring future research efforts. The second advantage is our application of the FFM to the gender wage gap. We explicitly allow for gender differences, both in terms of personality traits and corresponding premia/penalties. This enables us to examine to what extent gender differences in earnings are due to differences in masculine and feminine personality traits, as opposed to differences in estimated returns to such traits. The third advantage is the direct comparison that our data allows us to draw

between returns to the five personality traits and those to cognitive ability.

Having stressed the advantages of our approach, we do not want to shy away from mentioning the main limitation of our empirical work –a limitation that it shares with most other studies in the field and that is related to availability of reliable and credibly exogenous measures of personality. Reviewing the existing literature on the importance of noncognitive traits, Carneiro and Heckman (2004) express our concern. They note that most personality determinants of earnings studied so far are self-reported ex-post assessments and are likely to be both, causes and consequences of labor market outcomes. However, they also emphasize the value of such studies, shedding new light on the importance of personality traits. Given that research on personality traits is still in its infancy, there is ample room for explorative studies of the kind presented here.

II Five-Factor Model of Personality Structure

According to the Five-Factor Model (FFM), five independent categories are sufficient to describe individual personality differences at the broadest level of abstraction (Costa and McCrae 1992; Goldberg 1990). The dimensions of the FFM are labelled extroversion, agreeableness, conscientiousness, neuroticism and openness to experience. This categorization does not imply that all personality attributes can be fully reduced to five traits. Rather, the "big five" should be viewed as broad factors underlying a number of related personality facets and sets of even more specific attributes. To provide a better idea, Table 1 lists a number of characteristics related to each one of the five personality dimensions.

The five factor categorization of personality constructs is all-pervasive in the current personality and social psychology literature. The FFM was first suggested by studies that tried to organize trait adjectives commonly used to describe people, available from dictionaries of a natural language, into a taxonomic structure (Allport and Odbert 1936; Norman 1963; Tupes and Christal 1961). The factorial structure has since been retrieved in a large number of studies, cross-validated using a variety of questionnaire scales, and found to generalize across languages and cultures (e.g. McCrae and Costa 1997). For comprehensive reviews of the historical roots of the FFM, as well as the more recent developments, we refer to

Digman (1989, 1990), John and Srivastava (1999), McCrae and Costa (1999), McCrae and John (1992).

In this paper, we adopt the standard economic viewpoint of personality as a bundle of productive attributes valued in the labor market. Earnings follow, as usual, from the kind and amount of traits possessed, and the return that each trait receives in the market. We thereby implicitly assume that personality impacts behavior. This view closely corresponds to that of trait theorists who believe that personality traits constitute basic determining tendencies (e.g. McCrae and Costa 1999). Determining tendencies are psychological dispositions that evoke "recurrent patterns of acting and reacting that simultaneously characterize individuals and differentiate them from others" (op.cit.; p.140). This interpretation does not imply that traits predispose an individual to behave in exactly the same way, irrespective of the situation. It merely holds that traits make certain behaviors more likely to occur, that is, more frequently observed across a multitude of situations.[1]

Using the FFM as a comprehensive framework to organize traits, there have been multiple studies by organizational and industrial psychologists that examine how the big five personality dimensions relate to labor market outcomes, including job performance (Barrick and Mount 1991; Tett, Jackson and Rothstein 1991), job satisfaction (Judge, Heller and Mount 2002), firm performance (Welbourne, Cavanaugh and Judge 1998) and, most closely related to ours, executive career success (Boudreau, Boswell and Judge 2001), and occupational attainment across the life span (Judge, Higgins, Thoresen and Barrick 1999).

To round-off this section, we would like to stress that the FFM is certainly not all there is to be said about personality, and that researchers should not, "seduced by convenience and seeming consensus, act as if they can obtain a complete portrait of personality by grabbing five quick ratings" (Funder 2001; p.201). Nevertheless, it is certainly fair to say that the FFM is the most comprehensive categorization of personality traits available to date. And, for the time being, the FFM may turn out to be valuable to economists for the same reason

[1]The trait perspective, like every theory, is not without its critics. For brevity, we refer to Funder (2001) who reviews all of the major research paradigms in personality psychology such as the behaviorist and social-cognitive paradigms, most critical of trait theory, but also psychoanalytic, biological and evolutionary perspectives.

it proved useful to psychologists: by providing a common denominator to integrate findings for a variety of traits studied in isolation.

III Personality and Earnings Differentials

In this section we briefly discuss how personality may affect earnings. We follow a very simple framework outlined in most economic studies on earnings differentials and distinguish three alternative sources to explain differences in pay, being (a) differences in skills; (b) differences in preferences; and (c) a discriminating labor market. Within this framework, we will then draw on a much bigger literature in psychology, especially the empirical part of it, to understand which and in which way particular personality traits matter for earnings.

Differences in Skills.— Human capital theory features prominently in the analysis of wage differentials (Becker 1975; Mincer 1958). In this framework, systematic variation in earnings arises from differences in productive skills. Productive skills are individual human capital attributes providing a direct input into the production process, and may be anything ranging from innate abilities, to skills that an individual has developed through investments in education, training and work experience. Individuals sell their bundle of skills to firms against an equilibrium market price per unit of skill. Therefore, an individual's overall compensation depends on the kind and amount of skills possessed, and the return that each subcomponent of the skill vector earns in a given occupation. In this vein, one may think of personality as part of an individuals' set of productive traits, valued in the market, with both exogenous (innate) and endogenous (developed over time) components. Of course, this does not mean that personality traits are equally productive across all occupations. If some traits are valued in certain occupations but not in others, we expect to find occupational sorting based on personality, assuming that workers choose those occupations that offer the highest rewards for their traits.

There have been a number of studies in occupational psychology in which personality traits are linked to job performance (Barrick and Mount 1991; Tett, Jackson and Rothstein 1991). Since job performance is closely related to the economist's notion of productive output, we may associate these personality effects directly with higher earnings. Tett et

al. (1991) find that neuroticism and job performance were negatively related across all occupations. Barrick and Mount (1991) report a robust positive correlation between conscientiousness and job performance across all occupation groups. Extroversion predicted job performance within management and sales occupations, that is for jobs involving a strong interpersonal performance component. Thus, the traits that increase performance, and thereby wages, depend on the requirements of the job. This evidence is well in line with sorting theories suggesting that some of the five personality dimensions may predict "extrinsic career success" (e.g. salary) if personality traits fit the psychological requirements of the job (Bretz and Judge 1994; Holland 1997; Tharenou 1997).

Any group differences in personality traits between men and women will translate into gender differences in earnings either directly, through productivity differences, or indirectly, through occupational segregation (e.g. Polacheck 1981). In this regard, we expect the agreeableness and neuroticism dimensions to be of importance. In a recent literature review, Bouchard and Loehlin (2001) came to the conclusion that agreeableness and neuroticism are the two traits most consistently showing the largest gender differences.

There are alternative theories of earnings determination according to which certain traits/skills still receive a return in a competitive market, although they are not productive skills in the sense defined above. One example, which we shall explore later on in this paper, is the wage bargaining model. In *Women Don't Ask: Negotiation and the Gender Divide* Babcock and Laschever (2003) argue that personality differences between men and women may lead to differences in pay: women shy away from negotiations, and if they do start negotiating, women ask for less in their opening offer, and tend to concede too quickly in the end.[2]

Differences in Preferences.— In addition to differences in skills, individuals may as well posses different preferences or tastes that are work-related. If these differences are somehow related to someone's personality, it is possible that personality affects earnings indirectly through occupational choice processes. In particular, Tokar, Fischer, and Subich (1998)

[2]These hypotheses are related to recent experimental work on behavioral differences between men and women which finds that women try to avoid competitive environments, and that women perform worse within competitive environments (Gneezy, Niederle and Rustichini 2003; Niederle and Vesterlund 2005).

report results that indicate some overlap between FFM personality traits and vocational preferences. Significant positive associations were generally found of openness with artistic and investigative interests and of extroversion with enterprising and social interests. These findings generalized across genders. Judge and Cable (1997), based on a sample of college graduates applying for jobs with various employers, find that agreeableness relates positively to preferences for supportive, team-oriented organizational cultures, and negatively to aggressive, decisive, and outcome-oriented cultures. Conscientiousness related positively to preferences for detail and outcome oriented, and negatively to innovative cultures.

Labor Market Discrimination.— In light of the large part of the gender wage gap left unexplained by productive traits and vocational preferences, it has been argued that differences in occupational structure and pay may also be a result of labor market discrimination (e.g. England 1982). In fact, one may even conceive of discrimination against women that starts pre-labor market. This is because subject choice within schools plays a major role in determining subsequent occupational choices and thereby earnings. Females may be discouraged to enter gender-nontraditional fields of study such a engineering, physics and mathematics. Such gender stereotyping may later confine them to traditional service oriented female-type occupations with, generally, lower wages. Although discrimination certainly plays an important role as a determinant of the gender pay gap, it is difficult to separate out empirically the differences in pay that are due to discrimination from differences in unobserved preferences and productive traits (e.g. Bertrand and Hallock 2001).

With this in mind, the main focus of our empirical work is to determine whether standard earnings equations yield evidence of a pay difference based on personality, and to what extent these differences in pay relate to labor-market sorting. We explicitly focus on gender differentials and ask whether women are treated differently because they are different and posses, on average, more feminine and less masculine personality traits, or because they face different rewards and penalties for their prototypical traits.

IV Method

A Data and Sample

Our analysis employs the Wisconsin Longitudinal Study (WLS) of 10,317 randomly sampled graduates from Wisconsin high schools in 1957. After the initial wave of data collection, primary respondents were re-interviewed in 1975 and 1992. Together with their parents' interview of 1964, these waves provide information on, among others, educational attainment, mental ability, socio-economic background, family formation, and labor market histories. The original sample is broadly representative of white men and women, who have completed at least twelve years of schooling. For more detailed information on the WLS, be referred to Sewell, Hauser, Springer, Hauser (2001) and the references therein.

Unlike other large longitudinal studies of school-based samples, the WLS contains personality measures together with information on respondents' labor market careers. This allows us to work with a much larger sample than comparable studies do in the psychological literature. We use data on personality traits from the 1992 mail questionnaire sent to 8,493 members of the original survey. This questionnaire collects information on respondents' personality traits based on the Big Five Inventory (BFI) developed by John, Donahue and Kentle (1991). The BFI was specifically designed to facilitate the collection of personality data in surveys using a short test instrument that allows efficient assessment of the five dimensions when there is no need for a more differentiated measurement of individual facets (John and Srivastava 1999).

Of the initial 10,317 random sample of high school graduates, 8,493 received the 1992 mail questionnaire; 6,875 individuals responded, and 6,692 individuals gave at least two complete answers to the separate items that correspond to each personality trait. Thus, nonresponse is a potential threat to the validity of our analysis although, compared to other studies covering a similarly long time span, the response rate is fairly high. The population under study is then restricted to men and women who are in employment in 1992, which reduces our sample to 6,062 observations. We further exclude all workers who are self-employed, work less than 20 hours per week, earn less than one dollar per hour, and all

those for whom data on the various control variables are unavailable. In the end, we are left with a sample of 5,025 observations. Descriptive statistics for both, the male (N=2,424) and female (N=2,601) subsamples are provided in Table 2.

B Measurement

The personality test instrument used in the WLS assesses the various dimensions by means of self-ratings on 29 questionnaire items. It is an abbreviated version of the original 44-item BFI (John et. al., 1991). Each dimension is assessed by 6 items, except for neuroticism-emotional stability which is assessed by 5 items. Items are statements such as "I see myself as someone who is talkative" or "I see myself as someone who is easily distracted". Individuals are asked to rate to what extent these statements apply to themselves on a 6-point scale ranging from "agree strongly (1)" to "disagree strongly (6)". The single item responses are then coded into average scores.

Any research based on measurement must confront the reliability of its measures. We quantify the size of the measurement error by calculating reliability coefficients for the BFI scales, often referred to as Cronbach's alpha reliabilities (Cronbach 1951). Derivations are provided in the Appendix. We found some notable differences: extroversion .76, agreeableness .71, conscientiousness .66, neuroticism .77, and openness .60. The reliabilities of the abbreviated scales averaged .70, which suggest that a considerable fraction of the variability in the reported traits is due to measurement error.

It is possible to compare these numbers with previous estimates of reliability ratios. John and Srivastava (1999) report that reliabilities of the original 44-item BFI scales typically lie between .75 and .90 and are on average above .80. These estimates indicate that the internal consistency of the BFI scales is on average high, and about ten percentage points higher than those we find. This does not necessarily mean that the original BFI scales are better. Reliability ratios increase with the number of items. The abbreviated BFI scales we use include only five to six items. If we had eight to ten items, as the original scales do, the estimated reliability ratios would range from .69 to .83, average out at .78, and thus be very

similar to the ones previously estimated.[3]

To measure general intelligence, we use test scores on the *Henmon-Nelson Test of Mental Ability* that respondents took in 1957 while attending high school. Unfortunately, we do not have access to individual test items which precludes the option of estimating reliability coefficients ourselves. But, in contrast to the BFI, the Henmon-Nelson test was implemented as originally designed. We can therefore safely rely on estimates available in the literature. The psychometric properties of the test are well established with reliability ratios ranging from .87 to .94 (Buros 1959).[4] In addition to that, potential measurement error due to time and cohort effects are ruled out by the very nature of our data.

C Estimation

We first estimate a standard log-linear earnings equation separately for men and women in the form

$$Y_{im} = X'_{im} b_m + \epsilon_{im}, \quad Y_{if} = X'_{if} b_f + \epsilon_{if} \tag{1}$$

where i, m and f subscripts individual and gender groups, Y denotes the logarithm of hourly earnings, X is a vector of covariates including the five personality measures and control variables assumed to affect earnings, and ϵ is the remaining error. The parameter vector b contains the estimates of how the labor market would value different characteristics.

While these equations determine whether personality traits matter for generating earnings, and whether they affect earnings differently for men and women, it does not tell us

[3]The reliability ratio R_0 of any given personality measure is defined by

$$R_0 = \frac{k_0 \rho}{1 + (k_0 - 1)\rho}$$

where k_0 and ρ represent the number of items and the average inter-item correlation, respectively. Let R_1 be the reliability ratio of the same personality measure but measured with Δk additional items. With ρ fixed, we can express R_1 in terms of k_0, R_0 and Δk as follows

$$R_1 = R_0 \left(\frac{k_0 + \Delta k}{k_0 + R_0 \Delta k} \right)$$

It is easy to see that reliability ratios increase with the number of items. For example, if a reliability ratio of .71 is obtained with 9 instead of 6 items, like our original agreeableness measure, the ratio would rise to .79.

[4]Zax and Rees (2002; p.603) report that, based on publicly unavailable WLS data, Robert Hauser estimated the reliability ratio to be between .92 and .95. In our later calculations we will impose the average of .935.

how large a role these differences play in explaining the gender gap in earnings. To address that, we decompose the gender gap into two components; one that can be attributed to differences in observable personality traits between men and women, and a second, that can be attributed to differences in trait permia/penalties between men and women. To calculate the latter component, we must choose which set of coefficients to use as the standard of comparison (male or female). We follow Neumark (1988) and Oaxaca and Ransom (1994) and use the common coefficients estimated from a pooled regression of men and women ($\widehat{b}_p$). If we express the difference in earnings between men (m) and women (f) in terms of averages

$$\bar{Y}_m - \bar{Y}_f = \bar{X}_m' \widehat{b}_m - \bar{X}_f' \widehat{b}_f, \tag{2}$$

where $\widehat{b}_m$ and $\widehat{b}_f$ are the estimates from (1), the earnings differential can be separated into two components

$$\bar{Y}_m - \bar{Y}_f = [\bar{X}_m - \bar{X}_f]' \widehat{b}_p + [\bar{X}_m' (\widehat{b}_m - \widehat{b}_p) - \bar{X}_f' (\widehat{b}_f - \widehat{b}_p)] \tag{3}$$

The first term can be interpreted as the part of the earnings differential that is due to differences in observed characteristics, and the second, as the part due to differences in estimated parameters. Decompositions like these have a long tradition in studies of wage differentials beginning with the work of Oaxaca (1973), who interpreted the differences in returns between men and women with similar characteristics as a measure of labor market discrimination. We do not want to adhere to this particular interpretation. As noted earlier, different parameters may just as well come from (unobserved) differences in preferences and productive skills.

V Results

A Personality and Male-Female Earnings

Table 3 reports OLS estimates of the relationship between our measures of the five personality traits and the log of hourly earnings, separately for men and women. For reasons of comparability, we have standardized each trait scale on the full estimation sample to have zero mean and unit variance. The same transformation is applied to IQ-scores. Panel A and

B of Table 3 show results for samples of employed men and women, respectively. Each panel contains four OLS estimates, with varying sets of covariates.

We begin by discussing the personality effects on earnings of men. In column (i) we estimate a baseline specification in which the five personality traits are the only right-hand-side variables. We find that antagonistic, emotionally stable and open men enjoy significant and substantial earnings advantages. Of all five personality traits, openness to experience seems to be the most rewarding whereas extroversion and conscientiousness generate no returns at all. In column (ii) we add the childhood IQ test scores to the regression to somehow control for the respondents' cognitive ability. With this IQ measure added, the returns to being antagonistic, emotionally stable and open fall, but remain positive and statistically significant.[5] In column (iii) we add several other covariates including years of schooling, work experience and tenure, region, and other individual and family characteristics. Including these variables reduces the estimated coefficients for non-agreeableness, emotional stability and openness effects, yet results remain qualitatively similar.

It is not clear whether respondents' occupation (and industry) affiliation are appropriate variables to include in our wage regressions. If we believe that workers are selected into certain jobs on the basis of specific personality profiles, we would probably not want to control for occupations while estimating the effect of personality on earnings. When controlled for, we expect job-holding to partially mediate the significant effects of personality on earnings. In column (iv), where we added 8 one-digit industry and occupation dummies to the previous specification, returns to non-agreeableness and emotional stability remain virtually identical. Returns to openness fall some, but remain statistically significant.[6] It

[5]Based on psychometric and experimental studies, psychologists argue that there is no meaningful relation between personality and intelligence. However, there is evidence that actual performance on IQ tests is related to some dimensions of personality. It has been found, for example, that introverts show more vigilance and less fatigue during extended tests. Also, feelings of anxiety (a facet of neuroticism) are known to affect test performance if the test subjects the individuals to considerable stress (e.g. time pressure). Our proxy variable for intelligence might be picking up this performance effect to some extent. For an exhaustive treatment of the relation between personality and intelligence, see Sternberg and Ruzgis (1994)

[6]For information on individuals' job-holding we rely on the standard classification system of the U.S. Bureau of the Census, using 1990 occupation and industry definitions at the one-digit level. Of course, it is possible that personality results would change if we used more fine-tuned information on industry or occupation characteristics. As a simple test, we replaced the one-digit level dummies with sets of occupation and industry indicators defined at the two-digit and three-digit level. We find that our parameter estimates are robust to the inclusion of more detailed indicators of respondents' job-holding.

appears that antagonistic and open men always earn more. Across all specifications, the agreeableness-antagonism dimension has the most persistent effect on earnings. One standard deviation increase raises the hourly earnings for antagonistic male workers on average by 4 to 6 percent.

For measured cognitive ability, we find strong positive effects which are reduced substantially when we add human capital characteristics in the third column. The magnitude is of the order 7 to 17 percent due to a one standard deviation change in IQ-scores, conditional on the particular set of covariates entered. It appears much larger than any of the trait premia/penalties viewed in isolation, which range from 0 to 6 percent. However, a favorable personality profile potentially leads to equally strong earnings effects as cognitive ability if personality is viewed as bundle of traits. Nonetheless, personality does not predict earnings as well as our cognitive ability measure. In isolation, the five personality measures explain about 5 percent of the variance in earnings. The addition of IQ test scores improves the R-squared by almost 10 percentage points.

And what about women? In column (i) of Table 3, where we estimate the earnings specification without controls, we find that all five personality traits associate significantly with earnings. Three personality estimates are very similar to those found for men. Antagonistic, emotionally stable and open women earn higher wages. Two personality estimates are different. Unlike men, women appear to be penalized for being extrovert while they receive a premium for being conscientious. If we include IQ test scores in column (ii), we find that all partial personality effects decrease only marginally. When we start adding more controls, however, results appear to be sensitive. In columns (iii) and (iv) only returns to openness and conscientiousness are consistently significant and positive for women.[7] A one standard deviation increase in either of the two traits is associated with a 2 to 3 percent increase in hourly earnings. The combined premia of openness and conscientiousness compare in magnitude to the earnings effect of measured cognitive ability. With the full set of controls entered, a one standard deviation increase in IQ raises hourly earnings by about 5 percent.

[7]As for men, results are insensitive to replacing the one-digit occupation and industry dummies with indicators defined at the more detailed two or three-digit level.

Comparison of column (i) and (ii) further shows that personality and cognitive ability are roughly equally important in explaining the variance in earnings. The five personality measures together account for approximately 6 percent of the earnings variation; adding IQ test scores to the baseline specification in column (ii) improves the R-squared by 5 percentage points.

Overall, these results suggest that personality predicts earnings for both men and women. A favorable personality profile –a distinct bundle of traits rewarded in the market– appears to have an impact on earnings that is comparable to that of cognitive ability. Of course, we are not arguing to have identified causal effects of personality traits on earnings. We merely show that personality adds explanatory power to our model. All our F-tests indicate that the big five traits are jointly statistically significant. In terms of the magnitude of additional variance explained, the contribution is similar to that of cognitive ability; significant, but modest.[8]

There are, to our knowledge, two studies in the psychological literature that also investigate the relationship between the big five traits and earnings (Boudreau, Boswell and Judge 2001; Judge, Higgins, Thoresen and Barrick 1999). Both studies employ American data and are therefore most valuable for comparative purposes.[9] Boudreau, Boswell and Judge (2001) study the effects of personality on intrinsic and extrinsic career success based on samples of American and European executives. For the American sample, consisting primarily of white males in their late forties, they find that agreeableness and neuroticism relate negatively to remuneration, with extroversion and conscientiousness having little or no impact and openness to experience associating positively. The highly selective nature of the sample places limits on possible generalizations, most importantly with respect to the effects one

[8]The magnitudes are, for example, much smaller than those conventionally found for education. According to the specification in column (iii), the traditional "return to education", as measured by the earnings effect of an additional year of schooling, is estimated to be .064 for men and .066 for women. When we replace the years of schooling variable with its standardized equivalent, we find point estimates of .149 [13.73] and .153 [13.18] for men and women, respectively; with t-ratios shown in brackets.

[9]After the first draft of this paper was written, it came to our attention that Nyhus and Pons (2005) were analyzing the effect of big five personality traits on earnings using a sample of about 800 male and female workers in The Netherlands. In a specification comparable to our model in column (iii), they mainly find that emotional stability is positively associated with wages of both women and men. They do not analyze a gender wage decomposition.

should expect for women. Judge et al. (1999) also find that agreeableness and neuroticism have a negative effect on earnings. Extroversion and conscientiousness associate positively with earnings, but the positive effect of the openness dimension disappears with the full set of conditioning variables entered. Some caution is again in order when generalizing these findings to broader populations, as they are based on a sample only slightly in excess of one hundred observations.

B Limitations

While our results are comparable to those obtained by previous studies, we should treat our findings with care. The parameter estimates presented in Table 3 may be subject to a number of sources of bias: measurement error in the BFI scales, selective non-response, misspecification, and simultaneity between wages and personality traits.

Measurement Error.— Our first concern relates to the possible attenuating effects of measurement error. If personality effects seem only modestly important, it is quite possible that our personality traits are measured with error. After all, random error will bias any estimated effect to zero. One way to correct for such error is to adjust the parameter estimates and standard errors by imposing reliability ratios in estimation (see Appendix B). Panel A of Table 4 presents parameter estimates that are adjusted for the effects of measurement error.[10] The estimated effects remain qualitatively very similar, except that they are almost all larger than the corresponding point estimates in Table 3. The increase is substantial and often significant. Assuming that there is no serial correlation among the measurement errors across the five personality scales, our results suggest that unreliability in trait measurement indeed leads to a considerable underestimation of the corresponding premia and penalties.[11]

[10]We only allow for unreliability in the measurement of the five personality traits and the *Henmon-Nelson* IQ-scores. Note further that in Table 3 it was useful to see how coefficients changed as additional covariates were added. This is not as important when we test for the effects of measurement error. We therefore show only two specifications that correspond to columns (ii) and (iii) of Table 3.

[11]We have skirted around the more subtle issue of subjectivity in self-reported data. Bertrand and Mullainathan (2001) discuss how cognitive factors and the social nature of the survey procedure may affect the way people answer questions, and how subjectivity may be treated in a measurement-error framework. We cannot explore this issue empirically with the data at hand, but refer to Costa and McCrae (1988) who present evidence that the convergence between self and peer or expert-ratings is, on average, between .80 and .90.

Selective non-response.— A related concern derives from the fact that respondents are kept in the sample if they provided at least two complete answers to the question sets that correspond to each personality trait. It is possible that selective non-response introduces inconsistencies when we estimate our regression models. In order to see how sensitive our results are, we calculate reliability ratios and run OLS regressions on a sample of workers who responded to all items. As Panel B of Table 4 shows, this restriction induces a loss of 651 observations but does not affect the results substantially. This means that the trait coefficients, as well as the estimated reliability ratios, are not sensitive to item non-response.

Nonlinearities.— The third issue relates to whether or not the relationship between the big five traits and hourly earnings is nonlinear. When it comes to personality, it is not a priori clear that more is necessarily better. If, for example, the labor market values people who are only moderately extrovert and punishes those who are too introvert or too extrovert, it is possible that the linear specification is pushing estimated average returns to zero. In Panel C of Table 4, we test for nonlinear personality effects by replacing the reported trait scores with sets of trait level dummies. For each personality trait, we transform the average reported scores into quartiles, and create three corresponding dummy variables for whether or not the personality scores are in the top or bottom 25 percent of the distribution. The middle 50 percent of the scores is the omitted category. With personality traits measured in levels, we observe that not all of the individual dummy coefficients are significantly different from zero. However, for those personality traits which mattered in the linear specifications, we find that many individual dummy variables are significant and show a consistent monotonic pattern. These results suggest that for the traits that mattered previously, a linear representation is a pretty accurate approximation of the overall relationship. For the traits that did not affect earnings in previous specifications, the fluctuations we observe are difficult to reconcile with any consistent pattern.

Reversed Causation.— The fourth and our biggest concern is that of endogenous personality measures. Since in our data personality traits were assessed at the same time as hourly earnings, we do not know whether personality is the cause or the consequence of earnings. To the extent that trait measures are endogenous, our parameter estimates will be upward

biased because they capture both effect and result. In what follows, we will argue that the extent of the bias may not be as severe as it appears at first sight.

It is well-understood that personality traits are both inherited and formed. Bouchard and Loehlin (2001), for example, reviewing a large number of twin studies, find that 40 to 60 percent of the variation in personality is attributable to genetic differences between individuals. The inherited part, which is substantial, can be treated as predetermined with respect to earnings. The concern about endogeneity bias derives, of course, from the fact that part of one's personality is developed over time and shaped by labor market experiences.

The current state of knowledge indicates that the formation of personality occurs primarily during early childhood and adolescence, that personality is largely set by age 30, and that it remains fairly stable thereafter (see the reviews by Caspi and Roberts 1999; Costa and McCrae 1994, 1997; Digman 1989). The evidence on stability of mean levels in big five traits, 'absolute continuity', is pervasive. Moreover, measures of personality traits are found to exhibit strong 'differential continuity', meaning that individuals tend to preserve their relative position within the respective trait distribution as they age (e.g. Costa and McCrae 1988). Overall, the big five personality traits are heritable and enduring individual predispositions, second in stability only to measures of cognitive ability (Conley 1984).

Our study is based on a single cohort of equal age individuals in their early fifties. It therefore offers the clear advantage that sample members are homogenous in terms of age and timing of personality measurement. We referred to evidence saying that mean trait levels change only imperceptibly over time and that individuals generally maintain their own rank order within the group. This implies that, even if personality changed as people age, it is unlikely that the corresponding estimates are driven much by the simultaneity between wages and our personality regressors. We are aware that these arguments do not prove that endogeneity bias is absent. With the data at hand, it is impossible to remove this bias. It is appropriate, though, to interpret our estimates as upper bounds of true personality effects.

To summarize, we find that our estimated personality returns (a) increase substantially when adjusted for measurement error; (b) are not caused by selective non-response; (c) are not an artifact of the linear specification; but (d) remain upper bounds of actual personality

effects due to the endogeneity of our personality regressors. The sensitivity tests we performed reinforce our earlier conclusion. The impact of personality on earnings is significant and comparable to the impact of differences in cognitive ability, and though it is not large, it is not trivial either.

C Discussion

How do our findings in terms of FFM traits relate to other personality variables studied in the economic literature? A number of recent studies investigate whether personality traits account for differences in labor market success (Bowles, Gintis and Osborne 2001; Duncan and Dunifon 1998; Dunifon, Duncan, and Brooks-Gunn 2001; Goldsmith, Veum and Darity 1997; Osborne 2003), building on earlier work by Andrisanni (1978), Filer (1981, 1986), Jencks (1979), and Turner and Martinez (1977). In this section we briefly discuss our own findings in relation to some of the preceding studies.

We start-off with one of the earliest contributions. Based on a survey conducted by the National Opinion Research Center (NORC), Turner and Martinez (1977) examine the influence of the "Machiavellian" personality on socioeconomic attainment. Machiavellianism, that is being cool, distant and treating people as objects to be manipulated, can be related to the negative pole of the agreeableness dimension (Paulhus and Williams 2002). For men with above average education, Turner and Martinez find that Machiavellianism is associated positively with income. Inverting our estimates for the agreeableness scale, we observe a similar relationship.

Dunifon et al. (2001) examine the role of organization and efficiency in affecting earnings for fathers and their children. Based on the Panel Study of Income Dynamics (PSID), they use a measure of household cleanliness to proxy these traits, and find for both fathers and children (including daughters) that living (being raised) in a clean and organized house is positively related to hourly earnings obtained 25 years later. The authors do not report results for mothers, nor for sons and daughters, separately. Treating conscientiousness as a direct measure of being organized and efficient, we find statistically significant effects for women, but not for men.

Using data from the National Longitudinal Survey of the Youth (NLSY), Goldsmith, Veum and Darity (1997) find that self-esteem is positively and significantly associated with higher wages. Self-esteem, or the lack thereof, is clearly a facet of the neuroticism dimension. Unfortunately, Goldsmith et al. pool their male and female subsamples and do not provide estimates of gender differences in returns. In an analysis not shown in this paper, we estimate our earnings models on a pooled sample of men and women and, like Goldsmith et al., find a statistically significant negative effect for being neurotic. On the basis of our separate equations for men and women, we find that high levels of neuroticism (low self-esteem) are associated with lower earnings for men, but not for women.

A very recent example, and one that explicitly takes gender differences into account, comes from Osborne (2003). Using U.K. data from the National Child Development Study (NCDS), she examines whether measures of aggression and withdrawal are differentially rewarded across genders. Aggression has a dominance and lack of impulse control component and can therefore be viewed as a combination of extroversion and neuroticism facets. Withdrawal is highly related to compliance, that is agreeableness, but may also reflect aspects of introversion. According to Osborne, women appear to face significantly larger penalties for aggression, while men are more heavily penalized for withdrawal. We find that men are penalized for agreeableness across all specifications while introversion is found to have virtually no effect. For women, extroversion and neuroticism are both penalized in specifications without controls, however, as further controls are added these effects disappear.

Of course, those above are selected examples, but they are suggestive of the potential that lies in the FFM as an organizing framework. We agree with Bowles, Gintis and Osborne (2001), who conclude that we are unlikely to find a noncognitive personality analogue to the common g-factor *underlying* most measures of cognitive performance (in a factor-analytic sense). But, the FFM may assume a similar function by providing a common denominator, enabling comparisons of a multitude of variables that have been studied in isolation. It might bring the necessary structure to our inquiry into the role of personality traits in the labor market.

D Decomposing the Gender Gap

In the tradition of most empirical work on wage differentials, we focus on two major mechanisms explaining differences in pay: (a) differences in characteristics, and (b) differences in the corresponding premia and penalties.

Gender Differences in Personality Traits.— In the first column of Table 5 we test for average gender differences in personality characteristics using standardized trait scales to make the gender differences more readily visible. We find that women are significantly more agreeable, neurotic, extrovert and open, with differences in the first two traits being the largest. Gender means for neuroticism and agreeableness lie 20 to 40 percent of a standard deviation apart. These findings are consistent with evidence from the psychological literature (e.g. Bouchard and Loehlin 2001).

Gender Differences in the Earnings Premia and Penalties.— The next three columns of Table 5 present gender differences in personality returns based on error-corrected estimates.[12] According to the baseline model in column (ii) we find that women receive higher returns for the traits introversion, agreeableness, conscientiousness, neuroticism and openness. As we include more controls (columns iii and iv), agreeableness remains the only dimension that shows statistically significant differences in labor market valuation across genders; with the estimated penalties for men driving these differences. When it comes to measured cognitive abilities, we find that differences in returns to IQ-scores are insignificant. Since the magnitude and direction of the effects happen to be very similar across genders, the difference is virtually zero.

It is further interesting to note that, except for extroversion, the penalties (returns) to males tend to be larger for those personality traits for which males have the lower (higher) means; the converse holding for women.[13] This can easily be verified by checking that

[12]Since it is interesting to see what happens to these estimated differences when we take into account other sources of variation, we compute differences in parameter estimates based on the specifications shown in columns (ii)-(iv) of Table 3.

[13]Finding women slightly more extrovert than men appears odd, at first sight. However, extroversion has both dominance and sociability facets, and our abbreviated test instrument may be picking up the sociability component to a larger extent, therefore women scoring higher on this trait scale.

the following interaction term $(\bar{X}_m - \bar{X}_f)'(\widehat{b}_m - \widehat{b}_f)$ is strictly positive. Apparently, it is not universally better to be masculine (absolute advantage), but that individuals with masculine traits have a comparative advantage under a male wage; and those with feminine traits under a female one.

Decomposition Results.— In Table 6 we report earnings decompositions based on error-corrected parameter estimates from male and female earnings equations for the same three specifications as before. The overall differential, that is the difference in logarithms of hourly wages between men and women, amounts to .58. The magnitude of the gap is large, but is not unusual for the particular generation of men and women under study.

In rows 2 and 3 we start decomposing the wage gap into the share that is attributable to differences in characteristics (included in the model) versus differences in coefficients. It is clear that the part of the wage gap explained increases as more regressors are added. Our primary focus lies of course on the decomposition results for personality traits in the fourth and fifth row. Based on the first specification (column i), we find that 16 percent of the gender gap can be attributed to differences in mean personality traits, and about 13 to differences in labor market rewards/penalties. When additional variables are introduced in column (ii) and (iii), these numbers fall to 10 and 8 percent, and 7 and 5 percent, respectively. Note that the effects work in opposite directions such that the overall differential is only moderately affected. Overall, only 3 to 4 percent of the gender gap is explained by differences in personality including differences in traits and trait returns. This number is about the same in every column.

In the remaining rows we report in more detail how much of the total difference is attributable to each of the five personality traits separately. We find that the decomposition results for personality are primarily driven by one single dimension; agreeableness-antagonism. Rows 6 to 10 indicate that most of the share explained by differences in personality characteristics, comes from mean differences in agreeableness. Rows 13 to 17 describe a similar pattern, showing that most of the gender differences in personality returns are due to the differences in returns to non-agreeableness.

Interpreting the Decomposition Results.— Our findings thus suggest that, among the five

personality traits, differences in agreeableness are the most important factor in explaining differences in male-female earnings. Two channels are responsible for this result: (a) men are much less agreeable than women; and (b) men are those who receive a reward for being less agreeable. The first channel does not require an economic explanation, while the second one does. In what follows, we consider labor market sorting, discrimination and bargaining as possible sources for why the market rewards agreeableness differently for men and women.

The sorting argument is one of the standard arguments to explain particular differences in pay. With our focus on agreeableness, sorting implies that less agreeable workers (primarily men) select into occupations where being less agreeable is required and rewarded as a productive trait. In regression models that do not control for occupation choice, it is possible that the return estimates for the agreeableness trait are picking up sorting effects. A simple test for sorting would therefore be to add variables to our models that measure characteristics of occupations in which non-agreeableness is possibly productive. As it is difficult to identify such occupations a priori, we revert to the equivalent procedure of conditioning directly on occupation codes at the one, two and three-digit level. Consistent with our earlier findings, we conclude that there is little evidence supporting the view that returns to agreeableness are so different for men and women because of sorting.

A discrimination argument that is partly consistent with our findings comes from Badget and Fobre (2003). Their argument goes as follows. In the presence of societal expectations about gender-appropriate traits and behavior, it is possible that the market rewards men and women who comply to traditional gender roles, but punishes those who deviate. With this type of discrimination, we expect that agreeable men and non-agreeable women are punished for being perceived as too feminine and too masculine, respectively. Mens' returns to agreeableness behave as the model predicts; the market punishes those who are too considerate and cooperative, by male standards. In case of women, our evidence does not square with the model predictions. Womens' returns to agreeableness are either negative or close to zero, but never positive.

An alternative argument which received little attention in the empirical literature on gender wage differentials is the bargaining argument. Most of the work on gender differences

in bargaining has been done by psychologists, who find that women are more cooperative in bargaining than men (Walters, Stuhlmacher and Meyer 1998). Since we observe the extent to which men and women are cooperative in terms of our agreeableness measures, our data corroborate the findings that women are, on average, more cooperative when bargaining over their wages. So far, this argument does not explain the gender differences in returns, that is, why only men benefit from being uncooperative. If, however, anticipating employers start to offer lower wages to women, returns for uncooperative behavior will be higher for men than for women. Note that it is not necessary for men and women to be actually any different: it is sufficient for employers to think they are and to set their wage offers accordingly.

VI Concluding Remarks

In this paper, we estimate the effect of personality on male-female earnings using the Five-Factor Model of personality structure as a comprehensive organizing framework. The personality traits we examine are extroversion, agreeableness, conscientiousness, neuroticism and openness to experience. Our results indicate that (a) men, who are antagonistic, open and, to a lesser extent, emotionally stable enjoy earnings advantages over otherwise similar men; (b) women receive a premium for being more conscientious and open; (c) returns to non-agreeableness are very different for men and women; but (d) that the positive returns to openness are very similar across gender, suggesting that being creative, unconventional and artistic is equally important for men and women.

We would like to emphasize once more that our empirical findings require careful interpretation. The main reason is that causality may be reversed. We assume that personality affects earnings, but we cannot rule out the possibility that earnings may also impact personality. Despite well-founded endogeneity concerns, we still believe that an exploratory study like the one at hand makes a contribution in terms of organizing our thoughts about the role of personality in the labor market.

Last but not least, we should stress that our results are specific to a highly educated group of mainly white men and women, raised in the state of Wisconsin, and who were in their early fifties about a decade ago. Traits that are important for this particular group are

not necessarily relevant for current generations in the labor market.

Having said this, let us take one step back and evaluate what we have found. Our results indicate that personality matters and that the impact of personality on earnings is comparable to that of cognitive ability. Its contribution in explaining the variance in observed hourly earnings, much alike measured intelligence, is rather modest. Our analyses shows that the joint influence of the FFM trait variables is considerably weaker than that of education, for example. This holds even though we have made considerable allowance for unreliability in the measurement of personality and despite the fact that our estimates are likely to be upper bounds of true effects. Nonetheless, our results do indicate that personality has earnings effects comparable to those of cognitive ability, which has a recognized place in the literature.

When economists talk about the importance of abilities, they usually refer to unobserved abilities that may bias the estimated return to schooling or discuss measures of cognitive ability and their effects on outcomes like schooling and earnings. This is obviously too restrictive. Personality traits are interesting in their own right, and not just as confounding factors in estimating the returns to schooling.

Appendix

A. Measuring Unobserved Traits and Classical Measurement Error

$A_1, \ldots, A_k$ are observed scores on k items, all designed to measure the same but unobserved trait A. The following relationship is used to link these observed variables to the unobserved trait

$$A_i = A + e_i \text{ for } i = 1, \ldots, k$$

The observed measure is decomposed into its true value A and a classical measurement error e_i that is uncorrelated with A and with each other. If $\text{Var}(e)$ is the variance of the measurement error, assumed identical for all i, and if $\text{Var}(A)$ represents the variance of the true trait, the covariance matrix can be written down as

$$\begin{array}{ccccc} & & A_1 & \ldots & A_k \\ A_1 & & \text{Var}(A) + \text{var}(e) & & \text{Var}(A) \\ \vdots & & & \ddots & \\ A_k & & \text{Var}(A) & & \text{Var}(A) + \text{Var}(e) \end{array}$$

The reliability ratio of any available measure of A represents the fraction of the variance in the observed measure of A that is due to the true variation in A

$$\frac{\text{Var}(A)}{\text{Var}(A_i)} = \frac{\text{Var}(A)}{\text{Var}(A) + \text{Var}(e)}$$

which, in this model, is identical to the correlation between any two measures

$$\rho_{ij} = \frac{\text{Var}(A)}{\text{Var}(A) + \text{Var}(e)} = \rho$$

The reliability ratio of the average score $\bar{A} = (A_1 + \cdots + A_k)/k$ is defined by

$$\frac{\text{Var}(A)}{\text{Var}(\bar{A})} = \frac{\text{Var}(A)}{\text{Var}(A) + (\text{Var}(e)/k)} = \frac{k\rho}{1 + (k-1)\rho}$$

It is easy to see that the impact of measurement error is reduced when we use not one but all available measures of A. If we could consistently estimate ρ, we also obtain a consistent estimate of the reliability ratio by simply substituting the estimated ρ in previous equation.

B. Correcting the OLS Estimates

Having said this, consider the following simple model

$$Y = \beta A + \epsilon$$

where Y represents a measure for earnings, β measures the effect of A on earnings, and ϵ is an error independent of A. For simplicity we ignore other covariates and suppress all subscripts that indicate that variables are measured for individuals. We are interested in parameter estimation when A is an unobserved variable. We observe $\bar{A}$ instead. The effect of regressing outcome Y on $\bar{A}$ rather than on A

$$Y = \beta \bar{A} + \epsilon$$

provides the following least square estimator

$$\widehat{\beta}_{OLS} = \frac{\text{Cov}(Y, \bar{A})}{\text{Var}(\bar{A})} = \beta_{OLS} \frac{\text{Var}(A)}{\text{Var}(\bar{A})}$$

which is inconsistent. The least squares regression coefficient is attenuated by an amount equal to the reliability ratio. We already mentioned that data on all observed measures $A_1, \ldots, A_k$ allows us to measure the reliability ratio and therefore to identify the effect of A on earnings.

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Table 1: The Big Five Personality Traits

Dimension	Facet (and correlated trait adjective)
Extraversion vs introversion	Gregariousness (sociable)
	Assertiveness (forceful)
	Activity (energetic)
	Excitement-seeking (adventurous)
	Positive emotions (enthusiastic)
	Warmth (outgoing)
Agreeableness vs antagonism	Trust (forgiving)
	Straightforwardness (not demanding)
	Altruism (warm)
	Compliance (not stubborn)
	Modesty (not-show-off)
	Tender-mindedness (sympathetic)
Conscientiousness vs lack of direction	Competence (efficient)
	Order (organized)
	Dutifulness (not careless)
	Achievement striving (thorough)
	Self-discipline (not lazy)
	Deliberation (not impulsive)
Neuroticism vs emotional stability	Anxiety (tense)
	Angry hostility (irritable)
	Depression (not contented)
	Self-consciousness (shy)
	Impulsiveness (moody)
	Vulnerability (not self-confident)
Openness vs closedness to experience	Ideas (curious)
	Fantasy (imaginative)
	Aesthetics (artistic)
	Actions (wide interest)
	Feelings (excitable)
	Values (unconventional)

NOTE.— This table is adapted from John and Srivastava (1999) and shows Costa and McCrae's (1992) NEO-PI-R Facets.

Table 2: Summary Statistics

	Males ($N = 2,424$)		Females ($N = 2,601$)	
	Mean	Std. Dev.	Mean	Std. Dev.
Labor market outcomes:				
log hourly wages	2.886	*0.569*	2.299	*0.542*
hourly wages	21.891	*21.642*	11.827	*11.521*
Personality traits:				
extroversion	3.751	*0.878*	3.857	*0.898*
agreeableness	4.597	*0.737*	4.887	*0.701*
conscientiousness	4.875	*0.674*	4.904	*0.670*
neuroticism	3.081	*0.956*	3.277	*0.981*
openness	3.626	*0.770*	3.675	*0.807*
Individual characteristics, human capital and region:				
Henmon-Nelson IQ-scores	102.225	*14.870*	102.666	*14.332*
married	0.861		0.774	
no. of children	2.483	*1.490*	2.660	*1.609*
years of education	14.076	*2.507*	13.474	*2.089*
experience	17.773	*2.293*	15.372	*4.358*
tenure	17.723	*10.972*	10.912	*8.602*
state of residence Wisconsin	0.679		0.688	
Occupations:				
professional and technical	0.230		0.256	
executive and managerial	0.180		0.085	
sales and trade	0.098		0.092	
clerical	0.062		0.368	
production and crafts	0.176		0.015	
operatives	0.164		0.060	
service	0.056		0.106	
laborers	0.033		0.017	
other	0.001		0.001	
Industries:				
agriculture and mining	0.014		0.006	
construction	0.064		0.008	
manufacturing	0.371		0.139	
transportation	0.097		0.042	
wholesale and retail trade	0.106		0.166	
finance	0.048		0.088	
services	0.221		0.504	
administration	0.076		0.046	
other	0.003		0.001	
Public sector:	0.242		0.277	
Part-time:	0.019		0.226	

Table 3: The Effects of Personality on Male-Female Earnings

	(i)		(ii)		(iii)		(iv)	
	A. Males, log hourly earnings ($N = 2,424$)							
Personality traits:								
extroversion	– 0.002	*0.012*	0.019	*0.012*	0.014	*0.011*	0.009	*0.010*
agreeableness	– 0.064	*0.012****	– 0.047	*0.012****	– 0.036	*0.011****	– 0.037	*0.010****
conscientiousness	– 0.006	*0.012*	0.009	*0.012*	0.003	*0.011*	– 0.002	*0.010*
neuroticism	– 0.050	*0.013****	– 0.032	*0.012***	– 0.022	*0.011***	– 0.020	*0.011**
openness	0.104	*0.012****	0.058	*0.012****	0.033	*0.011****	0.024	*0.011***
IQ-scores	—		0.179	*0.011****	0.098	*0.011****	0.065	*0.011****
adjusted R^2	0.05		0.14		0.29		0.45	
F-test personality traits	24.39		11.35		5.37		4.39	
	B. Females, log hourly earnings ($N = 2,601$)							
Personality traits:								
extroversion	– 0.034	*0.011****	– 0.022	*0.011***	– 0.004	*0.010*	0.005	*0.009*
agreeableness	– 0.031	*0.012****	– 0.023	*0.011***	– 0.005	*0.010*	– 0.008	*0.009*
conscientiousness	0.030	*0.011****	0.028	*0.011***	0.025	*0.010****	0.023	*0.009****
neuroticism	– 0.035	*0.012****	– 0.017	*0.011*	– 0.018	*0.010**	– 0.006	*0.009*
openness	0.122	*0.011****	0.092	*0.011****	0.043	*0.010****	0.027	*0.010****
IQ-scores	—		0.127	*0.011****	0.066	*0.010****	0.051	*0.010****
adjusted R^2	0.06		0.11		0.31		0.40	
F-test personality traits	36.14		18.76		7.88		4.52	
Controls:								
Individual, human-capital, region	—		—		×		×	
Occupation, industry, job characteristics	—		—		—		×	

NOTE.— Standard errors in italics; ***significant at 1% level; **significant at 5% level; *significant at 10% level. F-tests indicate whether estimated coefficients for the big five personality traits are jointly significant.

Table 4: Sensitivity Analyses

	Males				Females			
Personality traits:	(i)		(ii)		(i)		(ii)	
	A. Effects of Personality on Earnings Corrected for Measurement Error							
extroversion	0.009	*0.019*	0.009	*0.018*	– 0.067	*0.017****	– 0.028	*0.016*
agreeableness	– 0.085	*0.021****	– 0.067	*0.019****	– 0.035	*0.020**	– 0.014	*0.018*
conscientiousness	0.023	*0.023*	0.011	*0.021*	0.055	*0.021****	0.045	*0.018***
neuroticism	– 0.042	*0.020***	– 0.033	*0.018**	0.005	*0.018*	– 0.007	*0.017*
openness	0.103	*0.025****	0.063	*0.025***	0.189	*0.025****	0.100	*0.026****
IQ-scores	0.179	*0.013****	0.102	*0.013****	0.111	*0.013****	0.063	*0.011****
R^2	0.16		0.30		0.15		0.33	
F-test personality traits	10.81		5.28		18.17		7.72	
	B. Effects of Personality on Earnings using the Full-Response Sample							
extroversion	0.006	*0.020*	0.008	*0.019*	– 0.054	*0.020****	– 0.023	*0.018*
agreeableness	– 0.087	*0.022****	– 0.067	*0.021****	– 0.042	*0.022**	– 0.021	*0.020*
conscientiousness	0.021	*0.024*	0.011	*0.022*	0.057	*0.022***	0.051	*0.020***
neuroticism	– 0.043	*0.021***	– 0.036	*0.019**	0.003	*0.020*	– 0.009	*0.018*
openness	0.108	*0.027****	0.065	*0.026***	0.177	*0.028****	0.090	*0.030****
IQ-scores	0.180	*0.014****	0.105	*0.013****	0.111	*0.014****	0.066	*0.012****
R^2	0.16		0.30		0.13		0.31	
F-test personality traits	9.66		4.86		14.17		6.29	
N	2,149		2,149		2,225		2,225	
	C. Testing for Nonlinear Effects of Personality on Earnings							
extroversion								
bottom 25 percent	– 0.016	*0.026*	– 0.012	*0.024*	0.015	*0.025*	– 0.004	*0.023*
top 25 percent	0.050	*0.028**	0.023	*0.026*	– 0.026	*0.025*	– 0.010	*0.022*
agreeableness								
bottom 25 percent	0.067	*0.024****	0.060	*0.026****	0.049	*0.025**	0.000	*0.022*
top 25 percent	– 0.050	*0.033*	– 0.029	*0.030*	0.008	*0.025*	0.009	*0.022*
conscientiousness								
bottom 25 percent	– 0.004	*0.027*	– 0.000	*0.024*	– 0.043	*0.025**	– 0.049	*0.022***
top 25 percent	0.023	*0.028*	0.021	*0.025*	0.014	*0.025*	0.003	*0.022*
neuroticism								
bottom 25 percent	0.058	*0.036***	0.036	*0.024*	0.007	*0.026*	0.006	*0.023*
top 25 percent	– 0.050	*0.026**	– 0.038	*0.027*	– 0.047	*0.025**	– 0.045	*0.022***
openness								
bottom 25 percent	– 0.070	*0.026****	– 0.033	*0.023*	– 0.112	*0.025****	– 0.074	*0.022****
top 25 percent	0.082	*0.028****	0.049	*0.027**	0.147	*0.026****	0.055	*0.024***
IQ-scores								
bottom 25 percent	– 0.217	*0.028****	– 0.131	*0.024****	– 0.158	*0.024****	– 0.081	*0.022****
top 25 percent	0.268	*0.028****	0.119	*0.026****	0.175	*0.025****	0.083	*0.023****
adjusted R^2	0.12		0.29		0.10		0.31	
F-test personality traits	5.93		2.72		25.07		7.83	
Controls	—		×		—		×	

NOTE.— Standard errors in italics; ***significant at 1% level; **significant at 5% level; *significant at 10% level. In Panel (1) reliability ratios imposed in estimation: extroversion .76, agreeableness .68, conscientiousness .63, neuroticism .77, openness to experience .60; *Henmon-Nelson* iq-scores .94; In Panel B the sample is restricted to workers who respond to all personality items. Corresponding reliability ratios imposed in estimation: extroversion .77, agreeableness .69, conscientiousness .64, neuroticism .77, openness to experience .60; In Panel C the (omitted) reference categories are the 2^{nd} and 3^{rd} quartile of the respective trait distribution; F-tests indicate whether estimated coefficients for the big five personality traits are jointly significant. The set of controls includes all variables on individual, human-capital and region characteristics as detailed in Table 2.

Table 5: Male-Female Differences in Personality Traits and Coefficients

	Characteristics $(\bar{X}_m - \bar{X}_f)$		Coefficients $(\hat{b}_m - \hat{b}_f)$					
	(i)		(ii)		(iii)		(iv)	
Personality traits:								
extroversion	– 0.120	*0.028****	0.075	*0.025****	0.037	*0.024*	0.012	*0.023*
agreeableness	– 0.396	*0.027****	– 0.050	*0.029**	– 0.052	*0.027***	– 0.049	*0.025**
conscientiousness	– 0.043	*0.028*	– 0.033	*0.030*	– 0.034	*0.028*	– 0.041	*0.027*
neuroticism	– 0.202	*0.028****	– 0.047	*0.027**	– 0.025	*0.025*	– 0.036	*0.024*
openness	– 0.062	*0.028***	– 0.086	*0.035***	– 0.037	*0.036*	– 0.016	*0.036*
IQ-scores	– 0.030	*0.028*	0.068	*0.018****	0.039	*0.017***	0.016	*0.016*
Controls:								
Individual, human-capital, region			—		×		×	
Occupation, industry, job characteristics			—		—		×	

NOTE.— Standard errors in italics; ***significant at 1% level; **significant at 5% level; *significant at 10% level.

Table 6: Decomposition Results for Personality Traits

	(i)		(ii)		(iii)	
Difference:						
(1) log hourly earnings	0.587					
Differences due to:						
(2) characteristics	0.091	*15.6%*	0.307	*52.3%*	0.403	*68.7%*
(3) coefficients	0.495	*84.4%*	0.280	*47.7%*	0.184	*31.3%*
Differences due to:						
(4) personality characteristics	0.095	*16.2%*	0.060	*10.3%*	0.043	*7.3%*
(5) personality coefficients	– 0.074	*12.7%*	– 0.045	*7.7%*	– 0.027	*4.5%*
Differences due to characteristics:						
(6) extroversion	0.006	*1.0%*	0.002	*0.3%*	– 0.000	*0.1%*
(7) agreeableness	0.076	*12.9%*	0.048	*8.1%*	0.035	*5.9%*
(8) conscientiousness	– 0.003	*0.5%*	– 0.002	*0.3%*	– 0.001	*0.2%*
(9) neuroticism	0.023	*4.0%*	0.016	*2.8%*	0.011	*1.9%*
(10) openness	– 0.007	*1.2%*	– 0.003	*0.6%*	– 0.001	*0.2%*
(11) IQ-scores	– 0.004	*0.7%*	– 0.002	*0.3%*	– 0.002	*0.3%*
(12) other characteristics			0.248	*42.2%*	0.361	*61.7%*
Differences due to coefficients:						
(13) extroversion	– 0.003	*0.4%*	– 0.001	*0.1%*	0.000	*0.1%*
(14) agreeableness	– 0.052	*8.8%*	– 0.031	*5.3%*	– 0.017	*2.9%*
(15) conscientiousness	0.001	*0.2%*	0.001	*0.1%*	0.000	*0.0%*
(16) neuroticism	– 0.019	*3.3%*	– 0.012	*2.1%*	– 0.008	*1.4%*
(17) openness	– 0.002	*0.3%*	– 0.002	*0.3%*	– 0.002	*0.4%*
(18) IQ-scores	– 0.000	*0.1%*	0.001	*0.1%*	– 0.000	*0.0%*
(19) other characteristics			0.139	*23.6%*	0.242	*41.3%*
(20) intercept	0.570	*97.2%*	0.187	*31.9%*	– 0.032	*5.4%*
Controls:						
Individual, human-capital, region	—		×		×	
Occupation, industry, job characteristics	—		—		×	

Note.— Earnings effects as a proportion (percentage share) of the gross differential in italics.