

Otten, Sina

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Gender-specific personality traits and their effects on the gender wage gap: A correlated random effects approach using SOEP data

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Sina Otten

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German Socio-Economic Panel (SOEP)
DIW Berlin
Mohrenstrasse 58
10117 Berlin, Germany

Contact: soeppapers@diw.de



**Gender-Specific Personality Traits and Their Effects on the Gender Wage Gap: A
Correlated Random Effects Approach using SOEP Data**

Sina Otten*

Hamburg, March, 2020

***University of Hamburg, Hamburg Business School, Institute for Human Resource
Management, sina.otten@uni-hamburg.de**

Abstract

Using longitudinal data from the German Socio-Economic Panel (SOEP), this article examines whether gender wage differentials occur due to differences in prototypical personality traits of women and men and provides the first application of a gender wage gap decomposition on the basis of a correlated random effects model. Main results show that agreeableness and openness are the most important personality traits in explaining wages and wage differentials. Openness has a positive effect and agreeableness has a negative effect on earnings for men, while the opposite effects are found for women. Concerning the gender wage gap, analyses show that although gender differences in openness and agreeableness explain small parts of the gap, gender differences in the returns of agreeableness and openness are larger.

Key Words

Gender Wage Gap, Correlated Random Effects, SOEP, Big Five Personality Traits, Panel Data

Explaining the gender wage gap has attracted much attention not only because it might be intrinsically interesting but also because discriminatory wage practices could lead to inefficient resource allocation. As such, the gender wage gap has been studied throughout the last several decades using many datasets, estimation methods, employee subgroups, and countries (for an overview, see Weichselbaumer and Winter-Ebmer (2005) or Blau and Kahn (2017)). However, despite the large number of studies on the gender wage gap, scholars still debate the underlying causes of it and point out that (unobserved) social, cultural, and psychological conditions are highly relevant in explaining the gap. Personality traits may thus come to play an increasingly crucial role in our understanding of gender wage differentials. Given differences in prototypical personality traits between men and women, I examine whether the earning differential between men and women can be explained by these traits.

My main contributions regarding the investigation of the gender wage gap are methodological in nature. First, I use a longitudinal dataset, which has per se a range of advantages over cross-sectional datasets (Baltagi 2013). More precisely, I utilize data from the German Socio-Economic Panel (SOEP) from the years 2006, 2010, and 2014 (Goebel, Grabka, Liebig, Kroh, Richter, Schröder, and Schupp 2019). Second, I identify a range of problems that occur while decomposing the gender wage gap with standard panel data methods, namely, with fixed effects (FE) or random effects (RE) models. Third, I rule out these problems by using a correlated random effects (CRE) model¹ (Mundlak 1978; Schunck 2013; Wooldridge 2010). This approach has become increasingly popular in panel data analyses (e.g., Phillips 2006; Ousey and Wilcox 2007; Zhou 2011); however, it has not been applied to the gender wage gap, although it is recommended by researchers in this field (e.g., by Oaxaca and Choe 2016).

¹Also known as Mundlak model.

Following this recommendation, to my knowledge, the present study is the first to decompose the gender wage gap while taking advantage of panel data models and including time-variant as well as time-invariant variables. In short, using a decomposition on the basis of CRE estimations a) yields results that are unbiased by unobserved heterogeneity and, at the same time, b) allows the integration of time-invariant explanatory variables.

From a theoretical view, I develop hypotheses by applying and expanding the human capital approach. I adopt a standard economic viewpoint of personality as a bundle of productive traits valued in the labor market (see also Mueller and Plug 2006). Personality traits may contribute to a worker's productivity and thus act as human capital variables in a wage regression. Wages follow, as usual, from the kind and amount of traits possessed and the return that each trait receives in the market.

Using the five-factor model (FFM) of personality I first describe gender-specific differences in personality traits from a theoretical and literature-based perspective. In accordance with common gender stereotypes, previous research showed that women consistently reported significantly higher neuroticism and agreeableness than men (Feingold 1994). Extroversion patterns are more differentiated: women reported higher on the nurturant aspect of extroversion, whereas men reported higher on the dominant aspect (e.g., McCrae and Costa 1989; Schmitt et al. 2008). Gender differences in openness to experience and conscientiousness have rarely been examined and are inconsistent (e.g., Feingold 1994; Costa, Terracciano, and McCrae 2001). I replicate these measures of differences in men's and women's prototypical personality traits and confirm their results: women clearly score higher than men on neuroticism, agreeableness, and the nurturant aspect of extroversion, while gender differences in conscientiousness and openness to experience are rather small.

Because this paper concerns the gender wage gap, it is useful to aim to increase the explanatory part of the gender wage gap with differences in endowments. I therefore put more emphasis on personality traits with important gender differences (for a similar approach, see Fortin 2008). Consequently, conscientiousness and openness to experience are less useful for my purpose of explaining the gender wage gap as they do not show gender-specific differences. Nevertheless, I include them as statistical controls in my models.

The Five-Factor Model of Personality

According to the FFM, five independent categories are sufficient to describe individual personality differences at the broadest level of abstraction (Goldberg 1990). The dimensions of the FFM are labeled 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 FFM should be viewed as broad factors underlying a number of related personality facets and sets of more specific attributes. Research about personality traits provides different approaches, but the FFM is the most extensive categorization of personality traits available to date.

Concerning gender, research has shown some patterns of differences in responses to the Big Five Inventory. In the following, I will give a short overview of the research about gender differences within the single dimensions.

Extroversion contains characteristics such as energy, assertiveness, sociability, talkativeness, enthusiasm, and action orientation. Extroverted people tend to be more dominant in social settings than introverted people. Low extroversion causes a reserved, reflective, quiet, low-key, and deliberate personality, with less involvement in the social world. Extroversion combines aspects of typical male domains (i.e., dominance) and typical female domains (i.e.,

nurturance) (McCrae and Costa 1989). Accordingly, gender differences in extroversion vary by facet, with men demonstrating higher assertiveness and excitement seeking (Lynn and Martin 1997) and women demonstrating higher warmth and gregariousness (Feingold 1994; Schmitt et al. 2008). In this study, I refer only to the female nurturant facet of extroversion and not to the male dominant facet, since only the former was collected in the dataset I used.

Neuroticism is a broad domain of negative affect, including predispositions to easily experience unpleasant emotions, such as anxiety, anger, depression, shame, vulnerability, and other distressing emotions. Neuroticism also refers to the degree of emotional stability and impulse control and is sometimes referred to by its low pole, emotional stability. A low need for stability causes a reactive and excitable personality that often characterizes very dynamic individuals who can be perceived as unstable or insecure. Individuals who score low on neuroticism are less easily upset and are less emotionally reactive. Many determinants of neuroticism are congruent with those of the female gender stereotypes; thus, having a high neuroticism score corresponds to being typically female. Hence, it has been consistently reported that women score higher on neuroticism than men (see, e.g., Costa et al. 2001; Schmitt et al. 2008).

Agreeableness refers to a tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others. The agreeableness trait reflects individual differences in general concern for social harmony. Agreeable individuals are generally considerate, kind, generous, trusting and trustworthy, helpful, and willing to compromise their interests with others. People with low agreeableness personalities are often competitive or challenging people who can be seen as argumentative or untrustworthy. They place self-interest above getting along with others, are generally unconcerned with others' well-being and are less likely to extend themselves

for other people. Almost all facets of being agreeable are coincidentally facets of female gender stereotypes (Smith, Dugan, and Trompenaars 1997); thus, scoring high on agreeableness most closely corresponds to the female social role as homemaker and to the communal stereotypes. Thus, research consistently showed not only that women report higher levels of agreeableness (e.g., Costa et al. 2001; Schmitt et al. 2008) but also that there is a normative prescription for women to be agreeable (e.g., Brescoll and Uhlmann 2008; Judge, Livingston, and Hurst 2012).

Openness to experience is a general appreciation for art, emotion, adventure, unusual ideas, imagination, curiosity, and variety of experience. Individuals with high openness are said to pursue self-actualization specifically by seeking out intense, euphoric experiences. People who are open to experience are intellectually curious, sensitive to beauty and willing to try new things. They tend to be, when compared to closed people, more creative and more aware of their feelings. Conversely, those with low openness seek to gain fulfillment through perseverance and are sometimes even perceived to be dogmatic and closed-minded. The vast majority of research did not find significant gender differences in openness (e.g., Feingold 1994; Costa et al. 2001).

Conscientiousness is a tendency to display self-discipline, act dutifully, and strive for achievement against standards or outside expectations. It is related to the way in which people control, regulate, and direct their impulses. High scores on conscientiousness indicate a preference for planned rather than spontaneous behavior and are often perceived as representing stubbornness and obsession. Low conscientiousness is associated with flexibility and spontaneity but can also appear as sloppiness and lack of reliability. Gender differences in aspects of conscientiousness have rarely been examined, and most studies did not find significant gender differences in conscientiousness (e.g., Feingold 1994; Costa et al. 2001).

Using the FFM as a comprehensive framework to organize traits, multiple studies examined how the Big Five personality dimensions relate to labor market outcomes (e.g., Barrick and Mount 1991; Boudreau, Boswell, and Judge 2001), but they did not investigate gender-specific effects. Mueller and Plug (2006) used cross-sectional data gathered in the USA in 1992 and examined gender differences in wages due to differences in psychological traits. They found that earnings advantages were associated with antagonism (the obverse of agreeableness) and emotional stability (the obverse of neuroticism) but only among men.

Human Capital Approach

Human capital theory features prominently in the analysis of gender wage differentials (see, e.g., Holst and Busch 2009). In this framework, systematic variation in earnings arises from gender-specific differences in the accumulation of human capital due to differences in productive skills (Becker 1975; Mincer 1958). Productive skills are individual human capital attributes providing a direct input into the production process and may be innate abilities or skills developed through investments in education, training, and work experience. Individuals sell their bundle of skills to firms at 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 skill receives in the market. Concerning these theoretical considerations and the fact that personality is a predictor of extrinsic career success (e.g., Heineck 2011), one may think of personality as a part of an individual's set of productive traits that may contribute to a worker's productivity and are valued in the market (see also Mueller and Plug 2006). Due to the assumptions that a) gender-specific differences in the accumulation of human capital cause gender-specific differences in wages and b) personality traits might act as productive skills and thus as human capital variables in a wage regression I hypothesize that gender-specific

personality traits (i.e., in neuroticism, extroversion, and agreeableness, as mentioned above) contribute to explaining the gender wage gap.

Based on the economic approach of personality traits as a bundle of productive attributes valued in the labor market, I implicitly assume that personality affects behavior (for a more detailed explanation, see McCrae and Costa 1999). However, this assumption 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, and therefore more frequently observed across a multitude of situations (see also Mueller and Plug 2006).

Data, Methods, and Variables

Data

Empirical analyses are based on data provided by the SOEP for the years 2006, 2010, and 2014. The SOEP is a repeated longitudinal study of a representative sample of 32,000 persons carried out yearly since 1984. This panel dataset is particularly suited for analyses of the gender wage gap (e.g., Busch and Holst 2009; Wieber and Holst 2015) since it provides a broad range of information related to compensation and characteristics that might be considered as causes of the gender wage gap. The population under study was restricted to men and women of primary working age (18-65 years old) and employed as blue- or white-collar workers or civil servants (persons who were unemployed or self-employed at the time of the survey were excluded). I further drop individuals in the top and bottom 1% of the income distribution², which leads to a final sample of 9,683 women and 9,305 men.

²For robustness checks, I reran the analyses after dropping individuals in the top and bottom 2% of the income distribution. The results are mostly the same.

The focus on Germany is especially interesting, as the gender wage gap is relatively high, and traditional gender norms still prevail. Germany's conservative welfare regime produces highly gendered employment patterns. Recent policy changes in Germany, such as publicly funded childcare, have improved the integration of work and care, but policies that institutionalize the role of women as secondary earners (e.g., tax-related income-splitting³) still loom large.

Methods

Derivation of Empirical Analyses

This article attempts to explain whether and to what extent gender-specific personality traits influence the gender wage gap. The availability of longitudinal data in the SOEP allows the use of panel data models. These models have several advantages over traditional cross-sectional methods. One advantage, especially regarding the analysis of wages, is that the determined results are independent and therefore unbiased in terms of period and time trends (e.g., economic crises or booms) with the inclusion of dummy variables for different time periods in the model. Another very important advantage of panel data models is that they can mitigate bias due to unobserved time-invariant heterogeneity. Using panel data methods, unobserved time-invariant heterogeneity can be dealt with in a number of ways. Standard methods are the FE and RE models (Greene 2012), but there is also a range of models that combine different approaches.

The FE model uses within-person variation and has the advantage of netting out all time-invariant unobserved heterogeneity, even when this heterogeneity is correlated with the observed variables. This property implies that the FE model identifies only the effects of time-variant

³ German tax law that equalizes total income between spouses.

variables. Consequently, the FE model is usually less efficient than the RE model. Moreover, ignoring time-invariant variables in a wage gap decomposition means that only the part of the wage gap based on within variation is decomposed. This is an unrealistic assumption in the context of gender wage gap decomposition and might lead to heavily biased results, as shown by Heitmüller (2005) in a methodological paper. The RE model uses both within and between variation and thus can identify the effect of time-invariant independent variables. However, this model assumes zero correlation between the independent variables and the unobserved time-invariant heterogeneity, an assumption that is rarely fulfilled (Greene 2012; Wooldridge 2010).

In short, the FE approach is inappropriate for a decomposition of the gender wage gap since it ignores time-invariant variables, which leads to biased results in wage gap decompositions. The RE model might be appropriate for decomposing the gender wage gap, but it has very strong assumptions that are rarely fulfilled. To respond to these constraints, I use a CRE model, as advised by Oaxaca and Choe (2016) in a methodological paper.

Application of Empirical Analyses

The CRE model combines features from the FE and RE models and relaxes the rarely fulfilled assumption of the RE model, which is that there is a zero correlation between the independent variables and unobserved time-invariant heterogeneity (Mundlak 1978; Schunck 2013; Wooldridge 2010). Equations 1 and 2 illustrate the CRE model. In the standard RE model (equation 1), Y_{it} is the dependent variable for individual i ($i=1, \dots, n$) at time period t ($t=1, \dots, t$) and x'_{it} is a vector of explanatory variables with regression coefficients β . ε_{it} is a normally distributed error term, and α_i is an individual-specific and time-invariant random component that is assumed to have a normal distribution and is uncorrelated with x'_{it} and ε_{it} .

$$(1) \quad Y_{it} = \beta x'_{it} + \varepsilon_{it} + \alpha_i$$

$$(2) \quad \alpha_i = \gamma \bar{x}_i + \omega_i$$

The particular features of the CRE model concern the specification of the α_i . Equation 2 shows that in the CRE model, α_i is a function of the within-individual means over t of the x'_{it} variables, \bar{x}_i , and ω_i , the normally distributed random effect. In other words, the CRE approach directly models the correlation between the random effect and the individual mean values of the x variables over time. This specification implies that any (linear) correlation between the α_i and \bar{x}_i will be captured by γ , and the β s will be consistent. Thus, the CRE model provides unbiased wage-function parameters to compute reliable male and female wages.

I use the Hausman test to test the validity of the CRE model relative to the RE model. The Hausman test compares the results from two competing model specifications where one model is more efficient but has stronger assumptions (here, the assumption of zero correlation between the independent variables and the unobserved time-invariant heterogeneity in the RE model) than the other (here, the CRE model). If there are no systematic differences in the results (i.e., when the result of the Hausman test is nonsignificant), the more efficient model can be accepted. If the test is significant, one must use the less efficient CRE model with weaker assumptions because the RE estimator is inconsistent.

However, the estimation of the effects of gender-specific personality traits on earnings do not tell us how great a role these traits play in explaining the gender gap in earnings. To address that question, I decompose the gender wage gap into three components (Blinder 1973; Jann 2008a; Oaxaca 1973):

$$(3) \quad E(Y_m) - E(Y_f) = [E(x_m) - E(x_f)]' \beta_f + E(x_f)' (\beta_m - \beta_f) + [E(x_m) - E(x_f)]' (\beta_m - \beta_f) \\ = E + C + I$$

There are two groups f (women) and m (men). $E(Y)$ denotes the expected value of the outcome variable (here, logarithm of hourly gross earnings). The subscripts m and f indicate, respectively, male and female groups.

$$E(Y_m) - E(Y_f)$$

is the log-wage differential between men and women, which is decomposed into three parts. A vector x contains the predictors. $E(x)$ denotes the expected value of the predictor variables, and β contain the slope parameters and the intercept.

The first summand (E, endowment effect) amounts to the part of the differential that is due to group differences in the predictors (i.e., gender-specific differences in factors that are relevant for compensation) and states how much more (or less) women would earn if their endowments (e.g., tenure, education) were the same as men's endowments. The second summand (C, evaluation effect) measures the contribution of differences in the coefficients (including differences in the intercept) and describes the hypothetical wage gain (or loss) of women if their own features were remunerated like men's features. The third summand is an interaction term (I) accounting for the fact that differences in endowments and coefficients exist simultaneously between the two groups. Thus, the interaction term is the portion of the wage gap that cannot be explained by either differences in the various characteristics (endowment effects) or the reward of these characteristic (evaluation effects). I opt for the three-fold decomposition rather than the more common twofold decomposition originating in the work of Oaxaca (1973) and Blinder (1973) since it can isolate the interaction effect that would otherwise be arbitrarily attributed to the endowment and evaluation effects and would thereby bias the results.

In short, I first use a CRE approach to estimate the effects of gender-specific personality traits on wages separately for men and women. On the basis of these estimations, I decompose

the earnings differential between men and women to see what part of the gap can be explained by different endowments and what part by different returns (i.e., penalties or rewards) of the same endowments.

Variables

The dependent variables are the logarithms of the hourly gross earnings in euros for men and women (see, e.g., Holst and Busch 2009). For employed persons without wage data, I used imputed wage data, which are provided by the SOEP. I also included a dummy variable that shows whether the respective income was imputed or not. The earnings are adjusted for inflation by dividing the earnings by the consumer price index (the base year is 2011). Taking the logarithms of the gross hourly earnings allows the regression coefficients to be interpreted as a percentage change in the wage when the particular independent variable increases by one unit (Wooldridge 2010) and can mitigate skewness in the wage data.

The focal independent variables of interest are the gender-specific personality traits of the FFM. Table 1 shows the items related to the Big Five personality traits provided by the SOEP. Accordingly, I built five indices⁴, which are assessed by 3 respective items. Table 1 further shows the average gender differences regarding the Big Five indices. Women score considerably higher in neuroticism and agreeableness. Moreover, women have clearly higher extroversion scores, which could be attributed to the fact that the items building the extroversion index belong to a nurturant content to a greater extent than they belong to a dominant content. These findings of gender differences in the Big Five are consistent with evidence from the literature (e.g., Bouchard and Loehlin 2001; Costa et al. 2001; Feingold 1994; Mueller and Plug 2006) and are congruent with conventional gender roles and gender stereotypes of men as agentic

⁴ Single-item responses for every year are coded into average scores.

"breadwinners" responsible for the financial welfare of the family and of women as communal "homemakers" or "caregivers" entrusted with household responsibilities, the care of children and the support of relationships (e.g., Eagly and Steffen 1984; Heilman 2012). Gender differences in openness to experience and conscientiousness are relatively small and therefore seemingly not specific to either women or men. Thus, they are less useful for my purpose of explaining the gender wage gap with gender-specific personality traits. Nevertheless, I included openness and conscientiousness as control variables to ensure that the observed effects are not confounded with one of the other traits.

[Table 1 here]

Unlike research investigating the gender wage gap with cross-sectional data and facing the concomitant problem of reserved causality (see, e.g., the study of Mueller and Plug 2006), the longitudinal aspect of the data allows the use of time-lagged personality traits. Thus, the endogeneity problem is minimized in my study since the measured personality traits were recorded one year before the respondents' wages were observed.

I controlled for several relevant covariates. Gender differences in earnings have primarily been explained within the Mincer-type wage equation including education, actual work experience during part- and full-time employment, unemployment experience, firm tenure, and time use patterns. The model was extended to capture workplace- and firm-related covariates that have proved to have notable impacts on the gender wage gap, namely, firm size, industry, occupation, occupational status, public and private sector, and autonomy in professional activities. Additionally, sociodemographic variables were included as statistical controls since

studies show that they also explain parts of the gender wage differential (see, e.g., Busch and Holst 2011; Polachek and Xiang 2009). Dummies for each year were added to the model to rule out period effects and time trends, which are equal for all observations (e.g., business cycles). Table 2 gives a more detailed description of the variables and summary statistics for men and women.

[Table 2 here]

However, there has been much discussion about which variables to include in a wage regression based on a Blinder-Oaxaca decomposition. Caution is required, especially since the sum of the evaluation effect (C) and interaction effect (I) is frequently interpreted as discrimination. Any approach that relies on a statistical residual will be open to question as to whether all the necessary independent variables were included in the regression. Two questions are therefore crucial:

First, do the included variables measure productivity comprehensively? If not, the estimate is biased upwards or downwards. For example, even if measured human capital characteristics can explain a portion of the wage gap between men and women, it is possible that unmeasured group differences in qualifications may explain part of the residual. If men are more endowed with respect to these omitted variables, we would overestimate discrimination. While an employer is assumed to have exact knowledge of all the relevant productive characteristics of an employee and can set the wage accordingly, the researcher usually possesses the data for only a restricted number of indicators for productivity. If the omitted variables correlate with gender,

then C and I might capture not only discrimination but also unobserved group differences in productivity.

Second, are the included characteristics affected by discrimination themselves? That is, if some of the factors controlled for in such regressions reflect the impact of discrimination, then the estimated discrimination will be underestimated. For example, if women face barriers to entry into certain occupations, they may have higher unmeasured productivity than men in the same jobs. This factor would suggest an underestimate of discrimination if occupation is controlled for. Accordingly, it is not clear whether respondents' occupation affiliations are appropriate variables to include in the 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 when estimating the effect of personality traits on earnings. Thus, when job-holding is controlled for, we expect it to partially mediate the effects of personality on earnings. To answer these constraints, I estimated a reduced model (i.e., a model that does not control for job-related variables) for sensitivity analyses and obtained almost identical results.

Results

Table 3 shows first the coefficients for men and women from the RE and the CRE models, which consider only within-person variance (coefficients concerning between-person variance are available on request).

[Table 3 here]

The Hausman test has χ^2 values of 555.29 for men and 441.31 for women, which are both highly significant. Thus, there are systematic differences between the RE and the CRE models. Consequently, I focus on the consistent estimations of the CRE specification.

Regarding the focal independent variables (extroversion, neuroticism, and agreeableness), the results of the CRE model show significant effects only of agreeableness on earnings, but the effects have different signs for men and women. More agreeable men suffer small but statistically significant earnings disadvantages compared to less agreeable men, while more agreeable women enjoy small but statistically significant earnings advantages compared to less agreeable women. More precisely, one step higher on the agreeableness scale raises the hourly earnings of women by 0.7% and reduces the hourly earnings of men by 0.8%, on average. Extroversion and neuroticism generate significant returns for neither men nor women.

Taking a look at the further regression results, we see small and significant positive effects of conscientiousness and openness on earnings for men and a small and significant negative effect of openness on earnings for women. That is, one step higher on the conscientiousness scale raises the hourly earnings of men by 1.3%. Moreover, one step higher on the openness scale raises the hourly earnings of men by 0.8% and reduces the hourly earnings of women by 1.2%.

Furthermore, most human capital variables have significant effects on income for men and women. This confirms human capital theory, assuming in the most general sense that more accumulated human capital increases wages. As mentioned above, I expanded the model by including workplace- and firm-related and sociodemographic characteristics since they might explain parts of the gender wage gap. The present results show significant links between most of these characteristics and income.

Overall, the effect sizes of the regressions are rather small yet unbiased by unobserved characteristics, as only the variance within persons in the calculation was considered, i.e., only the variance achieved through individual changes in the variables over time.

Consider now the decomposition results. The overall gap, that is, the difference in the logarithms of hourly wages between men and women, amounts to 0.242 (i.e., 24.2%) (Table 4). The magnitude of this gender wage gap is similar to that found in other studies of the gender wage gap in Germany (e.g., Arulampalam, Booth, and Bryan 2007; Weichselbaumer and Winter-Ember 2005). The results from Table 4 further show that, overall, 14.6 percentage points of the gap can be explained by the different endowments of men and women, 2.4 percentage points by differences in coefficients, and 7.2 percentage points by interactions.

[Table 4 here]

A more detailed view of the gender wage gap decomposition is shown in the right part of Table 3. These decomposition results were calculated on the basis of the CRE models and again consider only within-person changes over time, meaning that the level differences between persons are eliminated. A closer look at the endowment effects shows that among the gender-specific personality traits, only differences in agreeableness provide significant results showing that women would earn 0.2 percentage points less if they were as agreeable as men. In addition to gender-specific personality traits, the decomposition results indicate that 0.3 percentage points can be explained by differences in openness to experience, meaning that women's hourly earnings would be 0.3 percentage points higher if they were as open as men. In terms of the Mincerian human capital variables, the results show that women would earn 1.2 percentage

points less if they worked in the same industries as men. 1.4 percentage points of the gender wage gap are due to the longer firm tenure of men than of women. Moreover, 0.8 percentage points of the gender wage gap can be explained by the fact that men work in larger firms than women, and 0.7 percentage points of the gender wage gap are due to the fact that men have more autonomy in their professional activities than women. Almost one percentage point of the gender wage gap can be explained by the higher occupational status of men compared to women. Regarding sociodemographic characteristics, 0.2 percentage points of the gender wage gap are due to regional east-west differences between men and women.

In terms of the evaluation effect, agreeableness is again an important factor. Women receive much higher rewards for being agreeable than men, meaning that they would receive a wage loss of 7.8 percentage points if their agreeableness was remunerated like that of men. In other words, there is a 'positive discrimination' for women in terms of agreeableness. Further, women receive lower penalties than men for part-time work experience; their hourly earnings would be almost 13 percentage points lower if their part-time work experience was paid like that of men. However, women's hourly earnings would be 9.2 percentage points higher if their openness was rewarded the same as men's openness. Moreover, women would receive 1.1 percentage points higher income if the hours per weekday they spent in child care were assessed the same as they are for men. Another 3.6 percentage points can be attributed to different returns on occupations, meaning that women would receive a wage gain of 3.6 percentage points if their occupations were remunerated like men's. Additionally, women would earn 3.4 percentage points more if their occupational status was evaluated like men's and one percentage point more if their parenthood was evaluated like men's.

In short, regarding gender-specific traits, agreeableness is the only trait that shows significant decomposition results. With regard to extroversion and neuroticism, neither the differences in endowment nor the differences in returns contribute significantly to the explanation of the gender wage gap. Overall, the effect sizes of the decomposition are larger if the gender differences in means and coefficients are larger (e.g., with opposite signs).

Mueller and Plug (2006) had a similar research question to the one I present, and they both indicate the great importance of agreeableness in the gender wage gap research. Both studies found that agreeableness has a negative impact on men's wages while openness has a positive impact. The findings differ in that mine show a positive effect of agreeableness on women's wages, while those of Mueller and Plug (2006) did not show a significant relationship between agreeableness and income for women. Comparisons of the decomposition results are barely meaningful, as Mueller and Plug (2006) did not display significance levels of the decomposition results and an adequate interpretation of decomposition results is hardly possible without information on statistical precision (Jann 2008b, 2009).

Discussion and Conclusion

Following the human capital approach, I expected that gender-specific personality traits explain parts of the gender wage gap. However, the present results do not fully confirm this hypothesis. The discussion of the results requires an interdisciplinary perspective. Regarding the results on agreeableness the backlash approach provides a possible explanation: given societal expectations about gender-appropriate traits and behavior, it is possible that the market rewards men and women who conform to conventional gender roles and stereotypes and punishes those who deviate. That is, backlash refers to social and economic sanctions for counter-stereotypical behavior (Rudman and Fairchild 2004). Accordingly, one would expect that agreeable men and

non-agreeable women are punished for being perceived as deviants from their respective gender norms, and this is exactly what the present results show: men who behave agreeably suffer penalties in the form of lesser income, while agreeable women are rewarded in the form of higher income. Moreover, women would earn less if a) they were as agreeable as men and b) their agreeableness was compensated in the same way as that of men. In this context, the results also show that women would be punished for working in traditionally male domains, as they would suffer a wage loss if they worked in the same industries as men.

Another explanation could be provided by the diversity literature. Since heterogeneous teams are known to be more successful due to the different traits of the team members (e.g., Hoogendoorn, Oosterbeek, and van Praag 2013), different target aspects are pursued in the recruitment of men and women. Thus, with regard to heterogeneous team composition, women are hired because of their female traits, while men are hired because of their male traits. Consequently, agreeableness might be more rewarded for women than for men because women are hired with the goal of making a team more heterogeneous with the addition of women's female personality traits, and since agreeableness is typically a female trait, this approach rewards women more than men for this trait.

But why does only agreeableness provide a significant explanation regarding the gender wage gap, while other gender-specific traits (i.e., neuroticism and extroversion) do not? One explanation might be that agreeableness is more important in relation to the labor market and to perceived human capital than neuroticism and extroversion since it contains attributes such as compliance, trust, and straightforwardness, which might be important attributes for the environment of labor markets. In particular, the link between agreeableness and income might be stronger than the link between extroversion or neuroticism and income because disagreeable

people might value money more than agreeable people, who value communal relationships more highly (e.g., Abele et al. 2008). Accordingly, agreeable people tend not to do as well at salary negotiating because their high regard for interpersonal relationships prevents them from making as many demands as they need to obtain the best outcomes for themselves (e.g., Barry and Friedman 1998; Liu, Friedman, and Chi 2005).

A further interesting and surprising finding is the role of openness to experience in explaining the gender wage gap. Being open leads to higher income for men but lower income for women. Moreover, women would earn more if they were as open as men and also if women's and men's openness was similarly remunerated. Thus, there is a 'negative discrimination' for women in terms of being open. This result is interesting because openness is not a gender-specific trait, meaning that it is not typical for one gender to be open (gender differences in openness are relatively small). One possible interpretation might be that the openness trait is connoted differently for men and women. While open men might be perceived as visionaries and their creativity equated with intelligence, open women might be perceived as dreamers and their creativity equated with aestheticism. Thus, men and women might not differ in being open, but the perception of their openness might differ and be considered stereotypically. Thus, open men might be perceived as intelligent and visionary employees and open women as dreamy and aesthetic employees. Accordingly, since the same personality trait has different connotations for each gender, one gender might be punished and the other rewarded for being open.

My empirical findings require careful interpretation. First, my study includes three years; thus, longer time series would be preferred. Second, I cannot rule out endogeneity among wages and the control variables since only the personality trait variables were time lagged, and the other control variables were not. Third, the validity of the 'discrimination' estimation might be blurred

since it depends upon whether one controls for all characteristics measuring productivity comprehensively but not for the characteristics affected by discrimination. However, I answered this latter limitation by estimating a reduced model, as discussed above.

Overall, to my knowledge, the present study is the first to decompose the gender wage differential with longitudinal data in a CRE model, as emphasized recently by Oaxaca and Choe (2016) in a methodological paper. Therefore, this study is the first in the gender wage gap research field to decompose the wage differential between men and women while taking advantage of panel data models and including time-variant as well as time-invariant variables. Thus, the results should be unbiased and show that it might not be a universal advantage to demonstrate masculine behavior. Instead, men with more male characteristics have a comparative advantage in male wage patterns, while women with more feminine characteristics have a comparative advantage in female wage patterns; this applies at least for being agreeable. Personality traits cannot be seen as isolated productive traits in terms of human capital. Rather, the market prices of personality traits differ by gender. Thus, the present results suggest that it is the gender-specific demand for personality traits on the part of employers more than the gender-specific supply of these traits on the part of employees that drives the wage differential between men and women. Although a small part of the gender wage gap can be explained by factual differences in agreeableness and openness, the differences between the evaluations of agreeableness and openness for men and women are much larger. Thus, structural and institutional characteristics might be highly gendered, and therefore, the labor market in terms of payments might work differently for men and women.

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Tables

Table 1. The Big Five Personality Traits and the Gender Differences among Them.

<i>Items to answer on a 7-point scale (1=does not apply, 7=applies fully)</i>	<i>Big Five traits</i>	<i>Percentage difference between the means of women relative to men.</i>
I see myself as someone who...		
...is a thorough worker ...tends to be lazy (<i>reverse</i>) ...carries out tasks efficiently	Conscientiousness	2.38%
...is communicative ...is sociable ...is reserved (<i>reverse</i>)	Extroversion	6.56%
...is sometimes too coarse with others (<i>reverse</i>) ...is able to forgive ...is friendly with others	Agreeableness	6.39%
...worries a lot ...is somewhat nervous ...deals well with stress (<i>reverse</i>)	Neuroticism	14.22%
...is original ...values artistic experiences ...has a lively imagination	Openness to experience	2.40%

Notes: N=58,992 person-years. Items and data for calculations come from the SOEP.

Table 2. Summary Statistics.

<i>Variables</i>	<i>Men (N=9,305)</i>				<i>Women (N=9,683)</i>			
	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Log hourly gross earnings	2.84	0.47	0.67	3.91	2.60	0.48	0.65	3.91
Hourly gross earnings (€)	19.03	8.69	1.96	49.94	15.02	7.24	1.92	49.77
Gender-specific personality traits								
Extroversion	4.68	1.12	1	7	5.00	1.11	1	7
Neuroticism	3.52	1.14	1	7	4.00	1.19	1	7
Agreeableness	5.19	0.96	1	7	5.52	0.91	1.33	7
Human capital characteristics								
Firm tenure (in years)	13.33	10.91	0	49.80	11.32	9.94	0	46.60
Education (<i>1=university degree; 2=master craftsman qualification; 3=vocational training including training for public servants; 4=no vocational qualification</i>)	2.48	0.97	1	4	2.55	0.98	1	4
Actual work experience (full-time plus part-time, in years)	21.54	11.19	0.10	52.10	19.39	10.60	0.1	52.30
Part-time work experience as % of total	0.06	0.17	0	1	0.35	0.32	0	1
Unemployment experience (in years)	0.54	1.49	0	27	0.69	1.74	0	24
Hours per weekday spent in housework (washing, cleaning, cooking)	0.79	0.68	0	10	1.86	1.14	0	12
Hours per weekdays spent in child care	0.64	1.44	0	24	1.49	3.28	0	24
Workplace- and firm-related characteristics								
Industry (based on NACE classification) ^a	3.00	1.93	1	6	4.19	1.67	1	6
Occupation (based on 1-digit ISCO-88 classification) ^b	4.52	2.73	1	9	3.77	2.12	1	9
Firm size (<i>1=up to 20; 2=20-199; 3=200-1999; 4=more than 1999 employees</i>)	2.65	1.06	1	4	2.40	1.10	1	4
Public sector (<i>0=yes; 1=no</i>)	0.75	0.43	0	1	0.65	0.48	0	1
Autonomy	2.86	1.10	1	5	2.72	0.96	1	5
Occupational status (<i>1=blue collar; 2=white collar; 3=civil servants</i>)	1.71	0.63	1	3	1.92	0.48	1	3
Sociodemographic characteristics								
Region (<i>0=Western Germany; 1=Eastern Germany</i>)	0.23	0.42	0	1	0.24	0.43	0	1
Marital status (<i>0=married, living together; 1=unmarried, living separately</i>)	0.65	0.48	0	1	0.61	0.49	0	1
Migration background (<i>1=no migration background; 2=direct migration background; 3=indirect migration background</i>)	1.26	0.60	1	3	1.26	0.60	1	3
Number of children	0.64	0.95	0	7	0.52	0.82	0	7
Further control variables								
Openness to experience	4.42	1.11	1	7	4.54	1.18	1	7

Conscientiousness	5.85	0.88	1	7	6.01	0.83	1.33	7
Imputed income (<i>0=no; 1=yes</i>)	0.08	0.27	0	1	0.08	0.27	0	1

Notes: a) 1=university degree; 2=master craftsman qualification; 3=vocational training including training for public servants; 4=no vocational qualification; b) 1=manufacturing, energy; 2=agriculture, mining, construction; 3=trade, transport; 4=bank services; 5=other services; 6=public and education. c) 1=professionals; 2=legislators, senior officials, managers; 3=technicians and associate professionals; 4=clerks; 5=service workers, shop and market sales; 6=skilled agriculture and fishery workers; 7=craft and related trades workers; 8=plant, machine operators and assemblers; 9=elementary occupations.

Table 3. Effects on Men's and Women's Wages and Decomposition Results of the Gender Wage Differential.

<i>Variables</i>	<i>Regression results</i>				<i>Decomposition results</i>		
	<i>Men (N=9,305)</i>		<i>Women (N=9,683)</i>		<i>Endowment effect</i>	<i>Evaluation effect</i>	<i>Interaction effect</i>
	<i>Random effects</i>	<i>Correlated random effects</i>	<i>Random effects</i>	<i>Correlated random effects</i>			
Gender-specific personality traits							
Extroversion	0.003 (0.003)	0.004 (0.004)	-0.002 (0.003)	0.000 (0.006)	0.000 (0.002)	0.018 (0.036)	-0.001 (0.002)
Neuroticism	-0.007** (0.003)	-0.000 (0.004)	-0.005 (0.003)	-0.003 (0.005)	0.002 (0.002)	0.012 (0.025)	-0.001 (0.003)
Agreeableness	-0.010*** (0.003)	-0.007* (0.004)	-0.002 (0.004)	0.008* (0.004)	-0.002* (0.001)	-0.078* (0.039)	0.005* (0.002)
Human capital characteristics							
Firm tenure	0.014*** (0.001)	0.008*** (0.001)	0.015*** (0.001)	0.007*** (0.002)	0.014*** (0.004)	0.010 (0.026)	0.002 (0.004)
Firm tenure ²	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.014*** (0.004)	-0.010 (0.016)	-0.003 (0.005)
Education (<i>Base category: University degree</i>)					0.007 (0.005)	0.013 (0.029)	0.002 (0.005)
Master craftsman qualification	-0.171*** (0.016)	-0.049 (0.060)	-0.116*** (0.023)	-0.218** (0.110)			
Vocational training including training for public servants	-0.228*** (0.012)	-0.183*** (0.050)	-0.170*** (0.012)	-0.326*** (0.071)			
No vocational qualification	-0.268*** (0.017)	-0.340*** (0.062)	-0.248*** (0.017)	-0.351*** (0.083)			
Experience	0.004*** (0.000)	0.010 (0.007)	0.004*** (0.000)	0.007 (0.006)	0.016 (0.014)	0.059 (0.182)	0.006 (0.020)
Part-time work experience as % of total	-0.317*** (0.023)	-0.420*** (0.067)	-0.092*** (0.013)	-0.056 (0.047)	0.017 (0.014)	-0.129*** (0.029)	0.107*** (0.024)
Unemployment experience	-0.022*** (0.003)	-0.018 (0.016)	-0.017*** (0.002)	0.008 (0.016)	-0.001 (0.002)	-0.018 (0.015)	0.003 (0.003)

Hours per weekday spent in housework	-0.012*** (0.004)	-0.005 (0.006)	-0.013*** (0.003)	0.003 (0.005)	-0.004 (0.005)	-0.015 (0.014)	0.009 (0.008)
Hours per weekday spent in child care	0.004** (0.002)	0.005* (0.003)	0.001 (0.001)	-0.002 (0.002)	0.002 (0.002)	0.011** (0.005)	-0.006** (0.003)
Workplace- and firm-related characteristics							
Industry (<i>Base category</i> : Manufacturing, energy)					-0.012* (0.007)	-0.015 (0.011)	0.027*** (0.008)
Agriculture, mining, construction	-0.030*** (0.012)	0.022 (0.021)	-0.048* (0.026)	0.007 (0.039)			
Trade, transport	-0.093*** (0.010)	-0.003 (0.017)	-0.102*** (0.013)	-0.003 (0.023)			
Bank services	0.046** (0.021)	-0.067 (0.048)	0.023 (0.021)	0.023 (0.045)			
Other services	-0.074*** (0.011)	-0.038** (0.018)	-0.067*** (0.012)	0.038* (0.023)			
Public and education	-0.083*** (0.016)	-0.056** (0.025)	-0.034** (0.016)	0.065** (0.029)			
Occupation (<i>Base category</i> : Professionals)					0.006 (0.011)	0.036** (0.018)	-0.018 (0.012)
Legislators, senior officials, managers	-0.017 (0.014)	-0.004 (0.019)	0.018 (0.022)	0.094*** (0.032)			
Technicians, as associate professionals	-0.076*** (0.011)	-0.006 (0.015)	-0.094*** (0.013)	-0.003 (0.021)			
Clerks	-0.131*** (0.015)	-0.032 (0.021)	-0.141*** (0.015)	-0.025 (0.024)			
Service workers, shop and market sales	-0.206*** (0.018)	0.011 (0.030)	-0.240*** (0.016)	-0.038 (0.026)			
Skilled agriculture and fishery workers	-0.283*** (0.041)	-0.191** (0.087)	-0.299*** (0.055)	-0.046 (0.114)			
Craft, related trade workers	-0.171*** (0.014)	-0.055*** (0.021)	-0.212*** (0.027)	-0.041 (0.047)			
Plant, machine operators, assemblers	-0.190*** (0.016)	-0.054** (0.024)	-0.215*** (0.030)	0.032 (0.053)			
Elementary occupations	-0.252*** (0.018)	-0.127*** (0.028)	-0.266*** (0.021)	-0.083** (0.036)			

Firm size (<i>Base category</i> : up to 20 employees)					0.008*** (0.002)	0.000 (0.001)	0.001 (0.002)
Firm size 20-199 employees	0.086*** (0.010)	0.041*** (0.014)	0.098*** (0.009)	0.050*** (0.016)			
Firm size 200-199 employees	0.153*** (0.011)	0.073*** (0.017)	0.157*** (0.011)	0.085*** (0.018)			
Firm size more than 1999 employees	0.209*** (0.011)	0.102*** (0.018)	0.188*** (0.011)	0.085*** (0.019)			
Sector (<i>Base category</i> : public sector)					-0.001 (0.002)	0.018 (0.015)	0.003 (0.003)
Private Sector	0.002 (0.011)	0.021 (0.017)	-0.051*** (0.010)	-0.007 (0.016)			
Autonomy	0.107*** (0.005)	0.030*** (0.007)	0.124*** (0.006)	0.049*** (0.009)	0.007*** (0.001)	-0.050 (0.032)	-0.002 (0.002)
Occupational status (<i>Base category</i> : Blue-collar workers)					0.009* (0.005)	0.034* (0.021)	-0.013** (0.006)
White-collar workers	-0.002 (0.011)	0.014 (0.015)	-0.035*** (0.014)	-0.035* (0.022)			
Civil servants	-0.130*** (0.021)	-0.016 (0.055)	-0.047** (0.024)	0.033 (0.066)			
Sociodemographic characteristics							
Region (<i>Base category</i> : Western Germany)					0.002* (0.001)	0.001 (0.017)	0.000 (0.001)
Eastern Germany	-0.252*** (0.010)	-0.130*** (0.049)	-0.212*** (0.010)	-0.135*** (0.050)			
Marital status (<i>Base category</i> : Married, living together)					0.001 (0.001)	0.008 (0.012)	0.000 (0.001)
Unmarried, living separately	0.042*** (0.008)	0.033*** (0.014)	0.015* (0.008)	0.021 (0.015)			
Number of children	0.028*** (0.004)	0.027*** (0.006)	0.022*** (0.005)	0.008 (0.009)	0.001 (0.001)	0.010* (0.006)	0.002* (0.001)
Further control variables							
Openness to experience	0.004 (0.003)	0.008* (0.004)	-0.000 (0.003)	-0.012** (0.005)	0.003** (0.001)	0.092*** (0.030)	-0.005*** (0.002)
Conscientiousness	-0.000 (0.004)	0.013*** (0.005)	0.007* (0.004)	0.009 (0.006)	-0.001 (0.001)	0.026 (0.050)	-0.001 (0.001)

Year (<i>Base year: 2006</i>)					0.000 (0.001)	0.000 (0.001)	0.000 (0.002)
2010	-0.043*** (0.005)	-0.041 (0.029)	-0.033*** (0.006)	-0.032 (0.026)			
2014	-0.035*** (0.006)	-0.031 (0.055)	-0.038*** (0.007)	-0.021 (0.049)			
Imputed income (<i>Base category: Income is not imputed</i>)					0.000 (0.000)	-0.003 (0.002)	0.000 (0.000)
Imputed income	-0.031*** (0.011)	0.012 (0.016)	0.026* (0.012)	0.048*** (0.019)			
Intercept	2.668*** (0.041)	2.664*** (0.054)	2.452*** (0.045)	2.410*** (0.056)		0.239** (0.117)	
R ² (within, overall, between)	0.092, 0.603, 0.623	0.133, 0.618, 0.631	0.047, 0.538, 0.558	0.074, 0.552, 0.563			
Wald chi ²	9.645***	10.707***	7.782***	8.539***			
Rho (fraction of the variance explained by the unobserved coefficient)	0.696	0.696	0.617	0.617			

Notes: The results concerning between-person variation is available on request. Standard errors are in parentheses. *p<0.1; **p<0.05; ***p<0.01. a) According to the first component of the decomposition equation $([E(x_m) - E(x_f)]'\beta_f)$ values of the endowment effect state how much more or less women would earn if their endowments were the same as men's. Correspondingly, positive (negative) signs mean that women would earn more (less) if they had the same endowment level as men, e.g., women would earn 0.7 percentage points more (1.2 percentage points less) if they had as much autonomy in their professional activities (worked in the same industries) as men. b) According to the second component of the decomposition equation $(E(x_f)'(\beta_m - \beta_f))$ values of the evaluation effect describe the hypothetical wage gain or loss of women if their own features were remunerated like men's. Correspondingly, positive (negative) values mean that women would receive a wage gain (loss) if their endowments were compensated in the same way as those of men, e.g., women would receive a wage gain (loss) of 1.0 percentage point (12.9 percentage points) if their parenthood (part-time work experience) was remunerated like that of men.

Table 4. Overall Wage Differentials between Men and Women.

	<i>Overall wage differentials</i>
Men	2.835*** (0.005)
Women	2.593*** (0.005)
Difference	0.242*** (0.008)
Endowments	0.146*** (0.011)
Coefficients	0.024** (0.012)
Interaction	0.073*** (0.014)

Notes: N=18,988. Standard errors in parentheses. **p < 0.05; ***p < 0.01.