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**COGNITIVE, NON-COGNITIVE SKILLS AND GENDER WAGE GAPS:
EVIDENCE FROM LINKED EMPLOYER-EMPLOYEE DATA IN
BANGLADESH[#]**

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Abstract:

We use a first-hand linked employer-employee dataset representing the formal sector of Bangladesh to explain gender wage gaps by the inclusion of measures of cognitive skills and personality traits. Our results show that while cognitive skills are important in determining mean wages, personality traits have little explanatory power. However, quantile regressions indicate that personality traits do matter in certain parts of the conditional wage distribution, especially for wages of females. Cognitive skills as measured by reading and numeracy also confer different benefits across the wage distribution to females and males respectively. Quantile decompositions indicate that these skills and traits reduce the unexplained gender gap, mainly in the upper parts of the wage distribution. Finally, results suggest that employers place greater consideration on observables such as academic background and prior work experience, and may also make assumptions about the existence of sex-specific skills of their workers, which could then widen the within-firm gender wage gap.

Keywords: gender wage gap, cognitive skills, personality traits, matched worker-firm data, quantile decompositions, Bangladesh

JEL classification codes: J16, J24, J31, J71, C21, O12

Résumé :

A partir de données liées employeurs-employés de première main couvrant le secteur formel du Bangladesh, nous expliquons l'écart salarial de genre en introduisant des mesures des compétences cognitives et des traits de personnalité des employés. Tandis que les compétences cognitives s'avèrent être d'importants déterminants des salaires lorsque ceux-ci sont observés au point moyen, les traits de personnalité présentent en revanche à ce niveau peu de pouvoir explicatif. Néanmoins, l'emploi de régressions quantiles sur les salaires indiquent que ces traits de personnalité jouent à certains endroits de la distribution conditionnelle, en particulier lorsqu'il s'agit des salaires des femmes. Les compétences cognitives, approchées par des scores en lecture et en calcul des salariés, montrent elles aussi des effets différenciés selon le sexe le long de la distribution des salaires. Des décompositions en quantile indiquent ensuite que ces compétences et traits de personnalité réduisent la part inexpliquée de l'écart salarial de genre, et ce principalement dans la partie haute de la distribution des salaires. Enfin, les résultats suggèrent que les employeurs privilégieraient davantage dans leurs pratiques de recrutement et politique salariale l'acquis scolaire et l'expérience professionnelle antérieure. Ils ont aussi tendance à faire usage de stéréotypes sur l'existence de compétences spécifiques selon le sexe des salariés, ce qui a tendance à creuser l'écart salarial de genre au sein même de l'entreprise.

Mots-clefs : écart salarial de genre, compétences cognitives, traits de personnalité, données appariées employeurs-employés, décompositions quantiles, Bangladesh

1 Introduction

Non-cognitive skills or personality traits have recently received significant attention as determinants of labour market performance.¹ In fact, these non-cognitive traits, referring to qualities such as motivation, leadership, self-esteem, social skills, etc., have in some cases been shown to be at least as important as cognitive skills for wages and employment prospects (e.g., Heckman et al., 2006; Lindqvist and Vestman, 2011).² Theoretically, personality traits can have both direct and indirect effects on productivity (Borghans et al., 2008). They can affect productivity directly by being considered as part of an individual's set of endowments, or serve as incentive-enhancing preferences (Bowles et al., 2001). Additionally, they can indirectly affect productivity, for instance, through effects on occupational choice and educational attainment.

There is a growing body of literature that has explored gender differences in personality traits as potential alternative explanations of the gender wage gap.³ However, the existing evidence is based predominantly on developed economies with results indicating some variation in the contribution of these traits to the wage gaps. For instance, Mueller and Plug (2006) find that 3 percent of the gender wage gap in U.S. is explained by differences in personality traits (measured by the Big Five). On the other hand, Fortin (2008), on U.S. workers, reports that 8 percent of the gender wage gap is explained by differences in non-cognitive traits such as importance of money/work and importance of people/family. A similar magnitude has been documented for Russia (Semykina and Linz, 2007), while for the Netherlands, Nyhus and Pons (2005) find wage returns to personality to vary by gender. Using Australian data, Cobb-Clark and Tan (2011) find that men's and women's non-cognitive skills significantly influence sorting into occupations although the nature of this relationship varies across gender.

In this paper, our objective is to explain gender wage gaps as a function of gender differences in cognitive skills and personality traits in a developing country context. We do so for the case of Bangladesh using a recent survey representing formal sector firms and their employees that allows us to identify these skills and traits. To the best of our knowledge, our paper is among the first to contribute to this line of research examining the importance of cognitive and non-cognitive skills in explaining gender wage gaps in a developing country.⁴

¹Heckman and Kautz (2012) make a distinction between "traits" and "skills" where traits suggest permanence while skills can be learned. However, they acknowledge that the extent to which traits can change lies on a spectrum.

²Heckman et al. (2006) show that if an individual moves from the 25th percentile to the 75th percentile in the distribution of non-cognitive (cognitive) skills, wages at age 30 improve by about 10 percent (20 percent) for males, and by more than 30 percent (30 percent) for females.

³Further, a large experimental literature shows that men and women tend to differ in behavioural traits such as competitiveness, risk preferences, and attitudes towards negotiation, factors that can possibly explain gender differences in labour market outcomes (see Bertrand, 2011 for a review).

⁴A few examples of developing country studies are Diaz et al. (2013) who find that Grit and some

Further, since looking at gender gaps at the means of men’s and women’s wages may only reveal part of the prevailing gender inequalities, we also conduct a distributional analysis of wage gaps. Quantile regression based decomposition techniques, that decompose wage gaps into explained and unexplained components at various points of the wage distribution, document mostly a “glass ceiling effect”, i.e. the gender wage gap is increasing at the upper end of the wage distribution, for developed economies and some developing countries such as Morocco (Albrecht et al., 2003; Jellal et al., 2003; Nordman and Wolff, 2009a, 2009b). On the other hand, in several Asian developing countries, larger wage gaps have been observed at the lower tails of the earnings distribution, i.e. the “sticky floor” phenomenon (e.g., Chi and Li, 2008; Ahmed and Maitra, 2015). Carrillo et al. (2014) based on their examination of gender wage gaps in twelve Latin American countries find that poorer and more unequal countries exhibit sticky floors whereas glass ceilings characterize richer and less unequal ones.

Since our data are collected at the enterprise level and contain information about both firms and employees, we make use of the linked employer-employee nature of the dataset.⁵ We also use information on firm characteristics to examine correlates of within-firm gender wage gaps, relying on a two-step procedure including wage regressions and difference in firm fixed effects regressions. Household-level data typically do not allow one to control for firm characteristics that can often have important implications for wages and wage inequality (see Meng, 2004 and references therein). A priori, including firm-specific effects should alter the magnitude of the gender wage gap if (i), the wage gap is correlated with the firms’ observed and unobserved characteristics; (ii), the wage gap between males and females is due to gender-based sorting of workers across firms that pay different wages. For instance, there is evidence of gender segregation across firms in the African manufacturing sector (Fafchamps et al., 2009) and in small firms in USA (Carrington and Troske, 1995). If there are high paying firms that hire more men than women and low paying firms hiring more women, then firms’ characteristics will influence the gender differences in wages. Controlling for firm heterogeneity should then reduce the magnitude of the gender wage gap. With linked employer-employee data, we can include firm-specific effects to account for such influences on the gender wage gaps.

Our results show that cognitive skills matter more than personality traits in determining mean wages. Where the personality traits do matter, it is mostly for wages of

of the Big Five traits result in earning gains of 5-10 percent in urban Peru, and Glewwe et al. (2013) who find no evidence that non-cognitive skills matter for wage determination in rural China. But none of them examine the salience of these traits for gender wage gaps. Further, while there exists literature on estimating gender wage gaps in developing and transition countries (e.g., Appleton et al., 1999; Chi and Li, 2008; Nordman and Roubaud, 2009; Nordman et al., 2011), evidence documenting the influence of cognitive and non-cognitive skills on gender wage gaps in a developing country context is scarce.

⁵A caveat remains that employer-employee data are not representative of the population of interest at the country level, but to the extent that the firms’ characteristics matter in the wage formation process, inclusion of firm-specific effects yields important advantages in studying wage gaps.

female employees in certain parts of the wage distribution. Cognitive skills as measured by reading and numeracy also seem to confer benefits to women and men respectively, with returns varying across the wage distribution. The quantile decompositions indicate that cognitive skills and personality traits reduce the unexplained gender gap in the upper part of the wage distribution. Finally, the within-firm regressions suggest that employers may make assumptions about the existence of sex-specific skills of their workers, which could then widen the within-firm gender wage gap.

The paper is organized as follows: the next section discusses the methodology. Section 3 describes the data. Section 4 presents the descriptive statistics and results for mean and quantile decompositions, and within-firm gender wage gaps. Finally, Section 5 offers concluding comments.

2 Methodology

2.1 Blinder-Oaxaca Decomposition Framework

We first use the Blinder-Oaxaca method to decompose the mean wage gap between males and females into portions attributable to differences in the distribution of endowments (the explained component) and differences in returns to these endowments (the unexplained component) (Blinder, 1973; Oaxaca, 1973). This methodology involves estimating Mincerian wage equations separately for males and females. The resulting decomposition is as follows:

$$\bar{w}^m - \bar{w}^f = (\bar{X}^m - \bar{X}^f)\hat{\beta}^m + \bar{X}^f(\hat{\beta}^m - \hat{\beta}^f) \quad (1)$$

where the left hand side of the equation is the difference in the mean log hourly wages of males and females. \bar{X}^m and \bar{X}^f are average characteristics for males and females respectively and $\hat{\beta}^m$ and $\hat{\beta}^f$ are the coefficient estimates from gender-specific OLS regressions. The first term on the right hand side represents the part of the wage differential due to differences in characteristics and the second term represents differences due to varying returns to the same characteristics.

We also rely on the general decomposition proposed by Neumark (1988) in which the non-discriminatory wage structure is based on OLS estimates from a pooled regression (of both males and females) as follows:

$$\bar{w}^m - \bar{w}^f = (\bar{X}^m - \bar{X}^f)\beta^* + [(\hat{\beta}^m - \beta^*)\bar{X}^m + (\beta^* - \hat{\beta}^f)\bar{X}^f] \quad (2)$$

Neumark shows that β^* can be estimated using the weighted average of the wage structures of males and females and advocates using the pooled sample. The first term is the gender wage gap attributable to differences in characteristics. The second and the

third terms capture the difference between the actual and pooled returns for men and women, respectively.

2.2 Quantile Decomposition Framework

Generalising the traditional Blinder-Oaxaca decomposition that decomposes the wage gap at the mean, Machado and Mata (2005) proposed a decomposition method that involves estimating quantile regressions separately for males and females and then constructing a counterfactual using covariates of one group and returns to those covariates for the other group.

The conditional wage distribution is estimated by quantile regression. The conditional quantile function $Q_\theta(w|X)$ can be expressed using a linear specification for each group as follows:

$$Q_\theta(w_g|X_g) = X_{i,g}^T \beta_{g,\theta} \text{ for each } \theta \in (0, 1) \quad (3)$$

where $g = (m, f)$ represents the groups, w denotes the log of hourly wage, X_i represents the set of covariates for each individual i and β_θ are the coefficient vectors that need to be estimated for the different θ^{th} quantiles.

The quantile regression coefficients can be interpreted as the returns to various characteristics at different quantiles of the conditional wage distribution. Machado and Mata (2005) estimate the counterfactual unconditional wage distribution using a simulation-based technique.

Melly (2006) proposed an alternative to the simulation-based estimator that is less computationally intensive and faster. Instead of using a random sample with replacement, Melly (2006) integrates the conditional wage distribution over the entire range of covariates to generate the marginal unconditional distribution of log wage. Then, by inverting the unconditional distribution function, the unconditional quantiles of interest can be obtained. This procedure uses all the information contained in the covariates and makes the estimator more efficient. Melly (2006) shows that this procedure is numerically identical to the Machado and Mata decomposition method when the number of simulations used in the latter goes to infinity.

We construct a counterfactual for females using the characteristics of females and the wage structure for males:

$$CF_\theta^f = X_{f,i}^T \beta_{m,\theta} \quad (4)$$

Using the abovementioned counterfactual, the decomposition of wage gaps of the unconditional quantile function between groups f and m is as follows:

$$\Delta_\theta = (Q_{m,\theta} - CF_\theta^f) + (CF_\theta^f - Q_{f,\theta}) \quad (5)$$

The first term on the right hand side represents the effect of characteristics (or the quantile endowment effects) and the second the effect of coefficients (or the quantile treatment effects).

3 Data

The Bangladesh Enterprise-based Skills Survey (ESS) for 2012 was sponsored by the World Bank and carried out by a team of the Human Development South Asia Region (Nomura et al., 2013). The survey consists of formal sector firms.^{6,7} The ESS is a linked employer-employee survey, containing an employer survey as well as an employee survey for a random subsample of employees working in the firms surveyed.⁸ The survey samples 500 firms active in commerce (wholesale/retail), education, finance, manufacturing and public administration, while the employee survey samples 6,981 employees. The employer survey, that is administered to business owners or top managers, consists of a general enterprise profile, including characteristics of the firm and its managers, and its recruitment and training practices. The employee survey contains detailed information on an employee's education, work experience, and household background. Further, the employee surveys contain modules to assess cognitive and non-cognitive skills through specific tests. The surveys were conducted between November 2012 and January 2013 through face-to-face interviews.

Cognitive skills of employees were measured through literacy and numeracy tests, consisting of eight questions each. All the questions assess primary education level of cognitive skills. The literacy test includes reading of words and sentences, comprehension of short paragraphs, grammar, and translation from Bangla to English. The numeracy test consists of simple mathematical operations, measurement, and functional mathematics, such as cost calculation. Scores are calculated by assigning one point for each correct answer and then standardized.

Employees' personality traits were assessed by administering a battery of questions - taken from the World Bank Skills Toward Employment and Productivity (STEP) surveys - and asking them to answer on a 4-point scale ranging from "almost always", to "almost

⁶The Business Registry of 2009, collected by the Bangladesh Bureau of Statistics, was used as the sampling frame. The Business Registry contains 100,194 enterprises that have more than ten employees. The sampling methodology for the ESS is stratified random sampling, with the strata being economic sector and firm size. Further, since we only observe these firms and their employees and do not have observations on individuals outside the formal sector, we are unable to account for selection by workers into the formal sector or into specific occupations.

⁷While this may be perceived as a limitation of the dataset given that the Bangladeshi economy has a high proportion of informality, note that surveys collecting information on cognitive and non-cognitive skills in developing countries are mostly rare.

⁸From a roster of employees provided by the firm, a random sampling is done such that more employees are drawn from larger firms.

never”.⁹ Of these questions, 15 items measure the following five personality factors or traits, commonly identified as the Big Five: *Openness to experience* is the tendency to be open to new aesthetic, cultural, or intellectual experiences; *Conscientiousness* refers to a tendency to be organized, responsible and hard working; *Extroversion* relates to an outward orientation rather than being reserved; *Agreeableness* is related to the tendency to act in a cooperative and unselfish manner; and *Neuroticism* (opposite of emotional stability) is the tendency to experience unpleasant emotions easily, such as anger, anxiety, depression, or vulnerability. Further, two questions were used to measure *hostile bias* which may be defined as over-attributing hostile intent to peers’ behaviours, even when the actual intent is benign or ambiguous. Finally, four questions adapted from the Melbourne Decision-Making Scale were used to assess *decision-making*, that is, whether individuals think about the future consequences of their decisions, and if they consider multiple options when making decisions. Traits are measured by taking the average standardized score on items corresponding to each trait.

Limiting ourselves to the sample where we have complete information on socio-economic characteristics, cognitive skills, and personality traits for employees, we conduct the analysis on a sample of 2,150 employees at 225 firms.¹⁰ Since wages and personality traits are measured contemporaneously in the survey, one may be concerned about reverse causality. However, as we discuss in Section 4.1, the average employee in our sample is 32 years old, falling in the working-age range, during which personality traits are most stable and any changes are not found to be economically significant (Cobb-Clark and Schurer, 2012).¹¹

4 Results

4.1 Descriptive Statistics

We begin with descriptive statistics of firm characteristics listed in Table 1. About 71 percent of firms report themselves as being profitable. On average, there are 193 employees per firm of which 25 percent are females. About 32 percent of the sample is made up of small firms (10-20 employees), while medium (21-70 employees) and large firms (71 or more employees) account for 30 and 38 percent respectively. Sixty one percent

⁹These questions are available in Appendix A.

¹⁰Since a concern may be that that employees who respond to all questions assessing skills and traits may be different from those who do not, we checked for the existence of any selection bias with a Heckman selection model, relying on measures of survey quality (identifiers for survey controllers and enumerators) as exclusion restrictions. We did not find evidence of significant selection effects in the wage regressions. These results are available from the authors upon request.

¹¹In fact, Almlund et al. (2011) discuss that addressing the potential problem of reverse causality by using previously measured traits as predictors of later outcomes can lead to errors in variables problem if the traits evolve over time.

of top managers in firms have a post-graduate degree. Only a paltry 4 percent of firms have females in top managerial positions. Ninety seven percent of firms maintain either formal or informal accounts and 96 percent of firms are registered with the government.

In terms of industrial sectors, the largest chunk of firms (32 percent) is engaged in manufacturing. Public administration and education make up 20-22 percent each. Finance firms constitute 19 percent while commerce represents the remaining 7 percent. Further, within the manufacturing firms, textiles and wearing apparel are the dominant activities comprising 37 percent and 27 percent respectively while food products make up 17 percent.

More than half of the firms are based in Dhaka, the capital city. Chittagong, the second largest city in Bangladesh has 10 percent of the firms, and Rajshahi and Rangpur account for 8-9 percent of firms respectively.

Moving on to employee characteristics in Table 2, out of 2,150 employees, 420 are female, thereby constituting 19.5 percent of the employee sample. Males are two years older than females (two-sided t-test; p -value = 0.00) but there is no significant difference in the proportion of married males and females (p -value = 0.83). Males have approximately half a year more of education than females (p -value = 0.03). Males also exhibit significantly greater tenure at the current firm (p -value = 0.02) and experience prior to joining the current firm (p -value = 0.04). Given these differences in endowments, a priori a higher wage for men is expected. However, as our data show, the average hourly wage of males and females is approximately 51 taka (0.51 euros in 2014) with the average gap not being statistically significant (two-sided t-test; p -value = 0.98). While the average wage is similar across sexes, there does exist a wage gap at various other critical points of the wage distribution with males earning more than females. As seen in Figure 1, the male wage distribution lies to the right of the female distribution; a Kolmogorov-Smirnov test shows them to be significantly different (p -value = 0.00). Note that while this wage gap may appear small for Bangladesh where gender-based inequalities are large and fairly persistent, one should bear in mind that our sample is comprised of firms in the formal sector, and self-selection of high ability workers into the formal sector is a priori greater for women than for men (Kingdon, 1998).

Moving on to cognitive skills as measured by reading and numeracy tests, our data show that men outperform women significantly in terms of the numeracy score (p -value = 0.00) and the reading score (p -value = 0.099) although the difference in the latter is weakly significant. Finally, in line with the literature documenting gender differences in personality traits (Feingold, 1994; Costa et al., 2001), females report significantly higher standardized scores on agreeableness (p -value = 0.057) and lower scores on emotional stability (p -value = 0.006) as compared to men. They also score higher on openness to experience (p -value = 0.002), decision-making (p -value = 0.001) and hostile bias

($p - value = 0.005$). Men score higher on extroversion and conscientiousness but the gender differences are not statistically significant.

Another factor that could explain the wage gap is differences in occupational status between males and females. While 4.6 percent of males and 2.6 percent of females are in managerial roles, approximately 19 percent of males and females are in professional positions. Further, while almost 21 percent of women are in unskilled elementary occupations, the proportion of men is 13 percent.

4.2 The Mean Gender Wage Gap

We first estimate OLS regressions for the pooled sample of males and females and cluster the standard errors at the firm level. The dependent variable is the log of the current hourly wage. We subsequently expand the list of explanatory variables. The first set consists of socio-economic characteristics such as marital status, years of completed education, years of prior experience and years of tenure, with a quadratic profile for the last three variables. Quadratic effects of experience and tenure are used to approximate the concave profile between these variables and wages. We also introduce a dummy variable that is equal to 1 when the worker is a woman and zero otherwise. In the second set, to measure cognitive skills, we further include standardized scores on the reading and numeracy tests. In the third set, to measure personality traits, we also include standardized values of scores on each of the Big Five traits (extroversion, agreeableness, conscientiousness, openness to experience, and emotional stability), and on hostile bias and decision-making. Cognitive skills and personality traits are measures of employees' (usually unobserved) ability. Hence, we do not try to correct for endogeneity of human capital variables using instruments or the control function approach (Wooldridge, 2002). The lack of plausible instruments in the data is one reason, but also, we believe that this addition represents an added value compared to other studies that rely on a control function approach to estimate returns to education (Söderbom et al., 2006; Kuepie et al., 2009), because here we can control for employees' ability, thereby in a way, purging the wage equation of the omitted ability bias.¹² Next, in each of these regressions, we can pick up the role of unobserved firm heterogeneity by introducing firm dummies in the regression. Finally, dummy variables for occupational status are also added to account for the fact that wages within the same firm could differ on account of different occupations. If the female dummy variable partially picks up these occupational effects, it would lead to an over-estimated gender effect. However, a problem is that occupational

¹²Söderbom et al. (2006) provide a discussion on whether the control function method can also address sample selectivity issues. Their answer is yes, provided the instruments are independent of the error term of the selected samples. We make a similar assumption here, i.e., that the cognitive skills and personality traits - a substitute to the control function approach - may be independent of the error term of the selected samples.

assignment may itself be the result of the employer’s practices and not due to differences in productivity or individual choice (Albrecht et al., 2003). Further, since we are interested in examining the effect of cognitive and non-cognitive skills on wages, we may not want to control for occupations if one believes that individuals’ skills determine their occupational preferences.¹³

Results are in Table 3. In column 1, we regress the log wage on only the female dummy and obtain a negative coefficient indicating a significant raw gender wage gap of 11.6 percent. In column 2, upon adding the socio-economic controls, the female coefficient reduces significantly to 5.7 percent. In column 3, once the standardized scores on cognitive tests are added, the gender wage gap remains virtually unchanged at 5.9 percent. The reading score is positively linked with wages but the numeracy score is not a significant determinant. While Glewwe et al. (2013) find that reading skills are not significant when controlling for educational attainment, in our case we find reading proficiency to matter even in the presence of years of education, indicating that the two variables are measuring different aspects of educational accumulation. In column 4, we further add the standardized scores of the personality traits, which leads to a slight drop in the female dummy to 5.5 percent. The personality traits are neither independently nor jointly significant suggesting that there is no incremental effect of these traits on mean wages. In columns 5-7, we augment each of these regressions by adding the firm dummies. The gender dummy coefficients are no longer significant. This indicates the existence of sorting of male and female workers across firms that pay different wages. A test of joint significance of the firm dummy variables shows them to be highly significant. This shows that wages are correlated with firm-specific factors, thereby making it crucial to account for firm-specific effects. In the presence of firm effects, both reading and numeracy scores have positive and significant coefficients. In column 8, we add occupation dummy variables, with the omitted category being managerial jobs. Note that the coefficient on the female dummy is reduced while still being insignificant. Cognitive test scores remain positive and significant. In results not reported in the table, we find wages on all occupation groups to be significantly lower than those of the managerial group. Tests (listed at the bottom of Table 3) indicate that reading and numeracy skills are jointly significant in determining mean wages while personality traits do not matter for pooled mean wages across the sexes.

In terms of other independent variables included in Table 3, we find that the education-wage relationship follows a convex profile. While this is contrary to the standard assumption of concave relationship between education and earnings, there is now ample evidence suggesting increasing returns to education across schooling levels (e.g., Kingdon

¹³Results with occupation controls are reported only for the OLS estimates. In all other estimates, we do not include occupation status for reasons outlined above. Results are available from authors upon request.

and Unni, 2001; Söderbom et al., 2006). Tenure in current firm has the expected concave relationship with wages.

4.3 Quantile Regressions

As can be seen in Figure 2, the magnitude of the unconditional gender wage gap varies considerably throughout the wage distribution with the highest gaps being observed at the lower percentiles and the smallest (and negative) wage gaps at the highest percentiles. This phenomenon of greater wage gaps at the lower end is consistent with the “sticky floor” parabola that has been observed primarily in developing countries (e.g., Chi and Li, 2008; Carrillo et al., 2014). We now estimate quantile regressions to determine how the magnitude of the gender wage gap changes along the wage distribution once we control for socio-economic characteristics, cognitive skills, and personality traits. By pooling the data for males and females in the quantile regression, the assumption is that the returns to endowments are the same at the various quantiles for men and women. In Table 4, we estimate pooled quantile regressions for the most inclusive specification, without firm-specific effects. The coefficient of the female dummy varies across the wage distribution with gaps being higher at the lower end. The gender wage gap is 11 percent at the 10th percentile, and 14.1 percent at the 25th percentile and then declining to 8.7 percent at the median. It further declines to 4.9 percent at the 75th and becomes negligible and insignificant at the 90th percentiles. The reading score is positive and significant at all percentiles except the 90th. Among the personality traits, openness to experience and decision-making are negatively associated with wages at the 10th percentile.

In Table 5, we add the firm-specific effects. In order to conduct fixed effects quantile regressions, we use the method proposed by Canay (2011). This alternative approach assumes that the unobserved heterogeneity terms have a pure location shift effect on the conditional quantiles of the dependent variable. We notice that with the inclusion of firm-specific effects, the gender wage gap is lower at all the estimated percentiles of the wage distribution, as compared to results of Table 4. There is then evidence of sorting across firms by workers at all points of the wage distribution. The wage gap at the 90th percentile, while reversed and now marginally in favor of women is not significant. Both reading and numeracy scores have higher correlations with wages at the lower percentiles than higher ones. Agreeableness is positively associated with wages at the 10th, 25th and 50th percentiles, and emotional stability is positively associated with wages at the first decile. On the contrary, openness to experience is negatively associated with wages at the 10th percentile. Conscientiousness is differentially related with wages at both ends of the conditional distribution: negatively linked with wages at the 10th percentile, but positively related to wages at the 90th percentile. Tests of joint significance of the cognitive and non-cognitive skills indicate that for both sets of quantile regressions (Tables 4 and

5) while reading and numeracy tests are jointly significant at all points, the personality traits are only significant at the 10th percentile.

In Table 6, we estimate the gender-specific OLS and quantile regressions with firm-specific effects.¹⁴ The reading score is positively associated with female wages at all reported percentiles but only at the 25th and 50th percentiles for male wages. On the other hand, the numeracy score is positively correlated with the wages of men at all points except the 90th percentile, but is never significant for women. While in the pooled quantile regressions with firm-specific effects in Table 5 we saw that the coefficients on reading and numeracy scores are positive throughout the distribution, it is now evident that these results are differentiated by gender. Considering the personality variables, we observe that conscientiousness is rewarded for women at all percentiles except the 90th. Agreeableness also has positive and mostly increasing returns for women across the conditional wage distribution. On the other hand, openness to experience has increasingly negative returns for women at the 50th, 75th and 90th percentiles. Interestingly, we find that emotional stability is negatively related with women’s wages at the median and the third quartile, although weakly. On the contrary, for men, the effects of personality traits are more sporadic and reveal no consistent pattern. Tests reveal that personality traits are jointly significant at all percentiles for females but that is not so for men, indicating that personality traits are more important for determining women’s wages than men’s wages. Nyhus and Pons (2005) using Dutch data also find that personality traits matter more for wages of females than males.

Our results of gender-specific quantile regressions provide some support about the market rewarding individuals who adhere to societal expectations about gender-appropriate traits and behaviour. For instance, agreeableness is a positive quality associated with women especially in a developing country like Bangladesh where gender roles are well-defined and women may be expected to be more submissive and accommodating in nature, both at home and at the workplace, and in our sample, we find that more agreeable women are rewarded monetarily for this trait. However, this result is in contrast to evidence from developed countries where the trait of agreeableness is generally linked to lower wages, perhaps because agreeable individuals may be “too nice”, extremely cooperative, and reluctant to negotiate their wages (e.g., Nyhus and Pons, 2005; Mueller and Plug, 2006). The finding that numeracy is a skill rewarded for men and literacy a skill rewarded for women is supported by existing literature that documents a male comparative advantage in mathematics and a female comparative advantage in reading, and underrepresentation of women in fields requiring intensive use of mathematics and science. Further, there is also some evidence that the male-female gap in mathematics performance is larger in

¹⁴Results of gender-specific regressions without firm fixed effects are available from the authors upon request.

more gender-unequal cultures (Guiso et al., 2008; Dickerson et al., 2015). This could explain employers internalizing beliefs about comparative advantages that men and women have in numeracy and literacy skills respectively and adhering to those stereotypes.

4.4 Decomposition Analysis

Table 7 reports results from the mean decomposition that decomposes the average wage gap into explained and unexplained components. Panel A only includes socio-economic controls for marital status, education, tenure, prior experience, panel B also includes the standardized scores for the reading and numeracy tests, and finally in panel C, the standardized personality scores are also added. In each of the panels, we report results using the male wage structure, the female wage structure (Blinder, 1973; Oaxaca, 1973), and the Neumark pooled model. While columns 2 and 3 report the decomposition results without firm-specific effects, columns 4 and 5 include the firm-specific effects.

Without the firm-specific effects, we see that across all the three panels, using the Neumark decomposition, about half of the gap is explained by characteristics with the rest being unexplained. As we move down from panel A to panels B and C, the explained component first reduces by 2 percentage points from 51.6 percent to 49.3 percent and then increases to 53.9 percent. This is in line with the coefficient of the female dummy variable marginally increasing in Table 3 as we move from including only socioeconomic characteristics in column 2 to also adding cognitive test scores in column 3. However, with the inclusion of firm-specific effects, the proportion explained increases significantly within each of the panels, as expected. Looking across panels, 74.8 percent of the wage gap is explained with only the socio-economic characteristics, and increases to 78.4 percent and reduces negligibly to 78.2 percent upon successively adding cognitive skills and personality traits respectively. Hence, in the presence of firm-specific effects, controlling for cognitive and non-cognitive skills increases the mean explained component by about 3.6 percentage points. Mirroring the OLS results from Table 3, upon comparing panels B and C, we find that non-cognitive skills do not have an additional contribution over and above the cognitive skills in explaining the average gender wage gap. To the extent that the unexplained component is indicative of gender wage discrimination, controlling for previously unmeasured cognitive and non-cognitive skills gets us to a closer approximation of actual wage discrimination.

Next, we move to the quantile decompositions performed at the 10th, 25th, 50th, 75th and 90th percentiles of the distribution. In Tables 8 and 9, we report results using the male coefficients, i.e. if females were paid like males, without and with firm-specific effects respectively. Within each of the three panels, it can be seen that the raw wage gap declines as one moves from the 10th percentile to the 90th percentile. Further, the share of coefficients declines as one moves to the upper end of the distribution, thereby

supporting the evidence of a sticky floor. This is reflected in the increasing proportion of the wage gap that can be attributed to differences in characteristics as one moves to the higher quantiles. In fact, in each of the panels of Table 9, note that at the 75th and 90th percentiles, differences in characteristics between the sexes (over)explain the entire wage gap. In panel A of Table 9, the characteristics account for 28 percent of the wage gap at the 25th percentile, and 123 percent at the 75th percentile; in panel C, the respective proportions are 24 and 139 percent. Besides, cognitive skills and personality traits mostly explain the gender wage gaps in the upper part of the conditional wage distribution as illustrated by the visible increase in the explained component at the 75th and 90th percentiles, as one moves from panel A to panels B and C.

To sum, the decompositions highlight that, contrary to what gender-pooled regressions on mean wages predict, the effects of cognitive and non-cognitive skills are essentially gender specific, and are thereby able to explain a non-negligible proportion of the gender wage gap. Besides, looking at distributional effects, these skills and traits appear to reduce the unexplained gender gap in the upper part of the conditional wage distribution.

4.5 Determinants of The Within-Firm Gender Wage Gap

In this section, we look at factors on account of which firms pay males and females differently. In relation to the previous sections, the purpose of this analysis is to identify how, in particular, employers' valuation of employees' cognitive and non-cognitive skills may affect the magnitude of the within-firm gender wage gap. Indeed, to the extent that employers value certain skills more than others, and have some common beliefs or stereotypes about the ability of male and female employees in the absence of perfect information on their productivity, this could affect the premium they pay to the two groups of employees.

In order to examine this, we follow a hierarchical modelling approach (Bryk and Raudenbush, 1992), also applied in Meng (2004) and Nordman and Wolff (2009a), where wage equations for males and females are first estimated separately using a fixed effects model:

$$w_{ij}^m = \beta^m X_{ij}^m + \theta_j^m + \epsilon_{ij}^m \quad (6)$$

$$w_{ij}^f = \beta^f X_{ij}^f + \theta_j^f + \epsilon_{ij}^f \quad (7)$$

The male and female firm fixed effects ($\hat{\theta}^m$ and $\hat{\theta}^f$) retrieved from these regressions reflect a premium paid by the firm to its male and female employees respectively, since other socio-economic characteristics (marital status, years of education, prior work experience,

and tenure at current firm) have already been controlled for in the above regressions.¹⁵ The difference between the male and female firm fixed effects ($\hat{\theta}^m - \hat{\theta}^f$) is an estimate of the within-firm gender wage gap. For this exercise, from the original sample of 500 firms and 6,981 employees, we restrict the sample to those firms that have at least two male and two female employees.¹⁶ This leaves us with a sample of 165 firms and 3,231 employees (2,494 males and 737 females).

In a second step, we introduce a host of firm-level characteristics in order to explain this within-firm wage gap and use OLS regressions. As suggested in the literature, the firm level characteristics we consider are: economic sector dummy variables, size of the firm, whether the firm is reported profitable, export status, age of the firm, proportion of female employees in the overall firm workforce, proportion of females in top managerial roles, whether the firm conducts a performance review from time to time, whether the manager is female and whether the manager has completed college and higher levels of education.

Employers are also asked to state on a scale of 1-10 (with 10 being most important) *how important they think* it is for employees, both managers/professionals and non-professionals, to have each of the following skills: communication, team work, problem-solving, literacy and numeracy, customer care, responsibility, reliability and trustworthiness, creativity, and vocational job-specific skills.¹⁷ We use the responses on each of these by computing standardized scores. In addition, employers are asked to list the top 3 cognitive and non-cognitive skills (among 14 skills in the questionnaire) they use to make decisions regarding compensation and promotions, separately for managers/professionals and non-professionals.¹⁸ We then construct dummy variables for professionals and non-professionals respectively taking the value 1 if employers declared any non-cognitive skills to be either first or second most important, as compared to cognitive skills.

In column 1 of Table 10, we report the estimates of the within-firm gender wage gap including a set of firm characteristics and two dummy variables for whether employers value non-cognitive skills more than cognitive skills for compensation and promotion decisions for professionals and non-professionals respectively. As is evident, this variable is positive and significant for non-professionals only, implying that employers who place more weight on non-cognitive skills for this group of workers have larger gender wage gaps within their firms, that works to the disadvantage of female employees. This might

¹⁵Our results are robust to controlling for occupations in the first stage regressions.

¹⁶If there is only one person of each sex in a firm, the estimated firm effect would be equal to the residual estimated for this person and firm and individual residuals cannot be separated.

¹⁷Professional staff includes managers; and technical and associate professionals. Non-professional staff refers to support and service workers and those in elementary occupations.

¹⁸The set of cognitive skills are: problem solving, literacy, numeracy, ICT, general vocational job-specific skills, advanced vocational job-specific skills and English language, while the non-cognitive skills include communication, team work, customer care, responsibility, reliability and trustworthiness, motivation and commitment, creativity, and confidence.

be due to the fact that these employers use non-cognitive skills as signals in the absence of better information on cognitive credentials, in particular for women.

In columns 2 and 3, we introduce standardized scores of importance given by employers to a number of cognitive and non-cognitive skills listed above, for non-professionals (column 2) and for professionals (column 3) to save on degrees of freedom. While none of the coefficients are significant for professionals, we find that firms that value problem-solving skills for non-professional workers have significantly greater gender wage gaps. This effect is robust when one considers a regression including all the regressors for professionals and non-professionals (column 4). Finally, in the most inclusive specification of column 4, valuing communication skills among non-professional workers appears to be negatively associated with the within-firm gender wage gap. Hence, in the absence of perfect observation of such skills among employees, perhaps employers make the assumption that males are better endowed than females with certain skills (such as problem solving), which would tend to increase the gender gap in the wage premium. In the same way, a supposed feminine trait like communication skills tends to decrease such a gap.

In terms of other firm characteristics, the share of females in the top management and the top manager being female is associated with smaller wage gaps within firms.¹⁹ This effect is robust across all specifications reported. Other variables such as education level of the manager, size of the firm, sector of operation, and proportion of females in the overall workforce are not consistently significant across columns in explaining within-firm gender wage gaps.

5 Discussion and Conclusion

In this paper, our objective has been to explain gender wage gaps in the formal sector of Bangladesh by including measures of cognitive skills and personality traits as additional determinants of wages. We believe it makes an important contribution especially when the existing literature on these issues is scarce for developing countries.

Our results show that, for the particular sample at hand, while cognitive skills, as measured by reading ability, are positively correlated with wages, measures of personality seem to have almost no explanatory power in determining mean wages for the pooled sample. Where the personality traits do matter, it is mostly for wages of female employees, and in certain parts of the wage distribution. Interestingly, the finding that reading and numeracy skills are positively correlated with wages across the distribution is driven by employees' sex such that reading and numeracy skills seem to confer benefits to men and women, respectively. Further, in line with OLS regressions, mean decompositions indicate that including measures of cognitive skills reduces the unexplained component by 3.6

¹⁹This finding is robust to excluding employees in managerial roles from our sample.

percentage points when firm effects are also accounted for, but personality traits do not play a role. Consistent with other developing country literature, quantile decompositions indicate the presence of a sticky floor phenomenon, which is revealed by higher adjusted wage gaps at the lower end of the conditional wage distribution, with the unexplained component being larger at lower percentiles. Cognitive skills and personality traits greatly reduce the unexplained gender gap in the upper part of the conditional wage distribution.

The finding that cognitive skills and socio-economic characteristics are more important, in general, than personality traits in determining wages is also supported by the outlook of employers in our sample. In the data, employers are asked to rate how important the following criteria are on a 1-10 scale when making hiring decisions (10 being very important): academic performance, work experience, job skills and interview. 68 percent, 57 percent and 50 percent of employers rated academic performance, work experience, job skills respectively between 8 and 10. On the other hand, only 36 percent of employers considered interview to be an important selection criteria. This suggests that employers place greater consideration on observables such as academic performance and prior work experience, rather than on a face-to-face interaction during an interview, which gives them the opportunity to assess certain soft skills of the person such as their assertiveness, agreeableness, communication skills, etc. This could also point to low levels of learning and cognition in countries such as Bangladesh, which might explain why employers care more about evaluating those skills. These results are in contrast to studies based on developed countries such as the United States that find employers rank “attitude” as the most important skill among new hires (Bowles et al., 2001). Our results are however in line with other developing country studies such as Glewwe et al. (2013) that find cognitive skills to matter more than non-cognitive skills for determining wages in rural China.

Finally, we also have investigated the determinants of the within-firm gender wage gap. Share of top position females in the firm and sex of the manager all seem to be robust significant determinants of the wage gap observed inside the firm. Besides, in the absence of perfect observation of workers’ productivity and skills as hypothesized above, employers appear to rely on signals to set wages. These signals may be based on skill preference and beliefs in the existence of sex-specific skills. For instance, employers seem to better remunerate those workers making proof of typical perceived sex-specific skills. How and why such stereotypes persist and cause gender inequality in labour market outcomes in Bangladesh, and more generally in developing countries, would be worth investigating further.

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Table 1: Descriptive Statistics of Firm Characteristics

Variable	Mean	SD
Making profit	0.71	0.45
Number of employees	192.8	810.8
Share of female employees	0.25	0.17
Top manager: female	0.04	0.19
Top manager: post-graduate level education	0.61	0.49
Small (10-20 employees)	0.324	0.47
Medium (21-70 employees)	0.298	0.46
Large (71+ employees)	0.378	0.49
Maintain accounts (either formal or informal)	0.97	0.16
Registered with government	0.96	0.21
Sector: Commerce	0.067	0.25
Sector: Education	0.227	0.42
Sector: Finance	0.191	0.39
Sector: Manufacturing	0.316	0.46
Sector: Public Admn	0.2	0.4
Location: Rajshahi	0.093	0.29
Location: Khulna	0.071	0.26
Location: Dhaka	0.56	0.50
Location: Chittagong	0.102	0.30
Location: Barisal	0.049	0.22
Location: Sylhet	0.044	0.21
Location: Rangpur	0.08	0.27
Number of firms	225	

Source: Authors' calculations using the Bangladesh Enterprise Skills Survey, 2012.

Table 2: Descriptive Statistics of Employee Characteristics

Variable	All	Males	Females	p-value
Wages				
Hourly wage - mean	50.91 (54.75)	50.92 (45.76)	50.87 (82.06)	
Ln(hourly wage) - mean	3.69 (0.63)	3.72 (0.61)	3.60 (0.69)	
Hourly wage - 5th percentile	16.28	16.96	14.53	
Hourly wage - 10th percentile	19.38	20.76	16.96	
Hourly wage - 25th percentile	26.65	26.65	24.01	
Hourly wage - 50th percentile	38.76	38.76	32.95	
Hourly wage - 75th percentile	58.14	58.14	52.33	
Hourly wage - 90th percentile	89.63	89.63	87.90	
Hourly wage - 95th percentile	116.28	116.28	116.28	
Socioeconomic Characteristics				
Females	0.195 (0.39)			
Age	32.26 (8.49)	32.62 (8.51)	30.81 (8.27)	0.00
Married	0.80 (0.40)	0.80 (0.40)	0.80 (0.40)	0.83
Years of education	10.57 (4.92)	10.69 (4.85)	10.10 (5.21)	0.03
Tenure in current firm	5.94 (6.08)	6.09 (6.17)	5.3 (5.66)	0.02
Years of prior experience	1.92 (2.93)	1.98 (3.01)	1.65 (2.58)	0.04
Cognitive Skills				
Reading test score	4.96 (2.54)	5.01 (2.49)	4.77 (2.75)	0.099
Numeracy test score	5.76 (1.99)	5.84 (1.94)	5.44 (2.17)	0.00
Personality Traits				
Openness to experience	2.60 (0.59)	2.59 (0.59)	2.68 (0.59)	0.002
Conscientiousness	2.86 (0.58)	2.87 (0.57)	2.83 (0.58)	0.2
Extroversion	2.32 (0.49)	2.32 (0.50)	2.33 (0.49)	0.63
Agreeableness	2.57 (0.58)	2.56 (0.57)	2.62 (0.60)	0.06
Emotional Stability	2.71 (0.56)	2.73 (0.56)	2.65 (0.56)	0.006
Hostile Bias	2.38 (0.73)	2.36 (0.72)	2.47 (0.74)	0.005
Decision-making	2.56 (0.55)	2.54 (0.55)	2.64 (0.54)	0.001
Number of employees	2150	1730	420	

Source: Authors' calculations using the Bangladesh Enterprise Skills Survey, 2012. Standard deviation reported in parentheses. Wages are reported in taka. The maximum score for the reading and numeracy tests is 8. The maximum score for the personality traits is 4. p-values based on two-sided t-tests comparing males and females.

Table 3: OLS Regressions

	Col.1	Col.2	Col.3	Col.4	Col.5	Col.6	Col.7	Col.8
Female	-0.116** (0.051)	-0.057** (0.029)	-0.060** (0.028)	-0.055* (0.028)	-0.038 (0.029)	-0.033 (0.028)	-0.033 (0.028)	-0.021 (0.027)
Married		0.052* (0.029)	0.054* (0.029)	0.052* (0.029)	0.030 (0.029)	0.032 (0.028)	0.031 (0.028)	0.024 (0.026)
Years of Education		0.008 (0.011)	-0.001 (0.012)	-0.000 (0.011)	0.003 (0.011)	-0.019* (0.011)	-0.019* (0.011)	-0.025** (0.012)
Years of Education squared/100		0.341*** (0.053)	0.358*** (0.052)	0.353*** (0.051)	0.364*** (0.054)	0.418*** (0.053)	0.417*** (0.053)	0.291*** (0.059)
Tenure in current firm		0.033*** (0.006)	0.032*** (0.006)	0.032*** (0.006)	0.040*** (0.006)	0.039*** (0.005)	0.039*** (0.005)	0.037*** (0.005)
Tenure in current firm squared/100		-0.053** (0.023)	-0.051** (0.023)	-0.050** (0.023)	-0.070*** (0.021)	-0.068*** (0.021)	-0.069*** (0.021)	-0.067*** (0.020)
Prior Experience		0.018 (0.016)	0.018 (0.016)	0.017 (0.016)	0.015 (0.016)	0.013 (0.015)	0.014 (0.015)	0.007 (0.014)
Prior Experience squared/100		0.044 (0.073)	0.046 (0.074)	0.049 (0.074)	0.067 (0.069)	0.074 (0.069)	0.073 (0.068)	0.084 (0.067)
Reading Score		0.047** (0.021)	0.050** (0.021)	0.050** (0.021)	0.052** (0.021)	0.052** (0.021)	0.053** (0.021)	0.055*** (0.020)
Numeracy Score		-0.015 (0.020)	-0.015 (0.020)	-0.012 (0.020)	0.040* (0.021)	0.040* (0.021)	0.039* (0.020)	0.037** (0.019)
Openness to experience		0.002 (0.015)	0.002 (0.015)	0.002 (0.015)	0.002 (0.015)	0.002 (0.015)	0.003 (0.014)	-0.008 (0.013)
Conscientiousness		0.004 (0.013)	0.004 (0.013)	0.004 (0.013)	0.004 (0.013)	0.004 (0.013)	-0.004 (0.014)	-0.005 (0.014)
Extroversion		0.005 (0.013)	0.005 (0.013)	0.005 (0.013)	0.005 (0.013)	0.005 (0.013)	-0.009 (0.012)	-0.013 (0.012)
Agreeableness		0.006 (0.017)	0.006 (0.017)	0.006 (0.017)	0.006 (0.017)	0.006 (0.017)	0.018 (0.013)	0.017 (0.013)
Emotional Stability		0.005 (0.013)	0.005 (0.013)	0.005 (0.013)	0.005 (0.013)	0.005 (0.013)	0.007 (0.011)	0.012 (0.011)
Hostile Bias		-0.000 (0.012)	-0.000 (0.012)	-0.000 (0.012)	-0.000 (0.012)	-0.000 (0.012)	0.003 (0.012)	0.001 (0.011)
Decision Making		-0.024 (0.015)	-0.024 (0.015)	-0.024 (0.015)	-0.024 (0.015)	-0.024 (0.015)	-0.005 (0.013)	0.001 (0.013)
Constant	3.718*** (0.033)	2.917*** (0.073)	2.990*** (0.082)	2.995*** (0.080)	2.934*** (0.072)	3.089*** (0.064)	3.086*** (0.063)	3.735*** (0.110)
Observations	2150	2150	2150	2150	2150	2150	2150	2150
R ²	0.005	0.488	0.490	0.491	0.661	0.665	0.666	0.696
Firm effects	No	No	No	No	Yes	Yes	Yes	Yes
Occupation controls	No	No	No	No	No	No	No	Yes
Joint sig. of cognitive skills (p-value)			0.08	0.06		0.00	0.00	0.00
Joint sig. of personality traits (p-value)				0.85			0.92	0.78

Note: Dependent variable is log of current hourly wage. Standard errors clustered at the firm level are reported in parentheses. *** significant at 1%, ** significant at 5%, * significant at 10%.

Table 4: Quantile Regressions

	Q10	Q25	Q50	Q75	Q90
Female	-0.111*** (0.038)	-0.141*** (0.040)	-0.087*** (0.027)	-0.049 (0.031)	-0.007 (0.048)
Married	0.109*** (0.037)	0.099*** (0.035)	0.057** (0.025)	0.049 (0.037)	0.028 (0.041)
Years of Education	-0.017 (0.015)	-0.010 (0.013)	-0.011 (0.009)	-0.008 (0.010)	0.007 (0.015)
Years of Education squared/100	0.390*** (0.054)	0.361*** (0.052)	0.380*** (0.038)	0.397*** (0.050)	0.418*** (0.078)
Tenure in current firm	0.011 (0.008)	0.030*** (0.007)	0.032*** (0.007)	0.036*** (0.007)	0.041*** (0.008)
Tenure in current firm squared/100	-0.005 (0.028)	-0.063** (0.029)	-0.053* (0.027)	-0.044 (0.031)	-0.069** (0.028)
Prior Experience	-0.001 (0.013)	0.009 (0.014)	0.030** (0.013)	0.028* (0.014)	0.014 (0.018)
Prior Experience squared/100	0.061 (0.048)	0.033 (0.063)	-0.013 (0.071)	0.007 (0.083)	0.151 (0.101)
Reading Score	0.060** (0.030)	0.055*** (0.020)	0.056*** (0.018)	0.067*** (0.020)	0.030 (0.025)
Numeracy Score	0.014 (0.020)	0.000 (0.015)	-0.010 (0.011)	-0.028 (0.019)	-0.038 (0.026)
Openness to experience	-0.034* (0.019)	-0.007 (0.013)	0.003 (0.011)	0.011 (0.017)	0.005 (0.017)
Conscientiousness	-0.001 (0.018)	-0.014 (0.013)	0.003 (0.012)	0.016 (0.014)	0.021 (0.019)
Extroversion	-0.005 (0.015)	0.016 (0.012)	0.006 (0.009)	0.017 (0.013)	0.000 (0.014)
Agreeableness	0.014 (0.021)	0.019 (0.014)	0.004 (0.011)	-0.011 (0.015)	-0.000 (0.015)
Emotional Stability	0.023 (0.020)	0.013 (0.012)	-0.006 (0.012)	-0.006 (0.015)	0.006 (0.016)
Hostile Bias	-0.001 (0.017)	0.003 (0.013)	0.003 (0.009)	0.006 (0.015)	0.002 (0.019)
Decision Making	-0.031* (0.017)	-0.014 (0.015)	-0.017 (0.012)	-0.012 (0.016)	-0.026 (0.017)
Constant	2.720*** (0.096)	2.834*** (0.085)	3.041*** (0.062)	3.209*** (0.062)	3.294*** (0.081)
Observations	2150	2150	2150	2150	2150
Joint sig. of cognitive skills (p-value)	0.05	0.02	0.00	0.01	0.19
Joint sig. of personality traits (p-value)	0.00	0.56	0.83	0.65	0.73

Note: Dependent variable is log of current hourly wage. Bootstrapped standard errors based on 100 replications are reported in parentheses. *** significant at 1%, ** significant at 5%, * significant at 10%.

Table 5: Quantile Regressions (with firm specific effects)

	Q10	Q25	Q50	Q75	Q90
Female	-0.075*** (0.027)	-0.073*** (0.023)	-0.045** (0.019)	-0.042* (0.023)	0.009 (0.036)
Married	0.047* (0.027)	0.025 (0.021)	0.044*** (0.016)	0.046** (0.023)	0.035 (0.035)
Years of Education	-0.034*** (0.011)	-0.037*** (0.007)	-0.022*** (0.005)	-0.007 (0.008)	-0.011 (0.009)
Years of Education squared/100	0.458*** (0.050)	0.489*** (0.030)	0.428*** (0.023)	0.381*** (0.038)	0.423*** (0.052)
Tenure in current firm	0.037*** (0.008)	0.041*** (0.003)	0.041*** (0.005)	0.037*** (0.005)	0.037*** (0.006)
Tenure in current firm squared/100	-0.074** (0.031)	-0.077*** (0.012)	-0.075*** (0.019)	-0.052** (0.021)	-0.044** (0.019)
Prior Experience	0.011 (0.016)	0.011 (0.010)	0.008 (0.008)	0.016 (0.012)	0.021 (0.015)
Prior Experience squared/100	0.029 (0.080)	0.055 (0.048)	0.072 (0.050)	0.080 (0.065)	0.112 (0.078)
Reading Score	0.070*** (0.018)	0.071*** (0.015)	0.055*** (0.014)	0.036*** (0.013)	0.033* (0.017)
Numeracy Score	0.046*** (0.017)	0.032*** (0.011)	0.029*** (0.009)	0.027** (0.012)	0.034** (0.017)
Openness to experience	-0.024* (0.014)	-0.010 (0.011)	-0.001 (0.009)	0.012 (0.011)	0.002 (0.014)
Conscientiousness	-0.033** (0.016)	-0.012 (0.010)	-0.001 (0.008)	-0.003 (0.010)	0.025* (0.015)
Extroversion	-0.009 (0.010)	-0.011 (0.008)	-0.009 (0.009)	0.002 (0.010)	-0.006 (0.013)
Agreeableness	0.029* (0.017)	0.023** (0.011)	0.020** (0.008)	0.018 (0.014)	0.005 (0.015)
Emotional Stability	0.025* (0.014)	-0.000 (0.010)	0.011 (0.010)	0.010 (0.012)	-0.006 (0.014)
Hostile Bias	0.002 (0.015)	0.002 (0.011)	0.009 (0.010)	-0.001 (0.009)	0.004 (0.016)
Decision Making	-0.024 (0.015)	-0.008 (0.011)	-0.007 (0.009)	-0.003 (0.011)	-0.002 (0.015)
Constant	2.841*** (0.065)	3.004*** (0.044)	3.080*** (0.033)	3.168*** (0.051)	3.351*** (0.056)
Observations	2150	2150	2150	2150	2150
Joint sig. of cognitive skills (p-value)	0.00	0.00	0.00	0.00	0.00
Joint sig. of personality traits (p-value)	0.01	0.37	0.28	0.69	0.74

Note: Dependent variable is log of current hourly wage. Bootstrapped standard errors based on 100 replications are reported in parentheses. *** significant at 1%, ** significant at 5%, * significant at 10%.

Table 6: Gender-Specific OLS and Quantile Regressions (with firm specific effects)

	OLS	Q10	Q25	Q50	Q75	Q90	OLS	Q10	Q25	Q50	Q75	Q90
	Males	Males	Males	Males	Males	Males	Females	Females	Females	Females	Females	Females
Married	0.033 (0.030)	0.059 (0.036)	0.033 (0.026)	0.043** (0.018)	0.049** (0.024)	0.045 (0.037)	0.074 (0.083)	0.033 (0.063)	0.078* (0.044)	0.075*** (0.021)	0.073** (0.032)	0.084 (0.067)
Years of education	-0.016 (0.012)	-0.032** (0.013)	-0.037*** (0.008)	-0.019*** (0.004)	-0.009 (0.009)	-0.014 (0.012)	-0.057* (0.032)	-0.066*** (0.019)	-0.054*** (0.013)	-0.057*** (0.007)	-0.053*** (0.011)	-0.065*** (0.025)
Years of education squared/100	0.402*** (0.060)	0.446*** (0.054)	0.484*** (0.034)	0.418*** (0.021)	0.393*** (0.040)	0.440*** (0.060)	0.588*** (0.149)	0.660*** (0.089)	0.585*** (0.057)	0.588*** (0.029)	0.549*** (0.052)	0.621*** (0.114)
Tenure in current firm	0.039*** (0.006)	0.037*** (0.008)	0.040*** (0.004)	0.044*** (0.004)	0.033*** (0.006)	0.037*** (0.007)	0.052*** (0.018)	0.045*** (0.017)	0.042*** (0.007)	0.051*** (0.004)	0.050*** (0.010)	0.061*** (0.019)
Tenure in current firm squared/100	-0.069*** (0.024)	-0.074** (0.030)	-0.078*** (0.012)	-0.096*** (0.018)	-0.046* (0.025)	-0.042 (0.027)	-0.073 (0.085)	-0.041 (0.105)	-0.040 (0.038)	-0.074*** (0.011)	-0.075 (0.057)	-0.086 (0.094)
Prior Experience	0.021 (0.014)	0.008 (0.016)	0.014 (0.008)	0.018*** (0.007)	0.022* (0.013)	0.045*** (0.013)	-0.025 (0.079)	0.013 (0.049)	0.005 (0.019)	-0.030*** (0.011)	-0.038 (0.027)	-0.028 (0.061)
Prior Experience squared/100	0.030 (0.056)	0.079 (0.069)	0.049 (0.039)	0.035 (0.033)	0.031 (0.056)	-0.030 (0.053)	0.186 (0.269)	-0.007 (0.315)	0.012 (0.127)	0.235*** (0.084)	0.250 (0.198)	0.200 (0.734)
Reading Score	0.027 (0.022)	0.057** (0.025)	0.046*** (0.018)	0.017 (0.012)	0.013 (0.017)	0.017 (0.022)	0.126* (0.075)	0.082* (0.047)	0.101*** (0.033)	0.126*** (0.013)	0.153*** (0.032)	0.156*** (0.060)
Numeracy Score	0.048* (0.026)	0.063*** (0.016)	0.045*** (0.011)	0.032*** (0.010)	0.036*** (0.013)	0.027 (0.020)	-0.015 (0.036)	-0.019 (0.031)	-0.016 (0.022)	-0.016 (0.012)	-0.014 (0.020)	-0.015 (0.049)
Openness to experience	-0.007 (0.014)	-0.023 (0.019)	-0.015 (0.011)	0.000 (0.010)	0.014 (0.013)	-0.017 (0.017)	-0.041 (0.055)	-0.007 (0.031)	-0.023 (0.018)	-0.041*** (0.011)	-0.058** (0.026)	-0.100*** (0.038)
Conscientiousness	-0.008 (0.017)	-0.032* (0.017)	-0.017* (0.010)	-0.000 (0.008)	-0.005 (0.013)	0.026* (0.014)	0.044 (0.043)	0.053* (0.028)	0.043** (0.020)	0.045*** (0.009)	0.038** (0.016)	0.017 (0.030)
Extroversion	-0.007 (0.013)	-0.006 (0.015)	-0.019* (0.011)	-0.012 (0.008)	0.002 (0.010)	-0.008 (0.013)	-0.012 (0.039)	0.011 (0.027)	-0.041** (0.017)	-0.013 (0.010)	0.009 (0.017)	0.043 (0.027)
Agreeableness	0.008 (0.015)	0.027 (0.020)	0.024** (0.012)	0.011 (0.010)	-0.003 (0.013)	-0.012 (0.015)	0.102** (0.044)	0.055* (0.032)	0.067*** (0.019)	0.103*** (0.011)	0.100*** (0.019)	0.137*** (0.039)
Emotional Stability	0.006 (0.012)	0.030 (0.018)	-0.003 (0.011)	0.006 (0.009)	0.012 (0.011)	-0.015 (0.013)	-0.018 (0.032)	-0.008 (0.032)	-0.009 (0.019)	-0.018* (0.010)	-0.035* (0.019)	-0.044 (0.042)
Hostile Bias	0.001 (0.013)	-0.009 (0.017)	-0.003 (0.011)	0.008 (0.007)	0.007 (0.010)	0.004 (0.018)	-0.002 (0.037)	0.070*** (0.024)	0.030 (0.019)	-0.004 (0.011)	-0.027* (0.015)	-0.012 (0.034)
Decision Making	-0.007 (0.015)	-0.038** (0.017)	-0.013 (0.011)	-0.007 (0.009)	-0.010 (0.016)	0.015 (0.016)	0.021 (0.049)	-0.007 (0.035)	0.003 (0.019)	0.021** (0.009)	0.034 (0.021)	0.029 (0.039)
Constant	3.074*** (0.070)	2.832*** (0.083)	3.017*** (0.048)	3.055*** (0.035)	3.191*** (0.061)	3.314*** (0.071)	3.147*** (0.188)	2.827*** (0.134)	2.977*** (0.090)	3.155*** (0.045)	3.284*** (0.088)	3.407*** (0.165)
Observations	1730	1730	1730	1730	1730	1730	420	420	420	420	420	420
Joint sig. of cognitive skills (p-value)	0.07	0.00	0.00	0.00	0.02	0.18	0.25	0.22	0.01	0.00	0.00	0.02
Joint sig. of personality traits (p-value)	0.99	0.03	0.03	0.62	0.88	0.58	0.47	0.00	0.00	0.00	0.00	0.00

Note: Dependent variable is log of current hourly wage. Bootstrapped standard errors based on 100 replications are reported in parentheses. *** significant at 1%, ** significant at 5%, * significant at 10%.

Table 7: Mean Wage Decomposition

	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
		Without firm fixed effects		With firm fixed effects	
Panel A:	Total	Difference in	Difference in	Difference in	Difference in
Only socio-economic characteristics	difference	endowments	coefficients	endowments	coefficients
Male non-discriminatory structure	0.116	0.067	0.049	0.015	0.101
Female non-discriminatory structure	0.116	0.057	0.059	0.076	0.04
Pooled (Neumark) non-discriminatory structure	0.116	0.060	0.056	0.087	0.029
% of wage gap (Neumark)	100	51.6	48.4	74.8	25.2
Panel B:					
Adding cognitive skills					
Male non-discriminatory structure	0.116	0.056	0.06	0.034	0.082
Female non-discriminatory structure	0.116	0.055	0.061	0.08	0.036
Pooled (Neumark) non-discriminatory structure	0.116	0.057	0.059	0.091	0.025
% of wage gap (Neumark)	100	49.3	50.7	78.4	21.6
Panel C:					
Adding personality scores					
Male non-discriminatory structure	0.116	0.06	0.056	0.038	0.078
Female non-discriminatory structure	0.116	0.061	0.055	0.08	0.036
Pooled (Neumark) non-discriminatory structure	0.116	0.062	0.053	0.091	0.025
% of wage gap (Neumark)	100	53.9	46.1	78.2	21.8

Note: Panel A includes education, tenure, experience and the squared terms. Panel B further adds standardized scores for cognitive skills. In Panel C, standardized personality scores are also included.

Table 8: Quantile Decompositions of Log Wage Gaps

Percentile	Col.1 Difference	Col.2 Characteristics	Col.3 Coefficients
Panel A: Only socio-economic characteristics			
10	0.182*** (0.018)	0.036 (0.035)	0.146*** (0.036)
25	0.171*** (0.013)	0.045 (0.029)	0.126*** (0.033)
50	0.123*** (0.014)	0.055* (0.027)	0.068*** (0.033)
75	0.088*** (0.018)	0.085* (0.039)	0.003 (0.047)
90	0.054** (0.025)	0.13* (0.065)	-0.077 (0.071)
Panel B: Adding cognitive skills			
10	0.194 (0.184)	0.022 (0.069)	0.172*** (0.063)
25	0.173** (0.08)	0.037 (0.032)	0.136*** (0.031)
50	0.118*** (0.022)	0.055 (0.03)	0.064* (0.035)
75	0.082** (0.042)	0.077 (0.044)	0.005 (0.049)
90	0.063 (0.132)	0.114 (0.071)	-0.051 (0.078)
Panel C: Adding personality scores			
10	0.187*** (0.018)	0.019 (0.038)	0.168*** (0.034)
25	0.167*** (0.014)	0.042 (0.029)	0.125*** (0.029)
50	0.111*** (0.016)	0.052 (0.03)	0.059* (0.036)
75	0.091*** (0.021)	0.084* (0.037)	0.007 (0.044)
90	0.063*** (0.027)	0.107* (0.055)	-0.044 (0.059)

Note: Bootstrapped standard errors based on 150 replications reported in parentheses. *** significant at 1%, ** significant at 5%, * significant at 10%. Panel A includes education, tenure, experience and the squared terms. Panel B further adds standardized scores for reading and numeracy tests. In Panel C, standardized personality scores are also included.

Table 9: Quantile Decompositions of Log Wage Gaps (with firm specific effects)

Percentile	Col.1 Difference	Col.2 Characteristics	Col.3 Coefficients
Panel A: Only socio-economic characteristics			
10	0.163*** (0.014)	0.028 (0.026)	0.134*** (0.028)
25	0.141*** (0.013)	0.039 (0.023)	0.102*** (0.025)
50	0.109*** (0.015)	0.058 (0.028)	0.051 (0.034)
75	0.076*** (0.019)	0.094** (0.039)	-0.018 (0.041)
90	0.071*** (0.02)	0.135*** (0.052)	-0.064 (0.051)
Panel B: Adding cognitive skills			
10	0.165*** (0.015)	0.011 (0.029)	0.154*** (0.028)
25	0.147*** (0.015)	0.039 (0.026)	0.107*** (0.029)
50	0.096*** (0.016)	0.051 (0.03)	0.045 (0.039)
75	0.06*** (0.019)	0.083** (0.035)	-0.023 (0.045)
90	0.072*** (0.021)	0.129** (0.049)	-0.057 (0.054)
Panel C: Adding personality scores			
10	0.171*** (0.013)	0.009 (0.029)	0.162*** (0.027)
25	0.146*** (0.012)	0.035 (0.027)	0.111*** (0.028)
50	0.092*** (0.016)	0.049 (0.028)	0.043 (0.037)
75	0.064*** (0.021)	0.089** (0.032)	-0.025 (0.04)
90	0.064*** (0.022)	0.126** (0.047)	-0.061 (0.059)

Note: Bootstrapped standard errors based on 150 replications reported in parentheses. *** significant at 1%, ** significant at 5%, * significant at 10%. Panel A includes education, tenure, experience and the squared terms. Panel B further adds standardized scores for reading and numeracy tests. In Panel C, standardized personality scores are also included.

Table 10: Within-Firm Gender Wage Gap

	Col.1	Col.2	Col.3	Col.4
Education	-0.199** (0.092)	-0.189* (0.106)	-0.189* (0.110)	-0.176 (0.116)
Finance	-0.167** (0.084)	-0.186** (0.093)	-0.160 (0.097)	-0.161 (0.102)
Manufacturing	-0.207 (0.125)	-0.280** (0.138)	-0.180 (0.142)	-0.243 (0.151)
Public Admn	-0.104 (0.103)	-0.110 (0.118)	-0.086 (0.119)	-0.092 (0.125)
21-70 employees	-0.108 (0.070)	-0.077 (0.064)	-0.094 (0.072)	-0.082 (0.071)
71 or more employees	-0.131* (0.067)	-0.076 (0.065)	-0.110 (0.073)	-0.071 (0.069)
Age of firm	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
% of females	0.310* (0.182)	0.290 (0.199)	0.311 (0.205)	0.240 (0.211)
% of top mgmt females	-0.486*** (0.170)	-0.422** (0.188)	-0.414** (0.183)	-0.385* (0.198)
Formal performance review	0.001 (0.045)	0.005 (0.049)	0.009 (0.047)	0.020 (0.050)
Firm is profitable	0.048 (0.055)	0.035 (0.056)	0.049 (0.054)	0.034 (0.057)
Firm exports	0.021 (0.079)	0.053 (0.084)	0.043 (0.081)	0.053 (0.085)
Female manager	-0.187** (0.089)	-0.192** (0.094)	-0.202** (0.091)	-0.190* (0.097)
Manager college educated	-0.153 (0.106)	-0.184* (0.103)	-0.164 (0.103)	-0.180* (0.096)
Value non-cognitive skills for non-professionals	0.131** (0.057)			
Value non-cognitive skills for professionals	0.012 (0.047)			
<u>Importance given for non-professionals:</u>				
Communication skills		-0.044 (0.038)		-0.102* (0.057)
Team work skills		-0.029 (0.033)		-0.015 (0.035)
Problem solving skills		0.086** (0.039)		0.099** (0.049)
Literacy skills		-0.029 (0.045)		-0.040 (0.055)
Numeracy skills		-0.011 (0.035)		-0.008 (0.043)
Customer care skills		-0.001 (0.035)		-0.006 (0.040)
Responsibility		0.018 (0.037)		0.019 (0.047)
Creativity		-0.015 (0.031)		-0.038 (0.042)
Vocational job-specific skills		-0.015 (0.035)		-0.012 (0.059)
<u>Importance given for professionals:</u>				
Communication skills			0.002 (0.031)	0.061 (0.047)
Team work skills			0.002 (0.034)	0.020 (0.034)
Problem solving skills			-0.018 (0.034)	-0.055 (0.040)
Literacy skills			-0.009 (0.033)	0.007 (0.041)
Numeracy skills			-0.004 (0.033)	0.001 (0.042)
Customer care skills			-0.021 (0.038)	-0.005 (0.039)
Responsibility			0.022 (0.033)	-0.006 (0.044)
Creativity			0.045 (0.034)	0.053 (0.044)
Vocational job-specific skills			-0.031 (0.030)	-0.005 (0.053)
Observations	164	164	164	164
R ²	0.189	0.218	0.189	0.256

Note: Robust standard errors in parentheses. *** significant at 1%, ** significant at 5%, * significant at 10%.

Figure 1: Hourly Wage Distributions by Gender

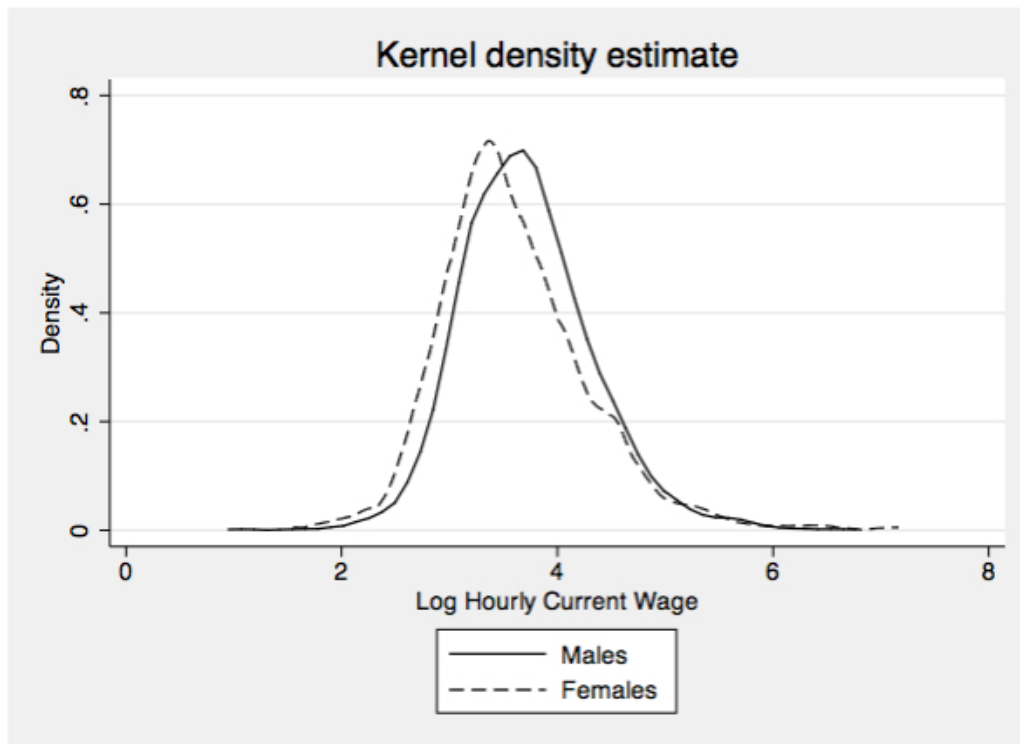
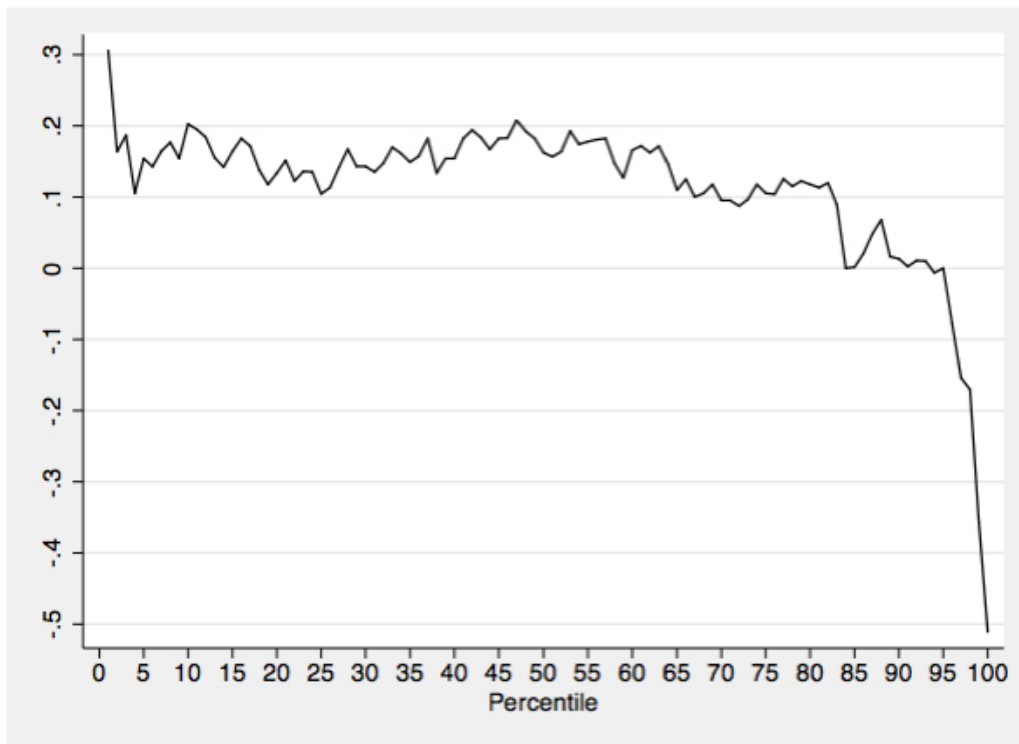


Figure 2: Gender Wage Gap Distribution



A Personality Questionnaire

How do you see yourself?

Response scale: Almost always; Most of the time; Some of the time; Almost never

Agreeableness:

Are you very polite to other people?

Are you generous to other people with your time or money?

Do you forgive other people easily?

Conscientiousness:

When doing a task, are you very careful?

Do you work very well and quickly?

Do you prefer relaxation more than hard work?

Neuroticism:

Are you relaxed during stressful situations?

Do you tend to worry?

Do you get nervous easily?

Extroversion:

Are you talkative?

Are you outgoing and sociable, for example, do you make friends very easily?

Do you like to keep your opinions to yourself?

Openness:

Do you come up with ideas other people haven't thought of before?

Are you very interested in learning new things?

Do you enjoy beautiful things, like nature, art and music?

Hostile Attribution Bias:

Do people take advantage of you?

Are people mean/not nice to you?

Decision-making:

Do you think about how the things you do will affect you in the future?

Do you think carefully before you make an important decision?

Do you ask for help when you don't understand something?

Do you think about how the things you do will affect others?