TI 2004-087/3
Tinbergen Institute Discussion Paper

Estimating the Effect of Personality on Male-Female Earnings

Gerrit Müller[1]
Erik Plug[2]

[1] *Faculty of Economics, Erasmus Universiteit Rotterdam, and Tinbergen Institute;*
[2] *Faculty of Economics and Econometrics, Universiteit van Amsterdam, and Tinbergen Institute.*

Tinbergen Institute
The Tinbergen Institute is the institute for economic research of the Erasmus Universiteit Rotterdam, Universiteit van Amsterdam, and Vrije Universiteit Amsterdam.

Tinbergen Institute Amsterdam
Roetersstraat 31
1018 WB Amsterdam
The Netherlands
Tel.: +31(0)20 551 3500
Fax: +31(0)20 551 3555

Tinbergen Institute Rotterdam
Burg. Oudlaan 50
3062 PA Rotterdam
The Netherlands
Tel.: +31(0)10 408 8900
Fax: +31(0)10 408 9031

Please send questions and/or remarks of non-scientific nature to driessen@tinbergen.nl.
Most TI discussion papers can be downloaded at http://www.tinbergen.nl.

Estimating the Effect of Personality on Male-Female Earnings

Gerrit Mueller* Erik Plug†

August 2004

Abstract

This paper uses the Five-Factor Model of personality structure as an organizing framework to explore 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. The positive returns to openness are very similar across genders, suggesting that being creative, unconventional and artistic is equally important for men and women working in all types of occupations. Moreover, we find significant gender differences in personality characteristics. Decomposition of personality-based earnings differentials into trait and parameter effects suggests that gender-atypical traits reduce the earnings advantage that individuals would otherwise enjoy under their own-sex wage structure. Overall, we find that the impact of personality on earnings is significant but not large –not trivial either– and comparable to the impact of differences in cognitive ability.

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

*Tinbergen Institute, Erasmus University Rotterdam, Burg. Oudlaan 50, 3062 PA Rotterdam, The Netherlands, and Institute for the Study of Labor (IZA), Bonn, Germany (mueller@few.eur.nl)

†Scholar, Research Center for Education and Labor, Department of Economics and Econometrics, University of Amsterdam, Roeterstraat 11, 1018 WB Amsterdam, The Netherlands, Tinbergen Institute and IZA (e.j.s.plug@uva.nl)

Data and Programs

This research uses data from the Wisconsin Longitudinal Study (WLS) of the University of Wisconsin-Madison. Since 1991, the WLS has been supported principally by the National Institute on Aging (AG-9775 and AG-21079), with additional support from the Vilas Estate Trust, the National Science Foundation, the Spencer Foundation, and the Graduate School of the University of Wisconsin-Madison. A public use file of data from the Wisconsin Longitudinal Study is available from the Data and Program Library Service, University of Wisconsin-Madison, 1180 Observatory Drive, Madison, Wisconsin 53706 and at http://dpls.dacc.wisc.edu/WLS/wlsarch.htm. Copies of the computer programs used to generate the results presented in this paper are available upon request.

Introduction

It is clear that abilities play a vital role in generating labor market success. And, we know that cognitive ability matters. 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.[1] But we know little about the role of noncognitive traits. Empirical studies that focus on noncognitive traits and earnings are scarce, and those few studies that are around focus on traits that are very different (e.g. Goldsmith, Veum and Darity 1997; Duncan and Dunifon 1998; Bowles, Gintis and Osborne 2001). Given the diversity of traits studied, their measures and corresponding returns, it is rather difficult to identify one consistent pattern.

This paper focusses on personality traits and earnings. It incorporates traits from the five-factor model (FFM) of personality structure (Goldberg 1990; Digman 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 clear advantages over previous studies.

The first advantage concerns the flexibility in which we model and estimate the role of personality. Many of the personality factors studied in the aforementioned literature can be analyzed within the FFM as a facet of a particular trait or a combination thereof. To give an example, withdrawal as studied in Osborne (2003) relates strongly to compliance, which can be treated as one of the facets of agreeableness. Therefore, the five-factor taxonomy lends itself as a comprehensive framework to organize our inquiry into the role of personality traits in the labor market. The second advantage is our application to the gender wage gap in the labor market. The paper explicitly allows for gender differences, both in terms of personality traits and corresponding premia/penalties. If we then take into account that males possess prototypically masculine and females feminine traits, we are able 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 masculine and feminine personality traits. The third advantage is the direct comparison that can be drawn between returns to the five personality traits and those to cognitive ability. The WLS contains not only measures of personality traits, but also of cognitive ability in combination with various labor market outcomes.

Having stressed the advantages of our empirical work, we do not want to shy away from mentioning its main limitation — 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 non-cognitive 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

[1] Yet, the explanatory power is not overwhelmingly large. For example, Griliches and Mason (1972) find that the contribution of IQ to the explained variance in earnings is significant but modest. More recently Murnane, Willet and Levy (1995) find that the addition of IQ test scores to the earnings function improves the R-squared only marginally by 2 to 4 percent. Both studies condition upon schooling, age and family background. Zax and Rees (2002) report that, in isolation, IQ explains about 4 to 8 percent of the variance in earnings.

and consequences of labor market outcomes. However, they also emphasize the value of such studies, shedding new light on the importance of noncognitive traits. Given that research on noncognitive traits is still in its infancy, there is ample room for explorative studies of the kind presented here.

The paper is organized as follows. Section I introduces the five-factor model of personality structure. We provide some background, discuss relevant results of psychological studies that use the five-factor model in relation to labor market outcomes, and examine the evidence on whether measures of personality can be treated as exogenous variables. Section II briefly describes the Wisconsin Longitudinal Study and our sample design. Sections III and IV discuss the test instrument used to assess the five personality dimensions, present reliability ratios and lay out the empirical strategy used in this paper. Section V tests whether there are earnings differentials based on personality. The estimates are subjected to further tests that aim to correct for biases arising from endogenous personality, measurement error, and nonlinearities. In Section VI, we then use previous earnings results to disentangle the role of personality in the male-female earnings gap. In particular, we examine the male-female decomposition of earnings in relation to masculine-feminine personality traits. And Section VII concludes.

I. The 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 conventionally 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 facets and sets of even more specific personality attributes. Table 1 provides some more intuition about the kind of facets and attributes relating to each one of the five dimensions.

The FFM does not reflect any particular theoretical perspective on personality. It was discovered in early factor-analytic studies that tried to organize trait adjectives available in dictionaries of a natural language into a taxonomic structure (e.g. Norman 1963). The history of the FFM as well as the more recent developments are discussed in John and Srivastava (1999), McCrae and Costa (1999), McCrae and John (1992) and Digman (1989, 1990). It is widely agreed that personality traits have their link to behavior. Traits are causal predispositions that lead to act frequencies (habits) and particular situational responses. Moreover, traits should be carefully distinguished from attitudes, interests, motives, goals or values and norms. McCrae and Costa (1999) interpret personality traits as "basic determining tendencies" in order to contrast them to "characteristic adaptations". Basic tendencies refer to an abstract underlying potential of the individual in the sense of the dispositions referred to above. Characteristic adaptations, instead, reflect interactions between the person and the environment accumulated over time.

Within organizational and industrial psychology, there have been multiple studies that examine how the FFM 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) and firm performance (Welbourne, Cavanaugh and Judge 1998). Studies within psychology that are –at least partly– concerned with earnings

and therefore most closely related to ours include, Boudreau, Boswell and Judge (1999) on executive career success, and Judge, Higgins, Thoresen and Barrick (1999) on occupational attainment across the life span.

Boudreau et al. (1999) 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 fourties, 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 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 is controlled away with the full set of conditioning variables entered. However, one should be cautious in interpreting these findings as they are based on a sample slightly in excess of one hundred observations.

In many of the aforementioned studies it remains unclear whether individuals with a successful personality profile are more successful in the labor market –as measured in either satisfaction, job performance or remuneration– as a result of their personality, or because of something else. For example, if measures of personality are somehow endogenously determined, the estimated effects of personality may be as much the consequence as the cause of earnings. This is also crucial for our purposes, unless personality is exogenously determined.

The genetic basis of personality is well established. Bouchard and Loehlin (2001) review a large number of twin studies based on FFM personality traits and find that 40 to 60 percent of the variation in personality is attributable to genetic differences between individuals. But we are not so much concerned about personality effects that are genetically driven. Since genes are automatically passed on from parent to child without regards for incentives, we may safely assume that the inherited part of personality is exogenously determined.

What about the other part? Again, Bouchard and Loehlin (2001) report that shared family environment is found to have virtually no effect. The remaining variation in personality is typically attributed to residual causes such as nonshared environment and measurement error. If personality changes, it does so slowly and to very moderate extents. In a six-year longitudinal study of trait stability among adults, Costa and McCrae (1988) found only slight evidence of maturational effects in mean trait levels; seldom accounting for more than 1-2 percent of the variance. We are not aware of any other longitudinal study of Big Five personality traits covering a longer time period.[2] As will become apparent later on, most importantly for our work is Costa and McCrae's (1988) assertion that individuals preserve their relative position within their reference cohort over time. This view is also shared by Caspi and Roberts (1999). They note that personality traits –much like cognitive performance measures– exhibit strong "differential continuity", meaning that individuals retain their rank order within the group as they age.

Finally, how does the FFM relate to the variables studied within the economic literature?

[2]There is one recent study by Srivastava, John, Gosling and Potter (2003) showing significant, yet small, effects for some of the five dimensions. However, some qualifications are in place here due to the cross-sectional nature of their data as well as the specific sampling design (internet-based questionnaires). For a comprehensive review of the literature on longitudinal stability based on a variety of personality test instruments and covering periods of up to 30 years, see Costa and McCrae (1997).

There are a number of recent contributions that follow up on the idea that non-cognitive traits can account for differences in labor market success (Osborne 2003; Bowles, Gintis and Osborne 2001; Heckman and Rubinstein 2001; Duncan and Dunifon 1998; Goldsmith, Veum and Darity 1997), building on earlier work by Filer (1981, 1986), Jencks (1979), Andrisanni (1978) and Turner and Martinez (1977). We have argued that one can treat the FFM as a taxonomic framework to organize the study of noncognitive traits in the labor market. In the following, we are going to discuss some of the relevant results found by previous studies in relation to the FFM.

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 "Macchiavellian" personality on socioeconomic attainment. For men with above average educations, they find that Macchiavellianism is associated positively with income. Macchiavellianism can be related to the negative pole of the agreeableness dimension, referring to lack of emotional affect, i.e. being cool, distant and treating people as objects to be manipulated. This suggests that we should expect to find agreeableness being penalized for males.

Dunifon, Duncan, and Brooks-Gunn (2001) examine the role of organization and efficiency in affecting earnings and other outcomes over two generations. 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. With conscientiousness as a direct measure of being organized and efficient, we should then expect positive returns.

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. On the basis of their results, one should expect to find negative effects of neuroticism on wages. Unfortunately, Goldsmith et al. pool their male and female subsamples and do not provide estimates of gender differences in returns.

A very recent example, and one explicitly taking 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. Women appear to face significantly larger penalties for aggression, while men are more heavily penalized for withdrawal. Aggression can be treated as one of the facets of extroversion and withdrawal is highly related to compliance, that is agreeableness. We shall evaluate our own findings against these as we move along.

Of course, these are selected examples and the above discussion is not meant to be fully exhaustive. Nevertheless, it is suggestive of the great 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 analog to the common g-factor underlying most measures of cognitive performance. But, we might have found an "analog" in the sense that almost any personality construct can be mapped onto the FFM (see e.g. Funder 2001). Therefore, the FFM could prove very valuable as a common denominator, enabling comparisons of a multitude of variables that have been studied in isolation. In the end, it might bring the necessary structure into a field long in need of one.

II. Data and Sample Choice

Our empirical 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.

Compared to other large longitudinal studies of school-based samples, the WLS contains a unique set of personality measures together with extensive information on respondents' labor market careers. This allows us to work with a much larger sample as 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 has been specifically designed to facilitate the collection of personality data through surveys. The goal was to create 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 randomly sampled graduates, 8,493 received the 1992 mail questionnaire with 6,875 individuals responding to it. Item non-response further restricts our study to a subsample of 6,692 individuals, who gave at least two complete answers on the separate personality items that correspond to each personality trait. Non-response appears to be a potential threat to the validity of our analysis. However, compared to other studies covering a similarly long time span, the response rate is relatively high. The population under study is then restricted to 6062 employed men and women. In the end, we 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.

Note that our study is based on a single cohort of equal age individuals in their early fifties. It is therefore not representative of the whole working population. However, it offers the clear advantage that sample members are homogenous in two important respects; age and time of personality measurement. This observation is crucial in the context of maturational effects on personality. Mean trait levels change only imperceptibly over time and individuals generally maintain their own rank order within the group. Thus, even if personality changed as people age, it would apply equally to all our sample members, leaving the relative position in the personality distribution unchanged.

III. Measuring Personality Traits and Reliability Ratios

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 have 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. With information on the level of single questionnaire items, we are able to quantify the size of measurement error by calculating reliability coefficients for the BFI scales in our data set. Reliability coefficients feature prominently in psychometric theory of measurement error and are quite often referred to as Cronbach's alpha reliabilities (Cronbach 1951). We rely on the same methodology as in the literature referred to above. When we estimate the reliability ratios for the five personality traits, we observe some notable differences: extroversion .76, agreeableness .71, conscientiousness .66, neuroticism .77, and openness .60. Overall, we find that the reliabilities of the abbreviated scales average at .70, which suggest that a considerable fraction of the variability in the reported traits is due to measurement error. Intuition and derivation of the reliability ratios are given in the Appendix.

It is possible to compare these reliabilities with previous estimates of reliability ratios. Generally, the internal consistency of the BFI scales is found to be very high. John and Srivastava (1999) report that reliabilities of the original 44-item BFI scales lie between .75 and .90 and are on average above .80. Reliability coefficients vary slightly by scale; extroversion .88, agreeableness .79, conscientiousness .82, neuroticism .84, and openness .81. Convergence of self versus peer ratings is in the same order of magnitude (Costa and McCrae 1988). Cross validity with other more elaborate test instruments, for instance Costa and McCrae's (1992) 60-item NEO questionnaires or Goldberg's (1992) 100-item Trait Descriptive Adjectives (TDA), range from .92 (BFI–NEO) to .95 (BFI–TDA).

These estimated reliabilities are about ten percentage points higher than those we find. This is not unexpected. Reliabilities of the abbreviated BFI scales are likely to be lower; even though generally there is much to be said in favor of brevity. Longer tests do not necessarily increase the accuracy of measurement if we think of test subjects' fatigue and boredom.

As far as measurement of general intelligence is concerned, 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 has been implemented as originally designed. For measurement error, 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). In addition to that, potential measurement error due to time and cohort effects are ruled out by the very nature of our data.[3]

IV. Empirical Strategy

We first examine whether the five personality traits affect earnings. We estimate a standard log-linear earnings equation separately for men and women in the form

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

[3]Zax and Rees (2002 p.603) report that Robert Hauser estimated the reliability ratio to be between .92 and .95. In our later calculations we will impose the average of .935.

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

While these equations determine whether personality matters for generating earnings, and whether personality affects earnings differently for men and women, it does not tell how large a role these differences in personality play in explaining the gender gap in earnings. To do so, we decompose the gender gap into the proportion that can be attributed to differences in observable personality traits between men and women, and the remaining contribution that can be attributed to differences in trait permia/penalties between men and women. We closely follow the approach to earnings decomposition as outlined in Oaxaca (1973). We begin by expressing 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 taken from (1). The earnings differential can be further separated into two components

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

In this decomposition, the first term can be interpreted as the part of the earnings differential that is due to differences in characteristics. The second term can be interpreted as the part due to differences in estimated parameters. It has often been –wrongfully– regarded as a measure of discrimination because it reflects differences in parameters of men and women with similar characteristics.[4]

Note that this composition depends on whether we evaluate the differences in characteristics at male or female coefficients. In (3) we choose male coefficients. If, instead, we choose female coefficients as the standard of comparison, the decomposed earnings differential reads as

$$\bar{Y}_m - \bar{Y}_f = (\bar{X}_m - \bar{X}_f)' \widehat{b}_f + \bar{X}'_m (\widehat{b}_m - \widehat{b}_f) \tag{4}$$

Obviously, this approach produces two estimates quite different from the ones obtained in (3). In our empirical analysis we shall present both.

V. Estimating the Effects of Personality Traits on 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 working sample to have zero mean and unit variance. The same transformation is applied to IQ-scores. Results in Panel A and B come from samples of working men and women. Each panel contains four OLS estimates. In column (1), we tabulate parameter estimates for all five personality traits in a baseline specification, stripped of all controls. We then subsequently introduce controls for respondents' cognitive ability as measured by childhood IQ tests (column 2), human capital including years of schooling, work experience and tenure, region, and other individual and

[4]The problem is that different parameters can be the result of differences in preferences and skills too. In the end, we do not believe that it is possible to isolate the effects of discrimination on the basis of this particular decomposition approach.

family characteristics (column 3), and occupation, industry and job characteristics (column 4). The idea is to isolate marginal effects of personality traits on average earnings by taking into account as many other sources of variation as possible. For a more detailed description and categorization of the respective set of controls we refer to Table 2.

We begin by discussing the personality effects on earnings of men. The baseline specification in column (1) shows 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 the traits extroversion and conscientiousness generate no returns at all. With IQ-scores added as control in column (2), the returns to being antagonistic, emotionally stable and open fall, but remain statistically significant and positive. The fall is most notable for the openness to experience trait, where returns are almost halved.[5] With the inclusion of human capital and other individual and family characteristics in column (3) and industry, occupation and other job characteristics in column (4), the estimated coefficients for non-agreeableness, emotional stability and openness effects fall somewhat further, yet results remain qualitatively similar. Antagonistic, emotionally stable and open men always earn more. Across all four specifications, the agreeableness-antagonism dimension has the most persistent effect on earnings. One standard deviation increase raises the hourly earnings for antagonistic 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 in the order of 7 to 17 percent due to a one standard deviation change in IQ-scores. For men, it is larger than any of the trait premia/penalties considered in isolation, which broadly range from 3 to 5 percent. However, viewing personality as a bundle of traits, a favorable combination thereof potentially leads to equally strong earnings effects as cognitive ability. 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 percent points.

And what about women? In column (1), where we estimate the earnings specification without controls, we find that all five personality traits generate significant returns. Three personality estimates are very similar to those previously reported for men. We find that women, who are antagonistic, emotionally stable and open enjoy higher earnings. But two personality estimates are different. More specifically, we find that extrovert women receive on average a pay penalty, whereas conscientiousness women receive a pay premium. Most of these results, however, are very sensitive to the inclusion of additional controls. Across the four specifications, only returns to openness and conscientiousness appear to be consistently significant and positive. A one standard deviation increase in either trait is associated with a 2 to 3 percent increase in hourly earnings. It is further interesting to note that openness to experience is the only personality trait that is beneficial to both men and women.

In comparison, the combined premia to openness and conscientiousness are very similar

[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)

to that of cognitive ability. With the full set of controls entered, a standard deviation increase in IQ raises hourly earnings by 5 percent. Columns (1) and (2) further show that both personality and cognitive ability are about equally important in explaining the variance in earnings. The five personality measures together explain about 6 percent of the variance in earnings. In column (2), we introduce IQ test scores into the earnings equation and find that the R-squared improve by almost an equal amount of 5 percent points.

All these results suggest that personality indeed matters for both men and women. In terms of their estimated effect on earnings, personality as a bundle of our five measured traits, produces returns that are quantitatively very similar to the returns to cognitive ability. In terms of their estimated effect on explained variance in earnings, however, the contributions of personality and cognitive ability appear to be modest.

Our personality results are also comparable to those obtained in previous studies that use measures of various personality traits in relation to earnings. As we already mentioned, Turner and Martinez (1977) and Osborne (2003) uncover a negative association between (facets of) agreeableness and earnings for men. So do we. Dunifon et al. (2001) discuss a positive relationship between being organized and efficient –which are parts of being conscientious– and earnings for fathers and their children. They do not report results for mothers, nor for sons and daughters separately. We find statistically significant effects for women, but not for men. Goldsmith et al. (1997) find that high levels of neuroticism (low self-esteem) are associated with lower earnings using a pooled sample of working men and women. We find statistically significant effects that are very similar for men, but not for women.[6] And finally, if we treat aggression as one of the facets of extroversion, Osborne (2003) finds evidence that extrovert women have on average lower earnings. We find that extroversion is penalized in specifications without controls, however, as further controls are added this effect disappears.

Endogeneity, Measurement Error and Nonlinear Effects

While our results are comparable to those obtained in previous studies on noncognitive traits and earnings, we should treat our estimates with care. After all, the strategy we have chosen does not perfectly identify the effect of personality on earnings. We do not estimate a structural model of personality on earnings. We merely estimate reduced-form associations between five different personality trait measures and log hourly earnings. In what follows, we outline the potential dangers that could possibly affect the accuracy of our personality estimates and explore what happens to our estimates if we attempt to solve these problems.

The first –and we think our biggest– problem is that of reversed causality. Because we measure personality at the same time as we measure hourly earnings, we do not know whether the estimated personality effects are the consequence or the cause of earnings. If our personality measures are endogenous, the personality estimates are biased and probably too high because they capture both effect and result. However, we believe that we can offer some fragmented evidence, suggesting that this is not as problematic as it might appear. The first piece of evidence is the one we already put forward in Sections I and II and comes from psychologists. They claim that personality traits are to a large extent inherited and stable over time. This interpretation allows us to ignore endogenous traits altogether. We

[6] In an analysis not shown in this paper, however, we estimate previous earnings models using a pooled sample of men and women and find negative returns for being neurotic that are statistically significant.

are somewhat hesitant to treat traits, the way they are currently measured, as exogenous. The second piece of evidence is perhaps more convincing. If workers tend to be selected into certain jobs and occupations on the basis of specific personality profiles, we expect that the inclusion of jobs' and occupations' characteristics has a noticeable impact on our personality estimates. This is not the case. According to columns (3) and (4) in Table 4, we do not observe a mediating effect on our five personality estimates.

Of course, these arguments do not prove that the endogeneity bias is completely absent. If we added more variables, for example, it is still possible that our personality results would change. Our arguments rather suggest that the estimates obtained are not entirely driven by the endogeneity of our personality regressors. With the data at hand, it is impossible to remove this bias. It is possible, however, to exploit the upward bias and put an upper bound on the personality estimates.

The second problem is the problem of measurement error. If personality effects seem only modestly important, the natural reaction would be that measurement error is one source to take very serious. After all, random measurement error will bias any estimated effect to zero. One way to correct for measurement error is to adjust our parameter estimates by imposing the constructed reliability ratios in estimation. A detailed exposition on how we correct for measurement error is relegated to the Appendix. In Table 4, estimates are given that intend to correct for measurement error in our personality measures. Note that in our estimations, we only impose reliability ratios of the Big Five and *Henmon-Nelson* IQ-scores.[7] As expected, the personality estimates remain qualitatively the same except that they are almost all larger than the corresponding estimates in Table 3. The increase is substantial and often significant. If we assume that there is no serial correlation among the measurement errors corresponding to the five reported personality traits, our results suggest that measurement error indeed leads to a considerable underestimation of the trait premia/penalties.

The third problem relates to whether or not the relationship between the personality 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 Table 5, which is similarly structured as 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 quintiles, and create five corresponding dummy variables. With the 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 tables, the fluctuations we observe are difficult to reconcile with any consistent pattern. This means that we do not hold nonlinearities to be responsible for the zero returns.

[7] In Table 3, it is useful to see how coefficients change as additional covariates are 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 (2) and (4) in Table 3.

In sum, we find that our estimated personality returns (a) are comparable to those obtained in previous studies; (b) are not sensitive to a linear specification; (c) increase substantially when adjusted for measurement error; but (d) remain upper bounds of actual personality effects because of the endogeneity of our personality regressors. The three sensitivity tests we performed hence reinforce our conclusion. The impact of the differences in personality on earnings is significant but not large –not trivial either– and comparable to the impact of differences in cognitive ability.

VI. Decomposing the Earnings Differential

In the tradition of most empirical work on wage differentials, we focus on two major mechanisms explaining differences in pay: (i) differences in personality traits (ii) differences in the corresponding trait premia and penalties. The following two subsections prepare the ground with a brief discussion of gender differences in personality and their impact on earnings.

Gender Differences in Personality

In Table 6, we first portray the average gender differences in personality traits. Again, we use standardized traits to make the gender differences more readily visible. We find that women are significantly more extrovert, agreeable and neurotic with differences in the last two traits being by far the largest. To give an example, gender means for agreeableness lie almost 40 percent of a standard deviation apart. The structure of our findings is consistent with evidence from the psychological literature. Neuroticism and agreeableness are the two traits most consistently showing relatively large sex differences (see Bouchard and Loehlin, 2001). Moreover, men appear slightly less conscientious and intelligent than women, but mean differences are not statistically significant.

Gender Differences in Personality Returns

In Table 6, we also present the relative gender difference in estimated personality returns.[8] Compared to working men, women appear to receive higher returns for the traits agreeableness, conscientiousness and neuroticism. For agreeableness, which is the only estimated difference that is statistically different from zero, the estimated penalties for men are driving these differences. The punishment for being altruistic, compliant and tender-minded, that featured so eminently in case of men, is entirely absent in the full-control model for women. To a lesser extent, we observe a similar earnings differential for neuroticism, where only men are penalized for being vulnerable, shy and moody. It appears that men endowed with prototypical feminine traits, prototypical in the sense of being on average more agreeable and neurotic, experience a loss in earnings.

The similarities of the estimated trait premia and penalties across the two genders are also of interest. The returns to openness to experience appear to be the most robust among all the trait premia and penalties. Whether we consider working men or working women, whether we use the barest baseline or full-control model, we always find that the labor market values the creative, unconventional and artistic. One standard deviation increase raises the

[8] In the discussions and calculations that follow, we focus primarily on the full-control error-corrected estimates in Table 4.

hourly earnings for open workers on average by 5 to 10 percent for men, and 6 to 19 percent for women. For women, the magnitude is only marginally larger (1.7 percent) as compared to men, but its impact is even bigger than that of general mental ability; with the full set of controls entered.

Overall, we conclude this section by stressing that personality matters for both genders and that the structure of rewards and penalties differs, most notably for agreeableness.[9] We now turn to the decomposition of the earnings differential in order to see how differences in personality traits and corresponding returns add to our understanding of the gender wage gap.

Decomposition Results and Estimates

Table 6 reports earnings decompositions based on error-corrected parameter estimates from male and female earnings equations. The overall differential, that is the difference in logarithms of hourly wages between men and women, amounts to .58 (see Table 2). We first report the decomposition results as shown in equation (3) and evaluate the differences in characteristics at male coefficients. Then, 5 percent of the gender gap can be explained by differences in mean personality traits, and somewhat more than 2 percent is due to differences in labor market rewards/penalties. The effects work in opposite directions such that the overall differential is only moderately affected. Qualitatively, these numbers imply the following two things. First, if males and females had the same characteristics, the total wage gap would be reduced. Put differently, a man with feminine traits under a male wage structure earns less than with masculine traits, all other things being equal. Second, if the labor market rewarded both genders according to the *same* (male) wage structure, but gender differences in mean trait levels remained unchanged, the total wage gap would actually widen. The interpretation is that women fare relatively worse with their traits in a 'male world'.

We also report how much of the total difference is attributable to each of the five personality traits separately. We find that the overall decomposition results are primarily driven by differences in means of two personality dimensions; agreeableness-antagonism and, to a lesser extent, neuroticism-emotional stability. The effect of cognitive ability is much smaller than that of personality as a whole, but also as compared to most of the individual traits considered in isolation.

The last two columns of Table 6 show decomposition results evaluated at female coefficients according to equation (4). As we already mentioned, the findings are somewhat

[9]One way in which agreeableness may affect women's labor market success differently from men is through differences in labor-force participation. In our analysis we excluded unemployed workers. If agreeableness, or any other trait for that matter, is somehow related to the decision to work, selection bias could manifest itself in our personality estimates. Since women usually have a weaker labor market attachment, it is then also possible that selection bias affect our trait estimates differently for men and women. In our sample, however, most women have children that are already grown up and are currently as actively participating in the labor force, the major difference to men being the extent of part-time work. Hence, we do not expect that selection due to current participation explains away the difference in the agreeableness estimates. If selection bias does occur, it is more likely to happen through differences in the accumulated labor force experience between men and women. But we already mentioned that it is a very complicated exercise to explain why personality traits are differentially rewarded across gender, one that is beyond the scope of this paper.

different. About 2 to 3 percent of the gender gap can be attributed to differences in labor market rewards/penalties. Differences in mean personality traits do not seem to matter. The interpretation is straightforward. Under the assumption that both genders are paid according to current female wages, but gender differences in mean trait levels prevailed, the wage gap would be reduced. The results are again driven by two dimensions. Under the female wage structure, agreeableness and neuroticism are not punished that harshly. Therefore, the relative earnings advantage enjoyed by men –being on average less agreeable and neurotic– vanishes in a 'female world'.

Among the five personality traits, differences in agreeableness appear to be the most important factor in explaining the differences between male and female earnings. On average, men are much less agreeable than women, and only men receive the reward for being less agreeable. It is further interesting to see that the relationship between returns/penalties and mean characteristics for the other traits is very similar to that observed for agreeableness. Admittedly, the magnitudes are at best moderate. Nevertheless, we find that 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. This can easily be verified by checking that the following interaction term $(\bar{X}_m - \bar{X}_f)'(\widehat{b}_m - \widehat{b}_f)$ is strictly positive.

We conclude this section by noting that gender atypical traits reduce the earnings advantage that an individual would otherwise enjoy under his/her own-sex wage structure. What follows is that it is not universally better to be masculine (absolute advantage), but that people with masculine traits have a comparative advantage in a male world; and those with feminine traits in a female world. This is reminiscent of the argument on "gender appropriate traits" put forward by Blau and Ferber (1986). Women might avoid male fields (and vice versa) because of the psychic costs to acting in a gender atypical way or because they might expect to be less successful in terms of returns to their traits in the other gender's field.

VII. Concluding Remarks

In this paper, we estimate the role of personality in explaining earnings. The personality traits we examine are extroversion, agreeableness, conscientiousness, neuroticism and openness to experience. Among the five personality traits, 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 that (d) the positive returns to openness are very similar across gender, suggesting that being creative, unconventional and artistic is equally important for men and women working in all types of occupations.

It should be noted, however, that obtained results require a careful interpretation. There are two potential dangers that must be taken into account. The first problem is the problem of reversed causality. We assume that personality affects earnings, and not the other way around. We do believe that causation runs from personality traits to earnings, but we cannot rule out that earnings itself has no impact on our personality measures. The second problem is that our results are specific to a highly educated group of mainly white men and women, raised in the state Wisconsin, all being in their early fifties in the year 1992. Traits that are important for this particular sample do not automatically carry over to current generations.

Having said this, let us take one step back and evaluate what we have found. Our results indicate that personality matters, that the impact of personality on earnings is comparable to that of cognitive ability, but that its contribution in explaining the variance in observed hourly earnings is at best modest. 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 or noncognitive traits are interesting in their own right, and not just as confounding factors in estimating the returns to schooling.

References

Andrisanni, P. (1978). *Work attitudes and labor market experience.* NY: Praeger.

Barrick, M.R., and Mount, M.K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, 44, 1-26.

Blau, F.D. and Ferber, M.A. (1986). *The economics of women, men and work.* NJ: Prentice Hall.

Bouchard, T.J., and Loehlin, J.C. (2001). Genes, evolution, and personality. *Behavioral Genetics*, 31, 243-273.

Boudreau, J.W., Boswell, W.R., and Judge T.A. (1999). Effects of personality on executive career success in the U.S. and Europe. CAHRS working paper, Cornell University.

Bowles, S., Gintis, H., and Osborne, M. (2001). The determinants of earnings: A behavioral approach. *Journal of Economic Literature*, 39, 1137-1176.

Buros, O.K. (1959). *The fifth mental measurements yearbook.* NJ: The Gryphon Press.

Carneiro, P., and Heckman, J. (2004) Human capital policy. In Heckman, J., Krueger, A.B. and Friedman, M.B. (eds.) *Inequality in America: What role for human capital policy?* MIT Press.

Caspi, A., and Roberts, B.W. (1999). Personality continuity and change across the life course. In Pervin, L.A. and John, O.P. (eds.) *Handbook of personality: Theory and research.* NY: Guilford.

Costa, P.T., and McCrae, R.R. (1988). Personality in adulthood: A six-year longitudinal study of self-reports and spouse ratings on the NEO Personality Inventory. *Journal of Personality and Social Psychology*, 54:5, 853-63.

Costa, P.T., and McCrae, R.R. (1992). *NEO PI-R Professional manual.* Odessa, FL: Psychological Assessment Resources.

Costa, P.T., and McCrae, R.R. (1997). Longitudinal stability of adult personality. In Hogan, R., Johnson, J. and Briggs, S. (eds.) *Handbook of Personality Psychology.* San Diego, CA: Academic Press.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297-334.

Digman, J.M. (1989). Five robust trait dimensions: Development, stability, and utility. *Journal of Personality*, 57, 195-214.

Digman, J.M. (1990). Personality structure: emergence of the Five-Factor Model. *Annual Review of Psychology*, 41, 417-40.

Duncan, G.J., and Dunifon, R. (1998). Soft-skills and long-run labor market success. *Research in Labor Economics*, 17, 123-149.

Dunifon, R., Duncan, G.J., and Brooks-Gunn, J. (2001). As ye sweep, so shall ye reap. *American Economic Review*, 91:2, 150-154.

Filer, R.K. (1981). The influence of affective human capital on the wage equation. *Research in Labor Economics*, 4, 367-416.

Filer, R.K. (1986). The role of personality and tastes in determining occupational structure. *Industrial and Labor Relations Review*, 39:3, 412-24.

Funder, D.C. (2001). Personality. *Annual Review of Psychology*, 52, 197-221.

Goldberg, L.R. (1990). An alternative description of personality: The Big Five factor structure. *Journal of Personality and Social Psychology*, 59, 1216-29.

Goldberg, L.R. (1992). The development of markers for the Big-Five factor structure. *Psychological Assessment*, 4, 26-42.

Goldsmith, A.H., Veum, J.R., and Darity, W. (1997). The impact of psychological and human capital on wages. *Economic Inquiry*, 35, 815-829.

Griliches, Z., and Mason, W.M. (1972). Education, income and ability. *Journal of Political Economy*, 82, S69-S86.

Heckman, J.J., and Rubinstein, Y. (2001). The importance of noncognitive skills: Lessons from the GED Testing Program. *American Economic Review*, 91:2, 145-49.

Jencks, C. (1979). *Who gets ahead?*. NY: Basic Books.

John, O.P., Donahue, E.M. and Kentle, R.L. (1991). *The Big Five Inventory – versions 4a and 54*. Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research.

John, O.P., and Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In Pervin, L.A. and John, O.P. (eds.) *Handbook of personality: theory and research*. NY: Guilford.

Judge, T.A., Heller, D., and Mount, M.K. (2002). Five-Factor Model of personality and job satisfaction: a meta analysis. *Journal of Applied Psychology*, 87, 530-541.

Judge, T.A., Higgins, C.A., Thoresen, C.J., and Barrick, M.R. (1999). The Big Five personality traits, general mental ability, and career success across the life span. *Personnel Psychology*, 52, 621-52.

McCrae, R.R., and Costa, P.T. (1999). A five-factor theory of personality. In Pervin, L.A. and John, O.P. (eds.) *Handbook of personality: Theory and research*. NY: Guilford.

McCrae, R.R., and John, O.P. (1992). An introduction to the Five-Factor Model and its applications. *Journal of Personality*, 60, 175-215.

Murnane, R.J, Willett, J.B. and Levy, F., (1995), The growing importance of cognitive skills in wage determination. *Review of Economics and Statistics*, 77, 251-266.

Norman, W.T. (1963). Towards an adequate taxonomy of personality attributes: Replicated factor structure in peer nomination personality ratings. *Journal of Abnormal and Social Psychology*, 66, 574-583.

Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *International Economic Review*, 14, 693-709.

Osborne, M. (2003). *The power of personality: Labor market rewards and the transmission of earnings*. Unpublished doctoral dissertation. University of Massachusetts, Amherst.

Sewell, W.H., Hauser, R.M., Springer, K.W., and Hauser, T.S. In press. As we age: The Wisconsin Longitudinal Study, 1957-2001. In Kevin T. Leicht, ed., *Research in social stratification and mobility*. Greenwich, Conn.: JAI Press. (Available as CDE Working Paper 2001-09. Center for Demography and Ecology, The University of Wisconsin-Madison.)

Srivastava, S., John, O.P., Gosling, S.D., and Potter, J. (2003). Development of personality in early and middle adulthood: Set like plaster or persistent change?. *Journal of Personality and Social Psychology*, 84, 1041-1053.

Sternberg, R.J., and Ruzgis, P. (1994). *Personality and intelligence*. NY: Cambridge University Press.

Tett, Robert P., Jackson, D.N., and Rothstein, M. (1991). Personality measures as predictors of job performance: A meta-analytic review. *Personnel Psychology*, 44, 703-42.

Turner, C.F., and Martinez, D.C. (1977). Socioeconomic attainment and the Machiavellian personality. *Sociometry*, 40:4, 325-36.

Wellbourne, T.M., Cavanaugh, M.A., and Judge, T.A. (1998). Does the leader make a difference? Relationship between executive leader personality and entrepreneurial firm performance. CAHRS working paper, Cornell University.

Zax, J.S., and Rees, D.I., (2002). IQ, academic performance, environment and earnings. *Review of Economics and Statistics*, 84:4, 600-616.

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

$$\begin{array}{cccccc} & A_1 & & A_2 & \ldots & A_k \\ A_1 & \text{Var}(A) + \text{var}(e) & & \text{Var}(A) & & \text{Var}(A) \\ A_2 & \text{Var}(A) & & \text{Var}(A) + \text{Var}(e) & & \text{Var}(A) \\ \vdots & & & & \ddots & \\ A_k & \text{Var}(A) & & \text{Var}(A) & & \text{Var}(A) + \text{Var}(e) \end{array}$$

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. The Effect of Measurement Error

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.

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

	(1)		(2)		(3)		(4)	
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	0.046		0.141		0.292		0.376	
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	*0.010*
agreeableness	– 0.031	*0.012****	– 0.023	*0.011***	– 0.005	*0.010*	– 0.008	*0.010*
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**	– 0.007	*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	0.063		0.111		0.315		0.398	
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 4: The Effects of Personality on Earnings Corrected for Measurement Error

	Males				Females			
	(i)		(ii)		(i)		(ii)	
Personality traits:								
extroversion	0.009	*0.019*	0.005	*0.017*	– 0.067	*0.017****	– 0.008	*0.015*
agreeableness	– 0.085	*0.021****	– 0.067	*0.019****	– 0.035	*0.020**	– 0.018	*0.017*
conscientiousness	0.023	*0.023*	0.002	*0.020*	0.055	*0.021****	0.044	*0.018***
neuroticism	– 0.042	*0.020***	– 0.033	*0.018**	0.005	*0.018*	0.003	*0.016*
openness	0.103	*0.025****	0.047	*0.024**	0.189	*0.025****	0.064	*0.026***
IQ-scores	0.179	*0.013****	0.067	*0.011****	0.111	*0.013****	0.051	*0.011****
R^2	0.162		0.389		0.145		0.409	
Controls	—		×		—		×	

NOTE — Standard errors in italics; ***significant at 1% level; **significant at 5% level; *significant at 10% level. Reliability ratios imposed in estimation: extroversion .76, agreeableness .68, conscientiousness .63, neuroticism .77, openness to experience .60; *Henmon-Nelson* iq-scores .94; The full set of controls includes all variables on individual, human-capital, region, occupation, industry and job characteristics as detailed in Table 2.

Table 5: Nonlinear Effects of Personality on Earnings

	Males				Females			
	(i)		(ii)		(i)		(ii)	
Personality traits:								
extroversion								
1^{st} quintile	– 0.014	*0.033*	– 0.010	*0.028*	0.016	*0.032*	– 0.025	*0.026*
2^{nd} quintile	– 0.022	*0.032*	– 0.032	*0.028*	0.009	*0.031*	– 0.011	*0.026*
4^{th} quintile	0.030	*0.036*	0.012	*0.030*	0.027	*0.032*	– 0.001	*0.026*
5^{th} quintile	0.039	*0.035*	– 0.008	*0.030*	0.052	*0.031**	– 0.022	*0.026*
agreeableness								
1^{st} quintile	0.080	*0.030****	0.062	*0.026***	0.031	*0.032*	– 0.004	*0.027*
2^{nd} quintile	0.010	*0.034*	0.018	*0.029*	0.039	*0.034*	0.033	*0.028*
4^{th} quintile	– 0.036	*0.033*	– 0.022	*0.028*	– 0.050	*0.029**	– 0.044	*0.024**
5^{th} quintile	– 0.098	*0.045***	– 0.077	*0.038***	– 0.020	*0.033*	– 0.011	*0.027*
conscientiousness								
1^{st} quintile	– 0.017	*0.031*	0.016	*0.027*	– 0.053	*0.029**	– 0.043	*0.024**
2^{nd} quintile	0.000	*0.034*	0.028	*0.029*	– 0.020	*0.033*	– 0.007	*0.027*
4^{th} quintile	0.008	*0.034*	0.008	*0.029*	0.023	*0.032*	0.022	*0.026*
5^{th} quintile	– 0.001	*0.036*	0.018	*0.031*	0.019	*0.032*	0.016	*0.026*
neuroticism								
1^{st} quintile	0.078	*0.036***	0.054	*0.031**	0.025	*0.034*	0.021	*0.028*
2^{nd} quintile	0.025	*0.036*	0.027	*0.030*	0.044	*0.034*	0.057	*0.028***
4^{th} quintile	– 0.017	*0.037*	– 0.004	*0.032*	– 0.004	*0.033*	0.010	*0.027*
5^{th} quintile	– 0.017	*0.041*	– 0.002	*0.035*	– 0.046	*0.035*	– 0.013	*0.029*
openness								
1^{st} quintile	– 0.095	*0.035****	– 0.020	*0.030*	– 0.116	*0.034****	– 0.038	*0.028*
2^{nd} quintile	– 0.026	*0.034*	– 0.016	*0.029*	– 0.051	*0.033*	– 0.011	*0.028*
4^{th} quintile	0.096	*0.037****	0.056	*0.031*	0.054	*0.035*	0.032	*0.029*
5^{th} quintile	0.075	*0.039**	0.056	*0.034*	0.173	*0.036****	0.053	*0.030**
IQ-scores								
1^{st} quintile	– 0.210	*0.033****	– 0.075	*0.029****	– 0.183	*0.031****	– 0.076	*0.026****
2^{nd} quintile	– 0.101	*0.035****	– 0.064	*0.030***	– 0.054	*0.032**	0.011	*0.027*
4^{th} quintile	0.127	*0.034****	0.031	*0.030*	0.063	*0.031***	0.016	*0.026*
5^{th} quintile	0.289	*0.035****	0.094	*0.031****	0.173	*0.033****	0.078	*0.028****
adjusted R^2	0.132		0.373		0.108		0.398	
Controls	—		×		—		×	

NOTE — Standard errors in italics; ***significant at 1% level; **significant at 5% level; *significant at 10% level. The (omitted) reference category is the 3^{rd} quintile of the respective trait distribution. The full set of controls includes all variables on individual, human-capital, region, occupation, industry and job characteristics as detailed in Table 2.

Table 6: Decomposition Results for Personality Traits

			using male coefficients		using female coefficients	
	$\bar{X}_m - \bar{X}_f$	$\hat{b}_m - \hat{b}_f$	$(\bar{X}_m - \bar{X}_f)'\hat{b}_m$	$\bar{X}'_f(\hat{b}_m - \hat{b}_f)$	$(\bar{X}_m - \bar{X}_f)'\hat{b}_f$	$\bar{X}'_m(\hat{b}_m - \hat{b}_f)$
Personality traits:						
extroversion	− 0.120	0.012	− 0.001	0.001	0.001	− 0.001
	*0.028****	*0.023*	*0.1%*	*0.1%*	*0.2%*	*0.1%*
agreeableness	− 0.396	− 0.049	0.027	− 0.009	0.007	0.010
	*0.027****	*0.025**	*4.5%*	*1.6%*	*1.2%*	*1.7%*
conscientiousness	− 0.043	− 0.041	− 0.000	− 0.001	− 0.002	0.001
	0.028	*0.026*	*0.0%*	*0.1%*	*0.3%*	*0.2%*
neuroticism	− 0.202	− 0.036	0.007	− 0.003	− 0.001	0.004
	*0.028****	*0.023*	*1.1%*	*0.6%*	*0.1%*	*0.6%*
openness	− 0.062	− 0.016	− 0.003	− 0.000	− 0.004	0.001
	*0.028***	*0.035*	*0.5%*	*0.1%*	*0.7%*	*0.1%*
net effect			*0.030*	*− 0.013*	*0.002*	*0.014*
			5.1%	*2.3%*	*0.3%*	*2.5%*
IQ-scores	− 0.030	0.016	− 0.002	0.000	− 0.002	− 0.000
	0.028	*0.016*	*0.3%*	*0.0%*	*0.3%*	*0.0%*

NOTE — Standard errors in italics; ***significant at 1% level; **significant at 5% level; *significant at 10% level; earnings effects as portion (percentage) of the gross differential in italics; *net effect* denotes the overall effect of all Big Five traits as a share of the gross differential.