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Multiple Glass Ceilings

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ABSTRACT

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Both vertical (between job levels) and horizontal (within job levels) mobility can be sources of wage growth. We find that the glass ceiling operates at both margins. The unexplained part of the wage gap grows across job levels (glass ceiling at the vertical margin) and across the deciles of the intra-job-level wage distribution (glass ceiling at the horizontal margin). This implies that women face many glass ceilings, one for each job level above the second, and that the glass ceiling is a pervasive phenomenon. In the Netherlands it affects about 88% of jobs, and 81% of Dutch women in employment work in job levels where a glass ceiling is present.

JEL Classification: J31, J24, J22

Keywords: glass ceiling, wage gap, gender

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1. Introduction

Recent analyses of US case studies – summarized in Shatnawi et al. (2011) – show that women's wages suffer from the effects of hierarchical segregation already at low job levels. This seems to suggest that hierarchical segregation is a rather pervasive phenomenon. This evidence is hard to reconcile with the literature on the glass ceiling, however, which has stressed that women's careers suddenly slow down (or stop) when approaching management positions. This literature has focused on the small fraction of women in the right-hand-side tail of the wage distribution (Muñoz-Bullon, 2010).[2]

In this paper we argue that these two facts coexist if the analysis is carried out at the job level. This is a relevant level of analysis, because both vertical and horizontal (or lateral) careers have equally important effects on wages, at least in the Dutch labor market (Dohmen et al., 2004). Vertical mobility entails movements between job levels, whereas horizontal mobility entails wage growth within the job level.[3] The effects of the glass ceiling on horizontal careers have not been investigated to date.

Studies that use a widening of the gender wage gap's unexplained part in the upper percentiles of the wage distribution (for example Albrecht et al., 2003; Arulampalan et al., 2007) have detected the glass ceiling at the highest job level. However, the quantiles of the wage distribution do not map one-to-one to job levels because there is a substantial overlap of wage distributions between adjacent job levels. Consequently, these studies have failed to detect a glass ceiling below the highest job levels.

This paper demonstrates that when the analysis is performed at the job level the glass ceiling becomes a pervasive phenomenon: most women work in job levels that are characterized by a glass ceiling. More specifically, the paper contributes to the literature in two ways. First, it shows that gender differences in job-level attainment account for a substantial portion of the unexplained gender wage gap.[4] Second, it shows that the glass ceiling is not necessarily limited to women's entrance into managerial positions. Women face multiple glass ceilings – in principle one at each

[2] The glass ceiling appears to be quite a common feature of many European labor markets (Albrecht et al., 2003; Kee, 2006; Arulampalan et al., 2007; de la Rica et al., 2008).

[3] Horizontal careers are made possible by the substantial intra-job-level wage variation that can be considered as an intra-job-level wage distribution.

[4] The importance of gender difference in job-level attainment stems from the consideration that the glass ceiling could be an impediment to women's career in general (Baxter and Wright, 2000; Wright and Baxter, 2000). Its presence would affect women's wages at lower job levels as well (Britton and Williams, 2000). In fact, women reach lower job grades than comparable male colleagues in Sweden, thus implying slower careers and a lower incidence of promotions (Kwon et al., 2010). Also Dutch women are less likely to be found in jobs offering career prospects; nevertheless, conditional on being in such an occupation, Dutch men and women have equal promotion probabilities (Groot and Maarsen van den Brink, 1996). Empirical analyses of gender difference in promotion rates show that US women have lower promotion probability than men (McCue, 1996; Pergamit and Veum, 1999; Cobb-Clark, 2001). However, studies using UK data have found that the probability of promotion does not differ across gender (Booth et al., 2003).

job level – because the glass ceiling stops their progression towards the highest deciles of the intra-job-level wage distribution. In this incarnation, the glass ceiling becomes a pervasive characteristic of the Dutch labor market, in which the majority of jobs and women are found in job levels characterized by a job-level-specific glass ceiling.

The paper is structured as follows. Section 2 describes the data. Section 3 analyzes gender differences in wages across the overall wage distribution. Section 4 focuses on the vertical margin of the glass ceiling in the Dutch labor market using the Brown–Moon–Zoloth generalization of the Oaxaca–Blinder decomposition (Brown et al., 1980). Section 5 investigates the pervasiveness of the glass ceiling effect on horizontal career moves by applying the quantile decomposition technique to the intra-job-level wage distribution (the intra-job-level glass ceiling). Section 6 complements this analysis by investigating the incidence of women in the low and high wage segments of the (men's) wage distribution and their wage in expectation. Section 7 offers some concluding remarks.

2. Data

We use an employer-employee matched data set that was compiled from administrative records of a broad sample of firms from all economic sectors. The data were constructed by the Dutch ministry of Social Affairs and Employment (Venema and Faas, 1999). The data set has two unique features. First, it contains a description of the job level, which is linked to both the degree of autonomy in decision-making and the complexity of the tasks. The full content of the job description (and of the occupational classification) can be found in Appendix I (while additional information on the data can be found in (Hassink and Russo, 2010). We use this information to organize jobs into a hierarchy consisting of 7 levels (for confidentiality reasons, it has not been possible to use the part of the data relative to job levels VII and VIII: top management, board of directors and CEOs). These definitions apply to all firms, so that inter-firm hierarchical job levels can be interpreted as comparable.

The second feature of the dataset is that it contains detailed and precise administrative information on wages (descriptive statistics are displayed in Appendix 2). The recorded wages consist of two parts: the so-called "base wage", which is linked to job title and occupation (this is the wage definition used in standard wage scales), and a variable (individual) wage component, which includes overtime payments, compensating differentials (for unpleasant working conditions), performance-related pay, and any other form of individual (incentive) pay.[5]

[5] The dataset also contains information on workers' characteristics (age, tenure with current employer, gender, non-Dutch nationality, educational level attained, and normal working hours), occupation and firm characteristics (number of employees and economic sector).

We will use the base wage of the individual worker. This is the wage component that is least sensitive to (unobserved) personal characteristics, since it excludes individual performance-related pay components. Hence the gender wage gap that we describe should be regarded as a conservative estimate of the real gender wage gap. Throughout the analysis, our dependent variable is the log of the hourly base wage (the base wage divided by the contractual number of working hours).

The dataset consists of 77,707 workers, of whom 52,402 men and 25,305 women (67.5% and 32.5%, respectively). Full-time jobs (at least 36 hours a week) account for the bulk of the positions (75%). 75% (18%) of part-time (full-time) jobs are held by women. Because of the important role of marginal jobs for Dutch women, we have distinguished between small part-time jobs – fewer than 20 hours – accounting for about 10.5% of all jobs, and regular part-time jobs – fewer than 36 hours but more than 20 hours – accounting for the remaining 14.5% of all jobs.

Table 1 about here

Table 1 shows the distribution of jobs, men, and women across the hierarchical job ladder. The fifth column shows that about 70% of all jobs are concentrated in just three rungs of the job ladder (job levels 3, 4, and 5). Moreover, the sixth column shows that the incidence of women decreases with the job level.[6]

For each of the job levels, we have determined the wage distribution. Remarkably, there is a substantial overlap in wage distribution between adjacent hierarchical job levels (see columns 4 and 10 of Table 1). The first decile of the wage distribution at a specific level k, (k=1,…,7), is always below the ninth decile of the wage distribution of the level directly below (level k-1). To quantify the degree of overlap, the fourth column in Table 1 shows the percentage of workers at job level k whose wage is below the ninth decile of the wage distribution at job level k-1.[7] The degree of overlap does not differ substantially among full-time workers. This brings us to the important conclusion that information on the overall wage distribution per se is not sufficient to investigate gender segmentation at the level of the job.

[6] The pattern is clearly visible when part-time jobs are included (left panel of Table 1), but it is less dramatic when full-time jobs only are considered (right panel). In fact, the women employed in the first three layers of the job ladder make up 44% of total employment of women compared to only 26% of men. Comparison between the number of jobs in the right and left panels shows that the lower rungs of the job ladder account for a disproportionally high number of part-time jobs but only for one quarter of full-time jobs. Therefore, in the empirical application, we will always check our estimates based on the full sample (including part-time workers) against those based on the restricted sample of full-time workers.

[7] As much as three-quarters of the workers at the second job level earn less than the wage corresponding to the ninth decile of the wage distribution of job level 1. The degree of overlap between adjacent job levels is equally high in the first four job levels and then decreases. However, as much as 38% of workers in the seventh job level earn less than the ninth decile of the wage distribution at job level six. Note that 54% (23%) of workers at job level 3 (4) earn less than the ninth decile in the wage distribution of job level 1.

3. Gender wage differentials across the overall wage distribution

Table 2 shows that the overall wage distribution exhibits a glass ceiling pattern: the raw gender wage gap is generally increasing (or roughly constant in the case of full-time workers) across much of the support of the wage distribution (the 25th centile is the only exception here) but then increases as we move into the upper tail of the wage distribution.

Table 2 about here

A standard Blinder-Oaxaca decomposition (not shown) suggests that a large part of the raw gender wage gap (which is about 20 log points) can be explained by observable characteristics: the unexplained part amounts to 3 log points.[8] However, there is substantial variation in the size of the wage gap across the wage distribution.

Figure 1 shows the raw wage gap and its unexplained part as resulting from a quantile regression decomposition using a counterfactual distribution (Machado and Mata, 2005) and adopting the equivalent estimator developed in (Melly, 2006). These present a pattern well known for the Dutch labor market: a stable raw gender wage gap of 15 log points spanning most of the wage distribution and that tends to grow larger at higher centiles (from the 70^{th} on).[9] The unexplained part of the wage gap is positive (favours women) in the low-wage part of the wage distribution but then becomes negative, and it too tends to grow larger across centiles.[10] This pattern is interpreted as indicating a glass ceiling which affects the upper tail of the wage distribution.

Figure 1 about here

This result seems to limit women's disadvantage to the upper centiles of the job distribution. However, in the next section we will show that the impact of gender differences on job level attainment is too large to be compatible with this view. In the subsequent sections we will go on to show that the glass ceiling affects women's horizontal careers at most job levels.

4. Wage decomposition at the job level

[8] All regressions in the paper use the set of controls described in the note to the tables. Descriptive statistics can be found in Appendix 1.

[9] These values of the gender wage gap are similar to those obtained by Albrecht et al. (2009) with a different Dutch data set.

[10] The advantage of women at low centiles is probably related to the gender wage gap among part-time workers. Part-time work has a small negative impact on women's wages but a large impact on men's wages, so that the gender wage gap among part-time workers tends to be positive (women earn more than men). The positive unexplained part of the wage gap is replaced by a small negative gap when the wages of full-time workers only are analyzed.

We consider the generalization of the Blinder-Oaxaca decomposition (detailed in Appendix 3). To assess the importance of gender differences in job level attainment (which relies on intra-job-level wage differentials) we will use the Brown–Moon–Zoloth wage decomposition. This makes it possible to ascribe gender differences in wages to, first, gender differences in job-level attainment, and second, intra-job-level gender wage differentials.[11]

The results from the Brown–Moon–Zoloth decomposition are presented in Table 3. The unexplained components relative to career progression and intra-job-level wages account for 47 percent of the raw gender gap. Unexplained gender differences in job-level attainment (vertical segregation) contribute to the overall gender wage gap as much as do intra-job-level wage differences. In fact, the unexplained components relative to job-level attainment and intra-job-level wage gap are of similar size. This remains true in the sub-sample of full-time workers (the two "unexplained" components are again equally important, and they now account for 56 percent of the raw gender gap).

Table 3 about here

Analysis of the explained parts of the gender wage gap also offers interesting insights. The importance of the explained wage component relative to job-level attainment is largest when part-time workers, who have reduced career opportunities (given that the vast majority of part-time jobs are concentrated in the lowest three job levels), are included in the wage regression. However, its relative weight is reduced in the sub sample of full-time workers, in which the explained component relative to the intra-job-level wage is about twice as important as the explained component relative to job-level attainment.[12]

Gender differences in job-level attainment appear to make an important contribution to the gender wage gap. However, the importance of gender differences in careers would still be underestimated if glass ceiling-like phenomena hampered the progress of women in horizontal careers. Hence, in the following section, we concentrate on this issue.

5. Gender wage gap at the job level

[11] We cannot rely on the standard Oaxaca–Blinder decomposition because it is based on the strong assumption that discriminatory practices do not impinge on gender differences in job level attainment.

[12] Another way to see this is to look at counterfactual wages. If women had men's rewards for their characteristics (within job levels) and men's career opportunities (men's coefficients in the job level attainment model), the wage improvement would account for 25 percent of the raw gender gap. The same computation on the subsample of full-time workers returns a wage increase representing 76 percent of the raw gender gap. Hence, in the full sample, endowments can explain about 75 percent of the wage gap, while the amount drops to 26 percent in the full-time workers subsample.

In this section we consider the development of the gender wage gap at each job level in order to gain insight into the intra-job-level wage distribution.

The raw gender wage gap at each job level, not yet corrected for workers' observable characteristics, is shown in Table 4. The wage gap across the deciles of the intra-job level wage distributions displays an intricate pattern: there is no clear relationship between the size of the gender wage gap and the centiles in job levels above the second for the entire data set.[13]

Table 4 about here

To detect the presence of a glass ceiling in horizontal careers, we have investigated the gender wage across the deciles of the intra-job-level wage distribution by replicating the quantile decomposition (Machado and Mata, 2005; Melly, 2006) described in section 3 (shown in Figure 1). The raw gender wage gap and its unexplained part at the deciles of the intra-job level wage distribution are shown in Table 5. The intra-job-level raw gender wage gap (upper panel in Table 5) tends to be roughly constant at higher job levels (above the fourth level) while it is increasing in the first two job levels (the third and the fourth job levels appear to be exceptions: in the former case there is no apparent pattern, and in the latter case the raw wage gap decreases across deciles).

The unexplained part of the intra-job-level gender wage gap (lower panel in Table 5) tends to increase across job levels: women are penalized at all job levels, but the intensity of the penalization increases with the job levels. However, in the first and second job levels women enjoy a positive wage gap across most of the deciles. The unexplained part of the wage gap is also positive, thus suggesting that men are penalized in the low-wage region of the wage distribution of the first job level. However, the unexplained wage gap corresponding to the top decile is negative. Hence, even at the job levels where women benefit from positive discrimination, they tend to be penalized in the highest part of the wage distribution.[14]

At the third job level, women tend to be penalized from the fourth decile onwards. At higher job levels, the unexplained gender wage gap widens across the deciles of the intra-job-level wage distribution. We interpret this result – and this is the novel aspect of this paper – as signalling the presence of multiple glass ceilings, one for each job level. Women begin to suffer from the "glass ceiling" phenomenon early on in their careers, in that they are confronted with the first glass ceiling already at the first job level (in particular women in full-time jobs).

[13] If the analysis is restricted to full-time workers, the size of the raw gender wage gap appears to decrease across the job level specific wage distribution at job levels 4, 5 and 7.

[14] The positive unexplained part turns negative when the analysis is restricted to full-time workers only. Hence, it is mainly part-time men that are penalized vis-à-vis their female counterparts.

The implication of this finding is that it is not enough to focus on gender differences in job level attainment (vertical mobility), for this element alone would underestimate the importance of careers towards the gender wage gap. Unexplained forces tend to hamper women's career in terms of wage growth at both the vertical (between job levels) and horizontal (within job level) margins, and this latter effect is common.

Table 5 about here

6. Women's position in the men's wage distribution

6. 1 The representation index

The increase in the unexplained part of the gender wage gap across the deciles of the within-job-level age distribution may not appear to be particularly large. Therefore, it is useful to further characterize the relative position of men and women in the within-job-level wage distribution. In particular, we will focus on the incidence of women in low- and high-paying jobs. To this end, we will make use of the representation and severity indexes applied in the context of racial wage gaps (Pendakur et al., 2008).

The unconditional representation index returns the proportion of women who earn a wage lower than the wage relative to a given quantile in the wage distribution of men (the anchoring distribution). The conditional representation index adjusts the concentration on women for the effects of observable characteristics (by means of a regression). We will focus on only two key deciles: the lowest and the highest. The results of these analyses are shown in Table 6.

Women are clearly over-represented in the lowest part of the overall wage distribution. In fact, whilst 10% of men earn a wage smaller than the 1st decile in their wage distribution, 21% of women earn less than this amount. In other words, women are over-represented by a factor of 2 in this region. By contrast, women are under-represented in the region above the 9th decile. The conditional representation index corrects the raw index for observable characteristics. The representation of women in the lowest deciles improves dramatically. That is, a large part of the over-representation of women in the lowest tail of the wage distribution can be largely attributed to their observable characteristics: less experience and human capital, and more part-time jobs. However, there remain a substantial over-representation and under-representation of women in the lowest deciles and upper deciles of the wage distribution. This pattern shows up also when we restrict the attention to full-time workers only.

We now focus on the various job levels in order to uncover specific patterns. The unconditional representation index shows that the first job level is the one that stands apart: it is

men that tend to be over-represented in the low-wage region and it is women that are over-represented above the upper part of the wage distribution (above the 9th decile). This pattern persists, although to a lesser extent, also after correcting for observable characteristics. As we move to higher job levels, the incidence of women in the upper part of the wage distribution tends to decrease, while women tend to be over-represented in the lowest decile. Hence, overall, from the third job level onwards (second job level onwards in the case of full-time workers), women tend to be over-represented (under-represented) in low (high) wage regions of the intra-job-level wage distribution. The under-representation of women in the right tail of the intra-job level of the wage distribution is consistent with the presence of a job-level-specific glass ceiling.

Table 6 about here

6.2 The severity index

We next investigate within-decile differences in the ranking of wages by gender. To do so, we use the severity index (Pendakur et al., 2008). This index weights women in a given region of the wage distribution with a measure of the distance of their wages from the cut-off: that is, it is a weighted representation index, where the weights are the wage differentials from the cut-off. Put otherwise, if women were concentrated in the low-wage region but their wages were clustered right under the first decile, their condition would be a less worrisome than in the case where their wages were clustered far away from it. In other words, the severity index measures the incidence of women below (or above) a given expectile (Newey and Powell, 1987) in the male wage distribution, where an 'expectile' is defined as the expectation in the tail (or in a given portion) of the wage distribution.[15]

The unconditional and conditional severity indexes are presented in Table 7, which shows that observable characteristics, predictably, tend to reduce the extent of the severity. Also in this case, consistently with the presence of a job-level-specific glass ceiling, the conditional severity index shows that women tend to be under-represented in the highest expectile from the third job level (second job level in case of full-time workers) onwards.

Moreover, by comparing the conditional representation and conditional severity indexes?, one can assess whether women tend to cluster close to or far away from the cut-off. Analysis of the overall wage distribution shows that there is not much clustering since the values of the severity

[15] Quantile regression lines are difficult to compare with OLS regression because the former are obtained through minimization of absolute deviations, while the latter is obtained through minimization of squared deviation (Breckling and Chambers, 1988). Expectiles instead adopt an asymmetric quadratic loss function and can be regarded as a generalization of quantile regression: expectiles are to OLS what quantiles are to the median (Abdous and Remillard, 1995).

index (in Table 7) are very close to that of the representation index (Table 6). However, analysis by job level reveals interesting patterns. At the first job level, the higher value of the conditional severity index relative to the representation index signals that women in the first decile (of the first job level) tend to be clustered towards the low end of the tail of the wage distribution, far from the cut-off. The clustering of women does not seem to take place for full-time women; in fact, the conditional severity index relative to the first decile is practically identical to the representation index.

The pattern that characterizes women in the top decile is also interesting. Women tend to be over-represented at the top decile of the first job level. However, the fact that the conditional severity index is smaller than the relative conditional representation index implies that women tend to be somewhat clustered in the neighbourhood of the cut-off and are less likely to be found deep in the right tail (where relatively high earnings are found).

In addition, as the job level increases, so the representation of women in the first decile appears to increase, and the conditional severity index suggests that, within this decile, women tend to be clustered in relatively low wage regions (away from the cut-off).

At all job levels above the second one, women are under-represented in the top decile of the wage distribution. The conditional severity index becomes noticeably smaller than the conditional representation index from the fifth job level onwards. This suggests that, for each of the job levels of level three and higher, we can observe a level-specific glass ceiling.[16]

Table 7 about here

7. Conclusion

Consistently with the literature stressing the importance of both vertical and horizontal mobility for wage growth, we have found that the glass ceiling works at two margins: at the vertical margin, the glass ceiling implies that the unexplained part of the wage gap grows across job levels; at the horizontal margin, the (intra-job-level) glass ceiling implies that the unexplained part of the gender wage gap grows across the deciles of the intra-job-level wage distribution. The paper makes two main contributions to the literature.

The first contribution is the finding that the vertical (inter-job-level) dimension, modelled as gender differences in job level attainment, is substantial. We have found that unexplained differences in job-level attainment are just as important as unexplained differences in intra-job-level wages. These

[16] However, the situation is worse for full-time women: in fact, besides the under-representation in the upper decile, the conditional severity index is smaller than the corresponding conditional representation index from the third job level onwards.

two unexplained components account for 47 percent of the gender wage gap (56 percent among full-time workers). Moreover, if women had men's rewards for observable characteristics and men's career opportunities, their wage would increase by an amount equal to 25 percent of the wage gap. The increase would be substantially higher among full-time workers, accounting for 74 percent of the gap.

The second contribution is the finding that gender differences at the horizontal margin are pervasive: the glass ceiling is a job-level-specific phenomenon. We have found compelling evidence that the glass ceiling is a phenomenon that affects most working women, and not just women in managerial positions. In fact, the unexplained part of the gender wage gap widens at higher deciles of the intra-job-level wage distribution already at the first job level. However, we do not argue that the glass ceiling operates already at the first level because neither the representation nor the severity index confirms its presence at the first two job levels; however, they do point to the presence of a job-level-specific glass ceiling from the third job level onwards (the second job level onwards when the analysis is restricted to full-time workers). In fact, after the third job level the conditional representation (severity) index at the 9^{th} decile (expectile) shows a lower incidence of women in this segment of the intra-job level wage distribution.

Hence, when the horizontal margin is duly considered, the glass ceiling becomes a very general feature of the Dutch economy: women tend to face multiple glass ceilings already at the third job level (although there are indications that the first glass ceiling may operate already at the first or second job level). When calculated in this way, the glass ceiling appears to be a pervasive phenomenon affecting most working women: 88% of jobs and 81% of women in the Dutch economy are found at job levels characterized by a glass ceiling. Taken together, gender differences in mobility at the vertical and horizontal margins account for more than half of the unexplained gender wage gap, although the contribution of the gender differences at the horizontal margin is rather difficult to quantify.

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Appendix 1: Occupational Level and Job Type

Occupational Levels

Level	Description (Skill Content or Job Complexity)
Level I:	Very simple and repeated tasks, which do not require any particular education or experience, and are carried out under direct supervision.
Level II:	Simple and repeated tasks, which require some basic administrative or technical knowledge or some working experience. Some autonomy is required, but the tasks are carried out under supervision.
Level III:	Less simple tasks, of a repetitive nature, which require low administrative or technical knowledge or some working experience. The tasks involve a degree of autonomy.
Level IV:	Less simple tasks, of different kinds, which require low administrative or technical knowledge with completed vocational education in a given occupation or profession. The tasks involve a degree of autonomy.
Level V:	Difficult tasks, of many different kinds, which require an intermediate level of administrative or technical knowledge and a high level of autonomy.
Level VI:	Composite tasks within an occupation, which require a high level of administrative or technical knowledge and a high level of autonomy.
Level VII:	Directive and managerial tasks, which require analytical, creative and personal communication skills. Tasks are carried out on the basis of autonomous decision-making and require an academic education. Management (CEO) of mid-size firms and participation in strategic decision-making.
Level VIII:	CEO of large firms (not included in the analysis for confidentiality reasons).

Job Type and Occupational Classification

Job Type	CBS one-digit and two-digits Occupational codes
Production	6, 7
Administrative	3
Information Technology	083 and 084
Commercial	4
Services	5
Creative	0 (excluded 083 and 084)
Managerial	2

Appendix 2: Variable List and Descriptive Statistics

TABLE A1 ABOUT HERE

Appendix 3. Statistical method: The Brown–Moon–Zoloth decomposition

The gender mean wage differential $\left(\overline{w}^M - \overline{w}^F\right)$ (superscripts *M* and *F* refer to men and women, respectively) can be decomposed according to hierarchical job levels (denoted by the subscript *k*; *k*=1,...,*K*):

$$(1) \qquad \left(\overline{w}^M - \overline{w}^F\right) = \sum_k p_k^M \overline{w}_k^M - p_k^F \overline{w}_k^F$$

where p_k^G, *G*=*M*,*F*, represents the sample proportion of gender *G* in job level *k*.

For each of the *K* job levels, separately for men and women, we regress the (log) wage on the observed characteristics of the workers and firms (denoted by the vector x_k^G). The average wage is rewritten as $\overline{w}_k^G = \hat{\beta}_k^G \, ' \overline{x}_k^G$, so that:

$$(2) \qquad \overline{w}^M - \overline{w}^F = \sum_k p_k^M \overline{x}_k^M \, ' \hat{\beta}_k^M - p_k^F \overline{x}_k^F \, ' \hat{\beta}_k^F = \underbrace{\sum_k \left(p_k^M - p_k^F\right) \overline{x}_k^M \, ' \hat{\beta}_k^M}_{JLE} + \underbrace{\sum_k p_k^F \left(\overline{x}_k^M \, ' \hat{\beta}_k^M - \overline{x}_k^F \, ' \hat{\beta}_k^F\right)}_{WDE}$$

The term *JLE* captures the impact of different distributions of men and women across job levels, whereas *WDE* gives the combined intra-job-level wage differential effect. Both effects can be further decomposed into an explained and unexplained part. *WDE* becomes:

$$(3) \qquad WDE = \sum_k p_k^F \overline{x}_k^F \, ' \left(\hat{\beta}_k^M - \hat{\beta}_k^F\right) + \sum_k p_k^F \hat{\beta}_k^M \, ' \left(\overline{x}_k^M - \overline{x}_k^F\right)$$

where the first term represents the unexplained parts of the intra-job-level wage differential, and the second term is based on differences in observed characteristics *x* (the endowment effect) across job levels.

Similarly, *JLE* can be decomposed as:

$$(4) \qquad JLE = \sum_k \overline{w}_k^M \left(\hat{p}_k^F - p_k^F\right) + \sum_k \overline{w}_k^M \left(p_k^M - \hat{p}_k^F\right)$$

$\hat{p}_k^F$ gives the predicted job-level attainment using the observable characteristics of the female workers. The estimated parameters underlying $\hat{p}_k^F$ are based on an ordered probit model for a selected sample of men. Thus, the estimated parameters for males are combined with women's characteristics to obtain the predicted job-level attainment for women.

The first term of equation (4) refers to unjustifiable gender differences in job-level attainment (vertical segregation); the second term refers to differences in observed characteristics *x* (the endowment effect). If $p_k^M = p_k^F$, *k*=1,…,*K*, the *JLE*-effect is nil. If, in addition, the parameter estimates of the wage equation do not vary across the *K* job levels, $\beta_k^M = \beta^M$, $\beta_k^F = \beta^F$, *WDE* returns the original Oaxaca-Blinder decomposition.

Table A1: Descriptive statistics.

Variable	Definition		Men		Women	
			mean	std. err.	mean	std. err.
small part-time	hours worked per week<20	dummy variable	0.03	0.16	0.25	0.43
part-time	20≤hours worked per week<36	dummy variable	0.02	0.14	0.25	0.43
full-time	hours worked per week≥36	dummy variable	0.95	0.21	0.51	0.50
foreign	foreign worker (non-Dutch)	dummy variable	0.04	0.21	0.05	0.21
age	worker's age		40.09	10.35	37.30	10.31
tenure	years with current employer		10.96	9.43	7.61	6.84
primary	Basic education (LO)	dummy variable	0.05	0.22	0.07	0.25
low general	first-level general education (MAVO)	dummy variable	0.07	0.26	0.19	0.39
low vocational	first-level vocational education (MBO)	dummy variable	0.39	0.49	0.22	0.41
secondary general	secondary school diploma (HAVO, VWO)	dummy variable	0.06	0.24	0.14	0.35
secondary vocational	advanced vocational education (HABO)	dummy variable	0.23	0.42	0.25	0.43
university	university (WO)	dummy variable	0.15	0.36	0.10	0.31
technical	technical occupation	dummy variable	0.44	0.50	0.11	0.31
Administrative	administrative occupation	dummy variable	0.10	0.30	0.31	0.46
information technology	IT occupation	dummy variable	0.03	0.17	0.01	0.10
Commercial	commercial occupation	dummy variable	0.08	0.27	0.12	0.32
services	service occupation	dummy variable	0.21	0.41	0.41	0.49
Management	Management	dummy variable	0.12	0.33	0.04	0.19
creative	creative occupation	dummy variable	0.02	0.15	0.02	0.13
very simple tasks	Level I	dummy variable	0.01	0.11	0.05	0.22
simple and repetitive tasks	Level II	dummy variable	0.07	0.25	0.12	0.33
routines with simple decision making	Level III	dummy variable	0.17	0.38	0.25	0.43
non routine, with simple decision making	Level IV	dummy variable	0.25	0.43	0.20	0.40
difficult tasks, decision making	Level V	dummy variable	0.28	0.45	0.27	0.44
difficult tasks, initiative	Level VI	dummy variable	0.17	0.38	0.09	0.28
Management	Level VII	dummy variable	0.05	0.21	0.02	0.14
1 - 4	fewer than 5 employees at the firm	dummy variable	0.02	0.13	0.02	0.15
5 - 9	5 - 9 employees at the firm	dummy variable	0.03	0.17	0.05	0.22
10 - 19	10 - 19 employees at the firm	dummy variable	0.08	0.28	0.08	0.28
20 – 49	20 - 49 employees at the firm	dummy variable	0.14	0.34	0.11	0.32

Table A1: Continued.

50 – 99	50 - 99 employees at the firm	dummy variable	0.15	0.36		0.14	0.35
100 - 199	100 - 199 employees at the firm	dummy variable	0.20	0.40		0.17	0.37
200 - 499	200 - 499 employees at the firm	dummy variable	0.18	0.38		0.19	0.39
=> 500	500 or more employees at the firm	dummy variable	0.20	0.40		0.23	0.42
Agriculture	ISIC (Rev. 3) 01 – 05	dummy variable	0.01	0.12		0.01	0.09
mining	ISIC (Rev. 3) 10 – 14	dummy variable	0.01	0.10		0.00	0.07
Manufacturing	ISIC (Rev. 3) 15 – 37	dummy variable	0.34	0.47		0.18	0.38
public utilities	ISIC (Rev. 3) 40 – 41	dummy variable	0.03	0.16		0.01	0.10
Construction	ISIC (Rev. 3) 45	dummy variable	0.09	0.29		0.01	0.10
wholesale & retail trade	ISIC (Rev. 3) 50 – 52	dummy variable	0.14	0.35		0.15	0.36
restaurants & hotels	ISIC (Rev. 3) 55	dummy variable	0.01	0.10		0.02	0.15
transport & communication	ISIC (Rev. 3) 60 – 64	dummy variable	0.09	0.28		0.05	0.22
financial services	ISIC (Rev. 3) 65 – 67	dummy variable	0.03	0.17		0.05	0.22
business services	ISIC (Rev. 3) 70 – 74	dummy variable	0.11	0.31		0.13	0.33
public administration	ISIC (Rev. 3) 75	dummy variable	0.07	0.25		0.07	0.25
education	ISIC (Rev. 3) 80	dummy variable	0.01	0.09		0.01	0.10
health services	ISIC (Rev. 3) 85	dummy variable	0.03	0.17		0.24	0.42
culture, sport, & other personal services	ISIC (Rev. 3) 90 – 99	dummy variable	0.03	0.18		0.07	0.26
industry level collective agreement	industry level collective agreement (bargaining)	dummy variable	0.72	0.45		0.73	0.45
firm level collective agreement	Firm level collective agreement (bargaining)	dummy variable	0.07	0.25		0.04	0.20
AVV	AVV	dummy variable	0.03	0.16		0.03	0.17
non union	Not covered by any union agreement	dummy variable	0.00	0.04		0.00	0.06
length of the working week	usual number of hours per week at the firm, in log		38.61	1.67		37.80	1.73
hourly base wage	gross base wage (without overtime or bonuses) divided		3.30	0.38		3.12	0.33
	by the number of hours worked (in log)		3.37	0.39		3.16	0.34
hourly full wage	wage including individual pay components per hour worked (in log)						
overtime	overtime compensation received	dummy variable	0.24	0.43		0.09	0.29
number of observations			52,402			25,305	

Figure 1: The raw gender wage gap and the unexplained part across the centiles of the wage distribution.

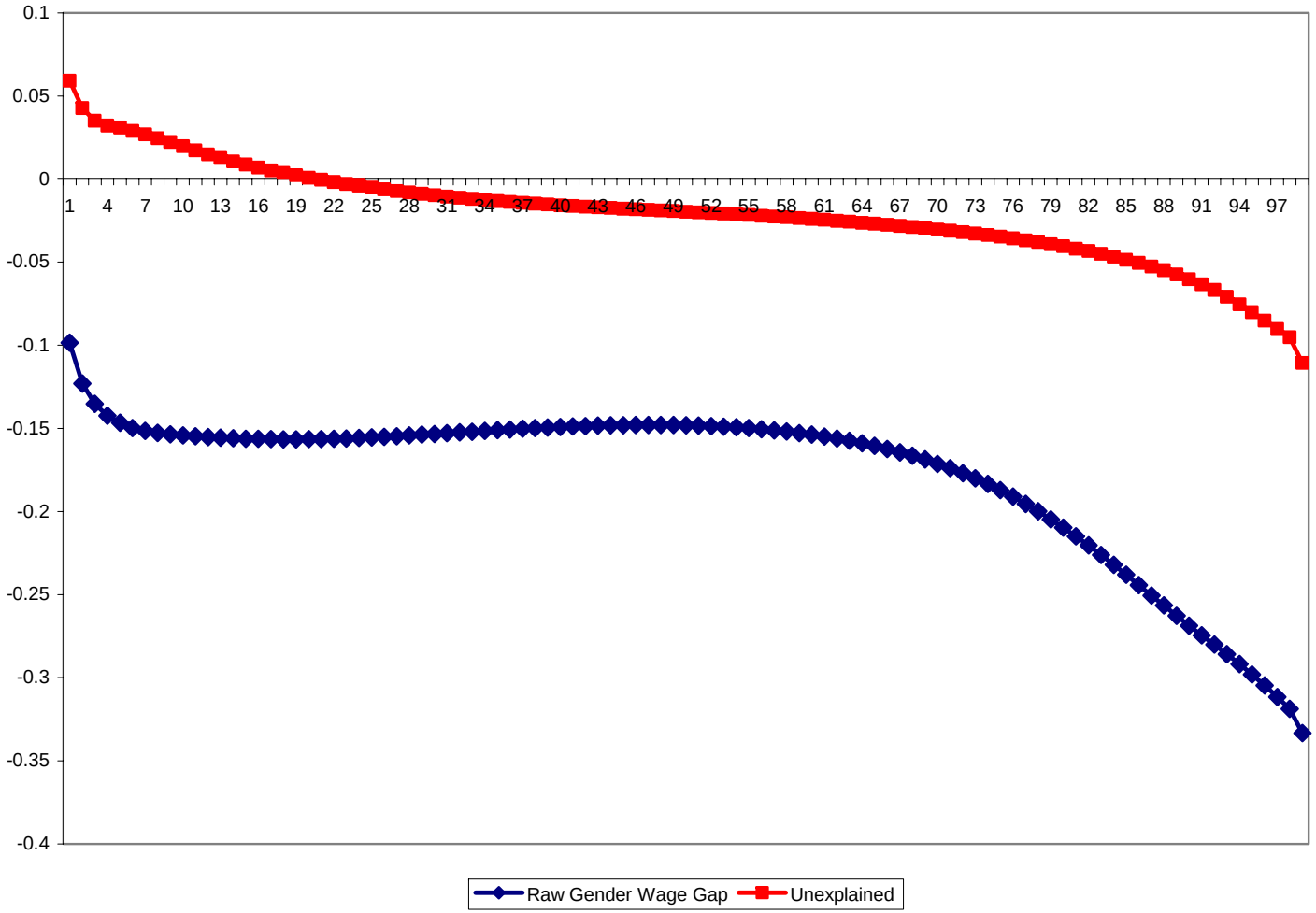

Table 1: The hierarchy of jobs: their number, the incidence of women and the wage distributions.

	Whole Sample						Full-time					
Job Level	average wage	percentiles 10	90	% workers level wage < $(w^{90})_{k-1}$	number of jobs	proportion of women	average wage	percentiles wage < $(w^{90})_{k-1}$	90	% workers level wage < $(w^{90})_{k-1}$	number of jobs	proportion of women
I	2.700	2.092	3.001	-	2,031	63.71	2.765	2.489	3.001	-	587	34.24
II	2.762	2.209	3.100	0.787	7,527	45.66	2.833	2.465	3.109	0.755	3,990	24.18
III	2.954	2.682	3.218	0.716	15,943	40.12	2.975	2.727	3.218	0.726	10,936	23.55
IV	3.114	2.880	3.332	0.716	17,769	27.64	3.117	2.900	3.326	0.724	14,111	15.12
V	3.300	3.030	3.576	0.560	20,644	31.80	3.306	3.038	3.577	0.536	16,514	19.53
VI	3.638	3.305	3.967	0.399	10,907	20.02	3.649	3.321	3.977	0.384	9,493	13.31
VII	3.971	3.601	4.351	0.503	2,886	17.32	3.986	3.618	4.363	0.490	2,584	11.46
Number of cases	77,707						58,215					

Table 2: Raw gender wage gap at selected centiles of the overall wage distribution

	Full Sample			**Full-Time**		
percentile	Men	Women	gap	Men	Women	gap
10	2.840	2.712	0.128	2.885	2.755	0.130
25	3.027	2.871	0.156	3.049	2.896	0.153
50	3.211	3.073	0.138	3.222	3.088	0.134
75	3.468	3.280	0.188	3.480	3.308	0.172
90	3.765	3.483	0.282	3.778	3.534	0.244

Table 4: Raw gender wage gap at selected centiles of the wage distribution by job level

Full Sample

	I			II			III			IV		
percentile	Men	Women	gap	Men	Women	gap	Men	Women	gap	Men	Women	gap
10	1.890	2.303	-0.413	2.218	2.198	0.020	2.699	2.660	0.039	2.919	2.823	0.096
25	2.470	2.712	-0.242	2.687	2.679	0.008	2.875	2.812	0.063	3.033	2.947	0.086
50	2.762	2.804	-0.042	2.875	2.829	0.046	3.014	2.947	0.067	3.135	3.098	0.037
75	2.896	2.913	-0.017	3.006	2.940	0.066	3.135	3.088	0.047	3.241	3.219	0.022
90	2.995	3.007	-0.012	3.127	3.051	0.076	3.238	3.201	0.037	3.343	3.306	0.037

	V			VI			VII		
percentile	Men	Women	gap	Men	Women	gap	Men	Women	gap
10	3.068	2.975	0.093	3.355	3.195	0.160	3.667	3.390	0.277
25	3.193	3.111	0.082	3.511	3.346	0.165	3.827	3.609	0.218
50	3.323	3.256	0.067	3.666	3.522	0.144	4.000	3.797	0.203
75	3.465	3.381	0.084	3.829	3.677	0.152	4.187	3.986	0.201
90	3.597	3.502	0.095	3.992	3.832	0.160	4.383	4.138	0.245

Full-time Workers

	I			II			III			IV		
percentile	Men	Women	gap	Men	Women	gap	Men	Women	gap	Men	Women	gap
10	2.487	2.515	-0.028	2.465	2.470	-0.006	2.753	2.669	0.084	2.928	2.798	0.131
25	2.713	2.700	0.013	2.766	2.716	0.049	2.896	2.804	0.092	3.039	2.916	0.124
50	2.849	2.821	0.027	2.912	2.832	0.080	3.022	2.923	0.099	3.135	3.054	0.082
75	2.939	2.887	0.052	3.022	2.923	0.099	3.135	3.050	0.085	3.237	3.178	0.059
90	3.033	2.964	0.069	3.127	3.023	0.105	3.236	3.161	0.075	3.334	3.283	0.052

	V			VI			VII		
percentile	Men	Women	gap	Men	Women	gap	Men	Women	gap
10	3.070	2.946	0.124	3.362	3.164	0.198	3.669	3.342	0.328
25	3.193	3.088	0.106	3.513	3.332	0.181	3.832	3.563	0.269
50	3.323	3.243	0.080	3.669	3.507	0.162	4.003	3.789	0.214
75	3.464	3.377	0.087	3.831	3.677	0.154	4.190	3.990	0.200
90	3.593	3.503	0.090	3.995	3.835	0.160	4.384	4.151	0.233

Table 3: Brown – Moon – Zoloth decomposition, full sample [a)]

wage differential (WDE)		vertical segregation (JLE)	
explained	**unexplained**	**explained**	**Unexplained**
0.017	0.044	0.078	0.040

a) The controls of the wage regressions (dependent variable: log hourly wage) and the ordered probit model (dependent variable job level) are: working hours (2 part-time dummies), foreign born, age, age squared, years of tenure, tenure squared, educational level (6 dummies), previous labor market position (5 dummies), dummy for worked overtime, firm size (7 dummies) occupation (7 dummies), industry (13 dummies), regular working hours at the firm, type of collective agreement (3 dummies).

Table 5: The raw gender (log) wage gap and its unexplained part across the deciles of the wage distribution by job level [a)]

	Job Level						
Deciles	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**
1	0.364	-0.022	-0.052	-0.089	-0.088	-0.155	-0.245
	(0.043)	(0.023)	(0.010)	(0.006)	(0.006)	(0.009)	(0.028)
2	0.314	-0.019	-0.063	-0.081	-0.083	-0.155	-0.232
	(0.037)	(0.018)	(0.006)	(0.004)	(0.004)	(0.007)	(0.021)
3	0.210	-0.031	-0.067	-0.069	-0.078	-0.154	-0.217
	(0.032)	(0.013)	(0.005)	(0.004)	(0.003)	(0.007)	(0.019)
4	0.130	-0.039	-0.066	-0.057	-0.076	-0.152	-0.209
	(0.022)	(0.009)	(0.004)	(0.004)	(0.003)	(0.007)	(0.017)
5	0.077	-0.048	-0.063	-0.046	-0.075	-0.150	-0.207
	(0.016)	(0.007)	(0.004)	(0.003)	(0.003)	(0.006)	(0.017)
6	0.042	-0.056	-0.057	-0.036	-0.076	-0.150	-0.202
	(0.013)	(0.006)	(0.003)	(0.004)	(0.003)	(0.006)	(0.017)
7	0.013	-0.062	-0.050	-0.028	-0.078	-0.150	-0.203
	(0.011)	(0.005)	(0.003)	(0.004)	(0.003)	(0.007)	(0.016)
8	-0.008	-0.066	-0.042	-0.024	-0.082	-0.150	-0.218
	(0.010)	(0.005)	(0.004)	(0.004)	(0.004)	(0.008)	(0.016)
9	-0.026	-0.066	-0.035	-0.026	-0.087	-0.156	-0.234
	(0.015)	(0.007)	(0.004)	(0.004)	(0.005)	(0.010)	(0.020)

Unexplained part of the raw gender (log) wage gap

	Job Level						
Deciles	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**
1	0.078	0.012	0.010	-0.019	-0.022	-0.035	-0.073
	(0.025)	(0.016)	(0.008)	(0.008)	(0.008)	(0.011)	(0.022)
2	0.083	0.018	0.001	-0.026	-0.029	-0.049	-0.080
	(0.018)	(0.012)	(0.006)	(0.006)	(0.006)	(0.009)	(0.019)
3	0.071	0.022	-0.006	-0.027	-0.035	-0.057	-0.078
	(0.016)	(0.010)	(0.005)	(0.006)	(0.005)	(0.008)	(0.018)
4	0.054	0.023	-0.011	-0.025	-0.040	-0.063	-0.082
	(0.015)	(0.009)	(0.005)	(0.006)	(0.005)	(0.007)	(0.018)
5	0.035	0.016	-0.014	-0.023	-0.045	-0.066	-0.091
	(0.015)	(0.009)	(0.005)	(0.006)	(0.005)	(0.008)	(0.017)
6	0.017	0.008	-0.015	-0.022	-0.050	-0.071	-0.094
	(0.014)	(0.008)	(0.005)	(0.006)	(0.005)	(0.008)	(0.017)
7	-0.0004	-0.001	-0.016	-0.023	-0.057	-0.077	-0.105
	(0.015)	(0.008)	(0.006)	(0.006)	(0.005)	(0.008)	(0.017)
8	-0.016	-0.012	-0.016	-0.028	-0.066	-0.080	-0.128
	(0.017)	(0.008)	(0.006)	(0.007)	(0.006)	(0.009)	(0.020)
9	-0.041	-0.023	-0.019	-0.046	-0.080	-0.083	-0.151
	(0.020)	(0.010)	(0.007)	(0.008)	(0.008)	(0.011)	(0.022)

a) Each of the seven regressions included the following controls: see Table 3.

Table 6: Unconditional and conditional representation of women below the first, and above the ninth decile of the male (log) wage distribution, by job level. Bootstrap standard error in parenthesis (100 replications).[a)]

Full Sample

	Overall		**Job Level I**		**Job Level II**		**Job Level III**	
	below 10	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**
unconditional	0.210	0.027	0.036	0.111	0.106	0.047	0.124	0.067
	(0.005)	(0.001)	(0.007)	(0.020)	(0.007)	(0.004)	(0.008)	(0.005)
conditional	0.111	0.068	0.110	0.159	0.102	0.097	0.104	0.074
	(0.004)	(0.004)	(0.043)	(0.039)	(0.012)	(0.013)	(0.009)	(0.007)

	Job Level IV		**Job Level V**		**Job Level VI**		**Job Level VII**	
	below 10	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**
unconditional	0.207	0.067	0.196	0.045	0.255	0.032	0.324	0.024
	(0.008)	(0.004)	(0.006)	(0.003)	(0.014)	(0.004)	(0.011)	(0.004)
conditional	0.125	0.044	0.153	0.055	0.163	0.063	0.182	0.074
	(0.010)	(0.005)	(0.011)	(0.005)	(0.013)	(0.007)	(0.029)	(0.017)

Full-Time

	Overall		**Job Level I**		**Job Level II**		**Job Level III**	
	below 10	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**
unconditional	0.238	0.025	0.035	0.037	0.099	0.032	0.17	0.048
	(0.005)	(0.002)	(0.028)	(0.017)	(0.012)	(0.006)	(0.010)	(0.005)
conditional	0.16	0.049	0.164	0.124	0.145	0.065	0.16	0.061
	(0.005)	(0.003)	(0.039)	(0.045)	(0.010)	(0.015)	(0.010)	(0.009)

	Job Level IV		**Job Level V**		**Job Level VI**		**Job Level VII**	
	below 10	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**
unconditional	0.275	0.052	0.228	0.041	0.298	0.036	0.38	0.024
	(0.011)	(0.005)	(0.009)	(0.004)	(0.016)	(0.005)	(0.013)	(0.005)
conditional	0.18	0.045	0.175	0.057	0.178	0.048	0.223	0.062
	(0.013)	(0.007)	(0.013)	(0.005)	(0.016)	(0.006)	(0.033)	(0.014)

a) For control variables of all regressions: See Table 3.

Table 7: Unconditional and conditional severity of the representation of women below the first and above the ninth deciles of the male (log) wage distribution, by job level. Bootstrap standard error in parenthesis (100 replications). [a)]

Full Sample

	Overall		**Job Level I**		**Job Level II**		**Job Level III**	
	below 10	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**
unconditional	0.255	0.020	0.040	0.170	0.123	0.051	0.131	0.061
	(0.006)	(0.001)	(0.039)	(0.045)	(0.008)	(0.004)	(0.008)	(0.003)
conditional	0.109	0.068	0.122	0.138	0.103	0.103	0.102	0.083
	(0.005)	(0.003)	(0.039)	(0.045)	(0.010)	(0.015)	(0.010)	(0.009)

	Job Level IV		**Job Level V**		**Job Level VI**		**Job Level VII**	
	below 10	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**
unconditional	0.184	0.058	0.224	0.035	0.329	0.023	0.443	0.018
	(0.010)	(0.004)	(0.009)	(0.002)	(0.015)	(0.003)	(0.034)	(0.006)
conditional	0.123	0.041	0.158	0.041	0.187	0.053	0.228	0.054
	(0.013)	(0.007)	(0.013)	(0.005)	(0.016)	(0.006)	(0.033)	(0.014)

Full-Time

	Overall		**Job Level I**		**Job Level II**		**Job Level III**	
	below 10	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**
unconditional	0.279	0.025	0.110	0.037	0.131	0.028	0.195	0.036
	(0.007)	(0.025)	(0.053)	(0.059)	(0.017)	(0.005)	(0.015)	(0.003)
conditional	0.182	0.041	0.157	0.111	0.177	0.075	0.176	0.051
	(0.007)	(0.002)	(0.053)	(0.059)	(0.024)	(0.011)	(0.014)	(0.006)

	Job Level IV		**Job Level V**		**Job Level VI**		**Job Level VII**	
	below 10	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**	**below 10**	**above 90**
unconditional	0.294	0.038	0.274	0.03	0.365	0.026	0.492	0.016
	(0.015)	(0.003)	(0.012)	(0.003)	(0.018)	(0.004)	(0.039)	(0.007)
conditional	0.191	0.037	0.19	0.044	0.231	0.037	0.309	0.036
	(0.016)	(0.005)	(0.014)	(0.004)	(0.018)	(0.006)	(0.037)	(0.010)

a) For control variables of all regressions: See Table 3