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Wage differences between women and men in Sweden – the impact of skill mismatch

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Wage differences between women and men in Sweden – the impact of skill mismatch*

by
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Abstract

We investigate skill mismatch and its impact on gender differences in wage gap and in returns to education in Sweden 1993 to 2002.

Women are more likely to have more formal education than what is normally required for their occupation (overeducation), while men are more likely to have less (undereducation).

Over- and undereducation contribute far more to the gender wage gap than years of schooling and work experience. In decompositions, adjusting for skill mismatch decreases the gender wage gap by between one tenth and one sixth. This is roughly a third to a half as much as is accounted for by segregation by industry. Thus, taking skill mismatch into account is essential for the analysis of gender wage differentiation, even though it does not alter the result that the estimated returns to education are smaller for women than for men in Sweden.

Keywords: Gender differentials, discrimination, over- and undereducation
JEL-codes: J16, J24, J31, J71

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1 Introduction

Gender inequality in wages is created and maintained by many different forces and mechanisms, a great number of empirical studies have been made, and many different approaches have been developed to add new pieces and aspects to the picture. Yet, while gender differences in educational attainment have been central to many studies of gender wage differentials, this paper takes the analysis a step further by using the concepts of Over-, Required and Under-education for this purpose. Such models (so-called ORU-models) have been developed within the economics of education to extend the traditional Mincer-equation by taking into account how the individual's attained level of education corresponds to the education required for his or her job.

This extension introduces the demand side of the labour market and can explain part of the variation in returns to education among individuals with the same level of formal schooling. Since the 1980's, a considerable number of studies using this approach have appeared, but not with a primary focus on gender. We believe that using ORU-models to study the gender wage gap, and focussing on gender differences in studies of the relation between skill mismatch and wages, is fruitful for both fields. As will be seen in section 3 below, the ORU-literature indicates that women are more likely to be overqualified for their jobs than men, and that men more often hold positions for which they are not formally qualified by schooling.

In this study, we will analyse over- and undereducation among employed women and men in Sweden during the period 1993–2002 and their importance for the gender wage gap. We will use Oaxaca-decompositions to analyse the role of mismatch between education and occupation for the wage gap in each of these ten years and a JMP-decomposition to investigate its importance for the change in wage differential over this period.[1]

The macroeconomic and institutional context during the period of study was dominated by a severe economic crisis during the first half of the 1990s. This was followed by a gradual, but not complete, recovery of the labour market. Unemployment rose dramatically from 1991 until 1993, and thereafter decreased until 2001, but remained higher than before the crisis (Johansson et al. 2005). The public sector underwent a far-reaching savings program. During

[1] These decompositions are described in Section 4.

the period 1991–2000, the difference between wages in the private sector, which employs the majority of men, and the public sector, which employs the majority of women, increased.

During the 1990's, average educational attainment increased, in particular the share of the labour force with tertiary education. Educational requirements also increased, but at a lower pace (le Grand et al., 2004).

The 1960s and 1970s saw a progressive and considerable decline in gender wage differentials in Sweden, but over the twenty-year period from 1980 to 2000, they remained practically undiminished, despite decreased male/female differences in participation, level of schooling and work experience, and despite equal opportunities legislation. Several Swedish studies show that during the 1990's, which is our period of study, women received a lower education premium, or return to education, than men.

The outline of the study is as follows: The next section summarises some theoretical issues concerning the gender wage gap, as well as pertinent previous studies of the Swedish gender wage gap during the 1990's. In the following section, ORU-models are described with an introduction to the literature. In section 4, we present the two methods of decomposing gender wage differentials that are applied in our analysis. Section 5 includes an introduction to the data set used and descriptive accounts of the gender wage differential and of the extent and distribution of skill mismatch. Section 6 reports regression results, results from Oaxaca-decompositions, as well as from JMP-decompositions. Finally, summary and conclusions are given in section 7.

2 Theories and previous studies on the gender wage gap in Sweden

2.1 Theories

The main perspectives in studies of the gender wage gap, within academic economics, are well known and we will only summarise them without specific references to this huge literature.[2] When neo-classical economics distinguishes wage differentials due to discrimination from wage differentials due to differences in productivity, this refers to discrimination in a narrow sense of

[2] As introductions and for further references, we suggest any of the following: Cain (1986), le Grand (1991), Altonji & Blank (1999), Katz (2001).

unequal rewards to workers with equal productivity. The forms of such "pure" discrimination that have been elaborated are, first, discriminatory preferences (on the part of employers, co-workers or customers) and, second, statistical discrimination, due to imperfect information about individual productivity, when the mean or the dispersion of labour market characteristics differs between women and men.

Discrimination in a broader sense is, however, part of the process in which labour market characteristics are acquired and therefore contributes to real or perceived gender differences in productivity. Discrimination in education, hiring and promotion can make the acquisition of skills more costly and diminish their pay-off for the discriminated group. The knowledge that this is likely to happen can discourage individuals from following preferences that do not conform to predominant gender norms. Thus, these characteristics can be considered to be partly endogenous in both a neo-classical and a feminist framework.

Neo-classical authors, most prominently Gary Becker and Solomon Polachek[3], emphasise choices based on differences in preferences and innate comparative advantages between men and women. The origin of these differences is not explained. The conclusion from these models is that in a household, which wants to maximise joint utility, spouses should specialise, and somehow men usually emerge specialising in market work and women in non-market work.

Feminist economists are generally sceptical about "innate" preferences and point out that norms and expectations in the social ambience may also form the preferences themselves, as well as the ability of spouses to realize their preferences in intra-household bargaining. They may also emphasise value discrimination – systematic underestimation of the worth of, and the skill and effort involved in, activities constructed as "feminine" in a social order where women are a subordinate gender category.

In this study, we will make a standard decomposition of the gender wage differential into an "explained" and an "unexplained" part. We emphasise that it should not be taken as a numerical estimate of the level of discrimination, but as a way of observe more clearly the mechanisms of gender differentiation. For example, historically, a considerable gender wage differential could be "explained" by women's lower education and experience but simultaneously,

[3] See, for instance, Becker (1991) and Polachek (1995).

the lower wages paid to women as compared to men with equal qualifications reduced the propensity of women to acquire education and experience. In today's labour market, a large portion of the wage gap can be attributed to gender segregation by sector, industry and occupation. Yet, the question remains to what extent women's choice to take particular jobs should be seen as a *sui generis* reason for women's lower wages and to what extent it should be seen as the result of much more complex social and historical processes, some of them distinctly discriminatory.

The *size* of the wage differential associated with a given difference in characteristics will depend on the size of returns to skills and the size of the premium for working in favoured jobs and industries. Therefore, the gender wage gap depends on the level of wage differentiation. (See, e.g., Blau & Kahn, 1992.)

2.2 Education and the gender wage gap in Sweden

In this section, we will summarise some earlier results concerning gender and returns to education, which are relevant for the present study. We will not cover the broad range of general studies of gender wage differentials and other forms of gender inequality on the Swedish labour market. The interested reader is referred to Persson & Wadensjö, (1997) which is part of Kvinnomakt-utredningen (Public Inquiry on Women and Power), appointed by the Parliament in 1994. Some more recent studies are surveyed in Johansson et al. (2005).

Edin & Richardson (2002) investigate the role of wage dispersion for the gender gap in Sweden during the period 1968–91, applying a JMP-decomposition (see section 4 below) to LNU-data[4]. They find that the effects of change in the wage structure on women's wages have varied over time. The marked decrease in education premiums in the period 1968–74 led to a fall in the gender wage differential, since the average education of women was lower than that of men. Their wage equation includes education, experience and industry dummies. In this model, the (percentage) returns to a university degree were slightly higher for women than for men in 1968 and 1974, whereas they

[4] LNU, the Swedish Level of Living Survey, is a panel data-set, collected by the Swedish Institute for Social research (SOFI). There have been five waves so far – 1968, 1974, 1981, 1991 and 2000 – and the data include information from both interview and register data. For an introduction, see Bygren et al. (2004).

were larger for men in 1981 and 1991. The premiums for three-year senior high school and high school plus vocational school were consistently higher for men. According to Edin & Richardson, the small increase in the gender wage gap between 1981 and 1991 seemed to be due to changes in inter-industry wage differentials, which outweigh the effect of the growth in women's education and work experience, which would otherwise have decreased the gap.

le Grand (1991) also uses LNU data (1981) and estimates two models, one with only basic human capital variables and some family and individual characteristics, while the other adds a large number of job characteristics. In the first model, the average return to a year of education is 4.4 percent for men and 3.5 percent for women. In the second specification, it is 2.4 percent for men and 2.0 percent for women.

le Grand et al. (2001) follow changes in the Swedish wage structure further through the LNU, to 2000. They find a small decrease in the unadjusted gender wage gap and a small increase in the adjusted gender wage gap from 1991 to 2000. The convergence between men and women in terms of education and experience has not resulted in a proportionate convergence in wages, mainly because wage differentiation, given education and experience, has increased. The trend towards smaller education premiums 1968–91 is reversed in the 1990s, with an increase of about half a percentage point per year of education. In all years, except 1968, the premium is one percentage point higher for men than for women.

Albrecht et al. (2003) investigate the gender wage differential at different points in the wage distribution, by means of quantile regression and find that the gender wage gap increases throughout the wage distribution and accelerates in the upper tail of the distribution. Returns to education are practically equal for low-paid men and women, but are higher for men from the 25th percentile and upwards. The higher up in the wage distribution and the higher the level of education, the larger the gender differential.

Johansson et al. (2005) analyse the gender wage gap in Sweden in each year 1981–98, using HINK/HEK data.[5] During the 1990's, the size of the gap was around 14–16 percent. In a decomposition analysis, the measured differences in jobs and qualifications between women and men accounted for between half

[5] These data are collected annually by Statistics Sweden from a probability survey of households. They include both survey and register data. For more details, see section 5 below.

and three fifths of the gender wage gap, if they are assumed to be rewarded according to the wage function for men. When the female wage function was applied, only between one fifth and one third were explained.

3 Theories and previous studies on ORU-models

3.1 Theories

In economic theory, human capital, especially formal education, is central for individual productivity and wages. However, if the education acquired is not utilised in the actual work of the respondent, it does not necessarily increase productivity. This issue is confronted by the ORU models. (See Hartog 2000a, 2000b; Groot & Maassen van den Brink, 2000a and references therein for an introduction to the literature). In ORU-models, a distinction is made between an individual's attained level of education and the education required for her/his occupation. This makes it possible to estimate returns to required years of education as well as how mismatch (i.e. over- and undereducation) affects the returns to education.

According to the survey of ORU-studies from different countries in Rubb (2003), the results are very similar in three respects: The returns to required schooling are higher than the returns to actual schooling. Years of overeducation are rewarded, but less than years of required education. Undereducated workers earn less than workers in similar jobs with the required level of education. However, they earn more than workers who have same level of education as themselves but work in jobs where the required level is lower. Tests of the ORU-model against equations that only include acquired education indicate that the ORU specification is superior (Hartog, 2000a).

There are several possible explanations for over- and undereducation and these are not mutually exclusive. Human capital interpretations of over- and undereducation may take various forms. One is that some of the human capital an individual brings to a job may be obtained in other ways than through attained formal education. Workers may qualify for jobs, for which they do not have the formal education if they compensate for this by possessing other forms of human capital, such as experience and on the job training. Moreover, especially younger workers may compensate lack of other human capital with overeducation and choose a low-level job, because it is seen as an investment

in human capital or as a "foot inside the door" with a particular employer or industry. Several empirical studies (e.g. Sicherman, 1991; Alba-Ramirez, 1993; Groot & Maasen van den Brink, 2000b; Oscarsson & Grannas, 2001) report that the probability of being undereducated increases and the probability of being overeducated decreases with age/work experience. Further, Cohn & Ng (2000) conclude that work experience is a substitute for formal education.

Another feasible explanation is that within an educational group, those who obtain jobs normally requiring a higher level of schooling are the more able, who can compensate for having less formal schooling with other qualities (Rumberger, 1987; Groot & Maasen van den Brink, 2000b). Difference in ability could, in turn, be connected to the different quality of different educational establishments. Gartell & Regnér (2005) show that the wage premium for tertiary education in Sweden depends on at which university the degree was obtained. It is possible that the quality or reputation of the school also influences the probability of obtaining a more or less qualified job, but as far as we know, the issue has not been investigated from this angle.

Search theory with imperfect information also offers an explanation of over- and undereducation. A mismatch between actual and required education may be due to the cost of search, on the part of either employers or employees. Within this framework, overeducation represents a poor match for the workers, as their educational level implies that they are qualified for a higher-level job. Over time, however, the worker is expected to leave this job in order to obtain an improved match.[6] In this sense, overeducation is expected to be temporary, at the individual level. On the other hand, if the worker has less education than what is normally required for his occupation, he or she has an incentive to stay longer on the job. In this sense, undereducation represents a favourable match for the worker. The company may hesitate to replace the worker because of labour turnover/recruitment costs and/or because undereducated workers make up for their lower education in another way, e.g. through greater experience and tenure. In empirical studies, general work experience decreases the probability of overeducation and increases the probability of undereducation, while the effect of tenure is uncertain (Hartog, 2000b; Sloane et al., 1999).

The assignment literature (see Sattinger, 1993 and references therein) emphasises that demand-side variables are as important for earnings as supply-side variables. This literature deals with the problem of how workers with

[6] Unless the cost of mobility is too high.

differing attributes are allocated to jobs with differing levels of complexity. In a dynamic economy, workers and jobs are unlikely to match perfectly, and over- and undereducation will be a permanent feature of the labour market. However, it may be a short-run phenomenon for many individuals (Sloane et al., 1999).

If the demand for workers with a particular education outgrows supply, qualifications other than formal schooling must make up for the discrepancy and undereducated workers are employed. Conversely, if the system of education and the attainment of schooling grow at a faster rate than the demand for more educated workers, employers may have to, or choose to, employ overeducated staff. (Even when not directly required, education may signal higher ability). This will give rise to cohort effects in the likelihood of over- and undereducation and also cause gender differences, due to historical differences in participation and education between men and women in different cohorts. The expansion and technological development of the male dominated Swedish engineering industry during the first half of the twentieth century may have provided opportunities for men with low formal schooling to advance into more qualified jobs.

For many workers, the relevant labour market is a local (regional) one. If there are no job openings matching the training of the individual in the local labour market, the worker may accept a job below her/his level of qualification (Büchel & van Ham, 2003).

The neo-classical model of household specialisation has been used to explain why women are more likely to be overeducated. Frank (1978) assumes that accepting a job below one's level of qualification involves a cost and that this cost is higher, the higher are one's potential earnings. Since men are assumed to be able to earn more, joint household income maximisation, and possibly social and cultural norms, will make couples give first priority to finding the best possible job for the husband when choosing where to live. Thus, married women will be "tied movers" or "tied stayers" in a particular local labour market and unable to search for their individually optimal job match. The cost in terms of the wife's wage will be higher if the labour market where the husband settles is small. The evidence from empirical investigations is mixed. While Büchel (2000) shows that married women in Germany run a higher risk of being overeducated, McGoldrick & Robst (1996), Battu et al. (2000) reject or fail to support Frank's theory.

Another reason why women, and especially married women, are more likely to be overeducated could be if their job-choices are constrained by unequally divided childcare responsibilities, but we have not seen any empirical test of this hypothesis.

3.2 Definitions of skill mismatch

There are four broad methods of evaluating skill mismatch (Rumberger, 1987; Dolton & Vignoles, 2000; Hartog, 2000a, 2000b).

The first method is to let specialists assess the level of education required for an occupational category based on a detailed *job analysis* (JA).

Second, with *self reporting* (or *workers assessment*) (SR), the workers themselves are asked to say what would be the minimum education required to perform their work.

Average education (AE) estimates the level of required education by computing the mean of educational attainment within an occupation, while *modal education* (ME) is the education that is most common within an occupation. The AE and ME estimates are not direct measures of job content, but rather of past and present hiring standards. If overeducation is common in an occupation, this will tend to increase the AE and ME taken as the standard, and it will be decreased by widespread undereducation. Therefore, these two measures of mismatch are downward biased.

In this paper, we use a JA-approach to define skill mismatch. JA and SR assessments, unlike AE and ME, refer to job content. JA and SR-assessments tend to produce similar results (Hartog, 2000a). They both have advantages and disadvantages relative to each other. The strength of the JA-method is that it has a clearer and more objective definition, involves detailed measurement instructions and should be more consistent than self-reporting, since individuals may tend to overstate or understate the requirements of their job. If the tendency to do this varies with any individual characteristics included in econometric models, estimates will be biased, for example if women and men have different propensities to over- or underestimate the skills involved in their work. This leads us to prefer the JA method for the purposes of the present study. However, we recognise that it also has disadvantages relative to the SR approach. First, due to the costliness of the exercise, JA-assessments are infrequently updated, while SR-evaluations draw on more up-to-date information. Thus, with the JA-method, assessments of changes in the job structure may be unreliable. Second, the assessment refers to an occupational

category, which may be quite broad, but the SR-evaluation concerns the actual work of each individual. The SR method has been used in earlier Swedish studies based on the LNU. Our use of JA data therefore has the further advantage of allowing a comparison of results based on the two methods.

4 Method

Cross-sectional wage equations are estimated for each of the years 1993–2002, separately for women and men. The (log) hourly wage of individual *i*, of gender *j*, in year *t* may be written as:

$$\ln W_{it} = X_{it}\beta_{jt} + \varepsilon_{it} \qquad j = f, m \qquad [1]$$

where lnW_{it} is the natural logarithm of the hourly wage; X_{it} is a vector of variables believed to be correlated with earnings; β_{jt} represents estimated returns to characteristics and subscripts *m* and *f* denote the values for males and females, respectively. In most specifications, X includes the variables of the classical Mincer equation, schooling, experience and experience squared. Since our aim is to introduce ORU-methods into the study of gender wage differentials, we have chosen to start, as is usual in the literature on wages and gender, from the Mincer-equation, use the respondent's actual schooling as the explanatory variable and add variables for years of over- and undereducation as an extension of the standard model. Formally, this differs somewhat from the majority of ORU-studies, where the education required to perform a specific occupation, plus measures of over- and undereducation, are the explanatory variables.[7] Logically, the models and results are, of course, equivalent. This choice also made the comparison between estimates of models with and without the ORU-approach more straightforward.

An alternative expression for lnW_i, for an individual of either gender, is

$$\ln W_{it} = X_{it}\beta_{mt} + \sigma_{mt}\theta_{it} \qquad [2]$$

[7] Some earlier ORU-studies use the definition applied in this paper, e.g. Groot, 1993 and Groot & Maasen van den Brink, 2000b.

Here, lnW_{it} is expressed as the (log of the) wage predicted by the male wage equation[8] plus an error term separated into two factors. σ_{mt}, the male residual standard deviation may be interpreted as the level of male residual wage inequality. For j= m, θ_{it} is a "standardized" residual with zero mean and unit variance, but not for j = f.

If the parameters from the male wage equation are used to assign weights to differences in average characteristics between men and women, the gender gap in (log) wages at time *t* may be written as:

$$D_t = \ln W_{mt} - \ln W_{ft} = (X_{mt} - X_{ft})\beta_{mt} + \sigma_{mt}(\theta_{mt} - \theta_{ft}) \\ = \Delta X_t \beta_{mt} + \sigma_{mt}\Delta\theta_t \qquad [3]$$

where Δ denotes male-female average difference. This is the standard Oaxaca-Blinder decomposition, (Blinder, 1973 and Oaxaca, 1973) which will be used in section 9. The first term on the right-hand side in equation [3] is called "the endowment term" or "the explained part" since it indicates the part of the wage gap that can be attributed to differences in measured characteristics (endowments). The second term on the right-hand side in equation [3], which cannot be ascribed to the variables included in the wage model, is usually referred to as "the unexplained part".

The change in the gender wage gap from year t to year t' is:

$$D_{t'} - D_t = (\Delta X_{t'} - \Delta X_t)\beta_{mt} + \Delta X_{t'}(\beta_{mt'} - \beta_{mt}) + \\ (\Delta\theta_{t'} - \Delta\theta_t)\sigma_{mt} + \Delta\theta_{t'}(\sigma_{mt'} - \sigma_{mt}) \qquad [4]$$

This is the JMP-decomposition (see Juhn et al., 1991, 1993; Blau & Kahn, 1997; Edin & Richardson, 2002). While the Oaxaca decomposition relates the difference in wages between two groups at a particular moment, the JMP method analyses the development of this differential between two points in time. The decomposition consists of four parts: The first term, the "observed characteristics effects", reflects contributions of changing gender differences in

[8] In this section, we exemplify by using the estimated male wage equation to make the decompositions. Naturally, it is possible to use the female parameters instead. In the empirical analysis, we will do both.

observed characteristics (X). The second term, the "observed price effect", reflects the impact of changing prices – or rewards – to observed characteristics for men. The third term, the "gap effect", measures the effect of changing differences in the relative wage position of men and women after controlling for observed characteristics (i.e. whether women rank higher or lower within the residual male wage distribution). In other words, it shows the contribution to the change in the gender wage gap that would result from a change in the percentile rankings of the female wage residuals in the male residual distribution, if the level of residual male wage dispersion had remained the same. This may happen if the level of unobserved skills of women changes relative to that of men, or if discrimination in the labour market changes. The fourth term, "the unobserved-price effect", reflects the impact of changes in male residual distribution. It measures the contribution to the change in the gender wage gap of the male residual distribution, even if the relative position of women in the male residual distribution had not changed. All else equal, the larger the penalty for being below average in the residual distribution, the larger will the gender wage gap be. If a change in male residual distribution is interpreted as a change in the reward for unobserved characteristics, this effect can be described as a change in relative "prices for unobserved characteristics".

In equation [4], the impact of changes in gender-specific factors (observed and not observed) is reflected in the first and third term. Changes in the male wage structure are reflected in the second and the fourth term of equation [4].

As mentioned above, in the Oaxaca decomposition, the gender wage gap may be divided into an "explained part" and an "unexplained part". Sometimes, this unexplained part is referred to as "the discrimination term". However, this term cannot be considered as a quantitative measure of discrimination. A more detailed model specification might have produced a smaller "unexplained" component. On the other hand, as discussed in section 2, other forms of discrimination will affect the values of the variables that are taken to "explain" wage differentials and this goes unnoticed (see Katz, 2001).

In the JMP-decomposition, Juhn et al. (1991) note that the interpretation of the "unobserved price effect" is complicated when the wage gap reflects both skill differences and labour market discrimination, as some of the wage loss due to discrimination may be sensitive to changes in the wage structure. With labour market discrimination, the term "unobserved price effect" reflects the interaction between the level of discrimination in the first year, which pushes women down the distribution of male wage residuals, and the change in the

overall level of inequality, which determines how large the penalty is for women for their lower position in the male distribution. In this paper, the main concern is to identify the role of gender-specific factors and wage structure, rather than identifying the importance of discrimination per se. Therefore, labour market discrimination sensitive to the wage structure is considered to be gender specific, since it is a consequence of market-specific treatment of women (Juhn et al., 1991; Blau & Kahn, 1997).

Suen (1997) discusses the JMP-decomposition when the extent of labour market discrimination is not sensitive to the wage structure. In this case, using percentile ranking to identify the "gap effect" will produce biased estimates. If male wage residuals become more unequally distributed, the average percentile rank of women's wages should rise, as more men with a below average level of unobserved skills will be paid a lower wage than the average woman, but the pay gap should remain stable. However, this estimation problem will not arise if the level of discrimination is sensitive to changes in the wage structure (Suen, 1997; Edin & Richardson, 2002).

Empirically, the question of whether the extent of labour market discrimination is sensitive to changes in the wage structure or not is unsolved. However, earlier Swedish studies find that the decline of wage inequality from the end of the 1960's to the mid 1980's was accompanied by a decline in the unexplained wage gap. Moreover, the increase in overall wage inequality during the 1980's and the 1990's was accompanied by an increased unexplained gender wage gap (see le Grand et al., 2001). To the extent that this unexplained gap is correlated with discrimination, the results are such as would follow if the degree of discrimination were sensitive to changes in the wage structure in Sweden, although it does not, of course, constitute proof. To the extent that discrimination is independent of changes in the wage structure, the gap effect is underestimated. However, as long as not the entire unexplained wage gap consists of discrimination and discrimination is not entirely independent of changes in the wage gap, the qualitative conclusions are not affected.

5 Data and variables

5.1 The data

The Swedish Household Income Survey (HEK) is a survey designed for the study of income distribution, and has been conducted annually since the mid

1970's. The reference population is all individuals living in Sweden at least half of the calendar year. Survey data are collected through telephone interviews, but also from administrative registers and tax return forms. During the period 1993 to 2002, each annual sample includes 10 000–19 000 households.

The survey is rich in variables measuring income, transfers and taxes. There are many individual and job characteristics, for example, industry, socio-economic status, region of residence and marital status. These qualities, i.e. a relatively large sample, the rich set of variables and the fact that the survey is conducted annually, make HEK suitable for investigation of the male-female wage gap in Sweden. The main drawback is that since it was not created for the purpose of wage-analysis, we have to impute hourly wages from register data on annual earnings and survey data on hours worked each month. Since some of the variables we want to include in our wage model were not collected until 1993, we start our analysis in this year.

From the register data on highest achieved level of education in HEK, we have imputed the corresponding years of schooling (Table A1). Thus, education which is not completed is not included. All variables are defined in the Appendix, those included in the wage regressions in Table A1 and those used in the analysis of the probability of over- and undereducation in Table A2.[9]

From each round of HEK 1993–2002, we have drawn a sub-sample, consisting of respondents aged 20–64, reporting any labour related income. We have excluded self-employed, farmers and full-time students. In addition, observations with missing values for any variables used in the models are deleted. This has left us with data sets including between 6 500 and 10 200 individuals each year.

5.2 Gender differences in characteristics

As may be seen from Tables A3 and A4 in the Appendix, gender differences in average experience, acquired education, country of birth, region and marital status are quite small. Because of the small gender differences in these characteristics, their contribution to the decomposition of the wage gap will also be small and they will be very briefly mentioned.

[9] Tables A1 and A2 also indicate which variables are based on interview data and which are taken from registers.

On average, women have more years of education than men during the entire period, but the difference is small. Mean years of education increased, from about 10.7 years for men and 10.8 years of education for women in 1993 to about 11.3 years and 11.6 years of education, respectively, in 2002.[10]

Apart from skill mismatch, industry variables are those showing the largest gender difference – men dominate the workforce in mining, manufacturing, utilities and construction and women constitute the overwhelming majority in the education, health care and social services industries.

Even though gender differences in country of birth are not large, it would have been desirable to have a more precise subdivision in this category. The sample size for each year is not sufficient for this, however.

5.3 Average wage differentials

As a background to the decomposition analysis in sections 6.2 and 6.3, we show the size and development over time of the average gender difference in hourly wages during the period studied.

The second column of Table 5.1 shows that the ratio between the unadjusted geometric means of the hourly wages of women and men in 1993–2002 was relatively stable and the differential varied between 13 and 15.5 percent. Columns 3 to 6 of Table 5.1 present the gender wage differentials adjusted by assuming the average characteristics of women and men to be equal. Columns 3 and 4 are only adjusted for human capital variables, while in Columns 5 and 6 industries, country of birth, region and family variables are also controlled for.[11] In each year, two different adjustments are made, one adjusting the average characteristics of women to the levels of men, and one adjusting those for men to the average level of women. The difference between them is due to the existence of different reward structures for women and men, as will be discussed below. When adjustment is only made for human capital variables, the unexplained wage differential varies between 11 and 15 percent. When other variables are also controlled for, the unexplained wage differential varies between 8 and 13 percent.

[10] Field of education differs, however. This may be of importance for the wage differential but for reasons of sample size, we were not able to control for both field of education and industry.

[11] Human capital variables include work experience, years of education and years of over- and undereducation. The variables adjusted for in Columns 5 and 6 are the same as in the regression analysis below.

Table 5.1 Gender wage differentials 1993–2002 (unadjusted and adjusted), female average wages in percent of the male wages.

		Human capital model		Large model	
	Unadjusted differential	Adjusted, female	Adjusted, male	Adjusted, female	Adjusted, male
1993	85.0	86.5	87.5	88.6	89.9
1994	85.6	87.2	89.1	87.2	91.4
1995	85.1	86.0	86.5	88.5	90.9
1996	86.2	87.1	88.0	90.5	92.5
1997	86.0	86.8	87.2	89.1	91.5
1998	84.5	85.2	86.1	88.7	90.9
1999	85.1	86.1	86.1	89.4	90.8
2000	86.0	86.3	86.6	90.1	91.1
2001	85.4	85.7	85.9	89.3	90.0
2002	86.8	87.4	87.0	90.0	91.7

5.4 Over- and undereducation in the sample

5.4.1 Educational mismatch in sub-groups of the sample

We use a JA-coding based on the normal educational requirement for the occupation according to the socio-economic index (SEI). The SEI was introduced in the mid 1970´s, and has been modified several times since then. This classification of individuals in the labour force is primarily based on their occupations. Distinctions between categories are based on blue- and white-collar jobs, qualifications needed in the job, and if the person is self-employed or not.[12]

We define a respondent as having the appropriate, or adequate, level of education if her/his actual level of formal schooling corresponds to the SEI-code[13]. (The level of education is defined according to the SUN-classification.[14]) If it does not, we impute the usual number of years to which

[12] The SEI classification is close in character to the EPG-schema (Eriksson & Goldthorpe, 1992).
[13] See notes to table 3.1 for normally required schooling in socio-economic groups.
[14] The SUN-code divided education into seven educational levels :
1 - primary education, less than nine years
2 - primary education, less than nine (ten) years
3 - secondary education, not more than two years after primary education
4 - secondary education, more than two but not more than three years after primary education
5 - tertiary education, less than three years after secondary education

the two levels of education correspond and calculate by how many years the person is over- or undereducated.[15] This means that we only analyse over- and undereducation. Horizontal mismatch between skills and occupation i.e., where the respondent's education is on the same level as that required in the occupation but of a different kind, is not indicated in our data. (For instance, we cannot tell whether a secondary school teacher with a university degree has been trained as a teacher or not.) Nevertheless, we use the term "skill mismatch" without qualification, as this is standard in the literature.

Table 5.2, shows the proportion of the employed respondents that, on average, belongs to each skill/education cell over the period 1993–2002. It indicates that about half of the employed labour force has the level of education which is normally required in the occupation. About 19 percent have an education that is lower than what is normally required, and about 31 percent are overeducated, according to this definition.

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6 - tertiary education, at least three years after secondary education
7 - PhD
SUN was replaced by SUN2000 in 2000 (see Statistics Sweden, 2000). As a key between the classifications exists, it is possible to use the old educational classification throughout the period.

[15] SEI was last updated in the mid-80's and reflects conditions on the labour market at that time. Since then, the structure of the labour market has changed considerably. Oscarsson & Grannas (2001) – who use both the SEI-code and the newer SSYK-code to classify occupations – criticise the SEI-coding as being partly out-of-date. We think, however, that the definition still captures fundamental differences in skill requirements for different occupations. One of the main differences between SEI and SSYK is that many jobs that are considered as unqualified (normally requiring less than two years of education after primary education) according to the SEI-code are considered to be more qualified according to SSYK.

Table 5.2 Distribution of adequately, under- and overeducated employees, mean 1993–2000. In percent of employed respondents (Overeducation is indicated by a light shading of the cell, undereducation by a darker.)[16]

SEI*/SUN	Compulsory school	Secondary school, short	Secondary school, long	University, short	University, long, Ph.D.	Row total
Unskilled blue-collar, Lower white-collar I	10.0	13.6	5.4	1.7	0.3	31.0
Lower white-collar II	1.6	3.9	2.5	1.6	0.6	10.2
Skilled blue-collar	3.8	10.3	3.0	0.7	0.1	18.0
Middle white-collar	2.3	4.7	4.2	9.0	5.4	25.7
Higher white-collar, managerial positions	0.7	1.4	1.7	3.0	8.3	15.1
Column total	18.4	33.9	16.8	16.0	14.9	100.0

*Normal educational requirement for the groups are:
- *Unskilled blue-collar, lower white-collar* I: < 2 years after primary education.
- *Lower white-collar workers II*: ≥ 2 but < 3 years after primary education.
- *Skilled blue-collar workers*: ≥ 2 years after primary education.
- *Middle white-collar workers*: ≥ 3 but < six years after primary education.
- *Higher white-collar workers and managerial positions*[17]: ≥ 6 years after primary education.

The proportion that is adequately educated (i.e. whose level of education coincides with the education normally required in their occupation) decreases somewhat from 1993 to 2002, from 52 to 47 percent for women and from 50 to 47 percent for men (see Figure 5.1).

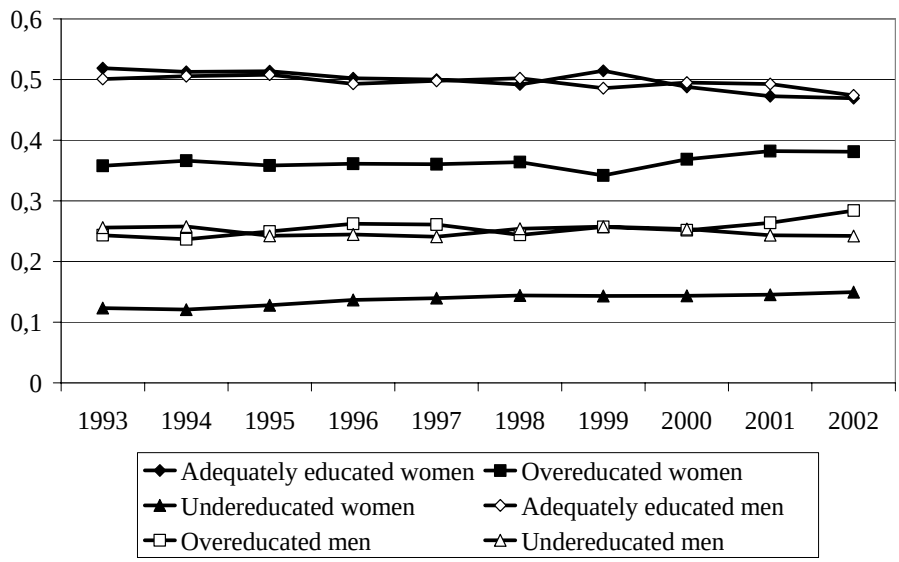
In each year, a larger proportion of men than women are undereducated, but while among women, the share of undereducated increases from 12 to 15 percent during the period of study, it decreases from 26 to 24 percent among men.

[16] The level of education considered to be normally required for this SEI-classification is marked as adequate. The SEI-requires skilled blue-collar workers to have not less than two years of secondary education. Therefore, it is, by definition, impossible for them to be overeducated according to this standard. Since the problematic category of "adequately educated" skilled blue-collar workers with a university education is so small – 0.8 percent of the workforce or 5 percent of all skilled workers – we have not modified this coding.

[17] There is no formal educational requirement for managerial positions. However, in this paper, we assume the educational requirement to be the same as for higher white-collar workers.

The proportion that is overeducated increases from about 36 to 38 percent for women and from 24 to 28 percent for men. Thus, the levels are different, but there is a tendency for the share of overeducated to increase for both women and men.

Figure 5.1 Percent adequately, over- and undereducated employed 1993–2002



These results are in line with earlier Swedish studies. le Grand et al. (2004) report that the educational level of the labour force as well as the required level of education in the labour market have increased since the late 1960's, but the supply of educated workers has increased faster than demand. le Grand et al. (2001) report that the proportion that is overeducated increased and the proportion adequately educated decreased from 1991 to 2000. Oscarsson & Grannas (2001) also report a weak tendency for the proportion of overeducated workers to increase and the proportion of adequately educated to decrease during the 1990's.

Table 5.3 reports the proportions of over- and undereducated in subgroups during the period 1993–2002. It is evident that irrespective of whether the

population is divided according to sector, work experience or educational level,[18] the proportion of women who are overeducated is larger than the proportion of overeducated men and the proportion of undereducated men is larger than the proportion of undereducated women.

Table 5.3 Percent adequately, over- and undereducated employed 1993–2002 in sub-groups

	Under		Adequately		Over	
	Wo-men	Men	Wo-men	Men	Wo-men	Men
Sector						
Private	18	27	42	48	40	25
Public	10	17	56	55	33	29
Work experience						
0–9 years	8	11	43	49	48	39
10–19 years	11	20	50	51	38	29
20–29 years	15	26	53	51	33	22
30–39 years	21	35	51	48	29	17
40–50 years	22	41	54	46	25	14
Level of education						
Compulsory school, six years	24	56	76	44	-	-
Compulsory school, nine years	39	57	61	43	-	-
Secondary school, short	13	23	41	43	45	34
Secondary school, long	7	13	33	51	59	37
University education, short	14	24	66	54	20	22
University education, long	-	-	47	66	53	34
PhD	-	-	90	90	10	10

The fact that women are overeducated to a larger extent than men, and men are more often undereducated than women, is not unique to Sweden. In a survey-article, Groot & Maasen van den Brink (2000a) show that most country-studies find the same pattern.

[18] The pattern is the same if employed women and men are divided according to industry or field of education (not reported here).

5.4.2 The probability of being over- or undereducated

Obviously, there may be correlations between variables such as sector, education, experience, marital status and number of children. There are definitely correlations between sector, industry and field of education, variables whose relation to over- and undereducation we would also want to investigate. To do this, and to see whether the cross-tabulation results stand up under multivariate analysis, multinomial logit models of the probability of being over-and undereducated were estimated. For these estimations, all the datasets were pooled, making a total of about 84 000 observations. The models control for work experience, educational level, field of education, industry, sector, country of birth, region, family variables, gender, and work-time. They were estimated separately for each gender as well as twice for all observations – once with only a gender intercept and once with every other variable interacted with gender.

In Table 5.4, we report estimates for women and men separately and indicate for which variables the fully interacted model for overeducation (O) or undereducation (U) showed that the difference between male and female odds ratios was significantly positive (+) or negative (-) at the 5%-level. We also note that the model with only a dummy variable for gender showed a significantly lower probability for women of being undereducated (odds ratio 0.600) and a significantly higher probability of being overeducated than for men (odds ratio 1.483).[19]

The probability of being undereducated increases and the probability of being overeducated decreases when work experience increases. However, the curve flattens after about 20–30 years of work experience. The effects of experience are significantly larger for men.

For women, the probability of being undereducated is significantly lower if they have a short (six-year) compulsory education than with a short secondary education, while it is the opposite for men. Another gender difference is that women with a long university education have a larger probability of being overeducated than women with a short secondary education, while it is the other way around for men.

[19] We also tried to use dummy-variables for birth-cohort as well as age, but due to collinearity with work experience (especially for men), they were excluded.

Table 5.4 Probability of being under- and overeducated *(Reference categories in italics)**

	Gender difference		Women		Men	
			Under	Over	Under	Over
Work experience						
0–9 years	U+	O-	0.710**	1.338**	0.596**	1.617**
10–19 years		O-	0.785**	1.085*	0.788**	1.257**
20–29 years						
30–39 years			1.309**	1.025	1.332**	0.902*
40–50 years		O+	1.224*	1.158	1.295**	0.875*
Level of education						
Compulsory, 6 years	U-		0.611**	-	1.347**	-
Compulsory, 9 years			1.387**	-	1.767**	-
Secondary, short						
Secondary, long	U-		0.404**	1.296**	0.349**	0.743**
Tertiary, short	U+	O-	0.808**	0.287**	0.661**	0.395**
Tertiary, long		O+	-	1.248**	-	0.570**
Field of education						
General education	U+		0.912	1.003	0.682**	0.990
Religion, aesthetical, art			0.956	0.861	0.830	0.931
Teacher/education			0.316**	1.145*	0.407**	1.191*
Soc sci, law, commerce						
Sciences, tech. & man.	U+	O+	0.621**	0.699**	0.381**	0.594**
Transport & commun.		O+	0.939	2.538**	0.584**	1.609**
Health care & nursing		O+	0.318**	0.707**	0.334**	0.515**
Agriculture, forestry			0.338**	1.082	0.420**	1.224*
Service	U+	O-	0.521**	1.554**	0.386**	1.926**
Industry						
Agricult, fishing, hunting			0.731	0.747	0.623**	1.259
Mining, manufacturing, electricity & gas						
Construction	U+	O+	1.709**	1.058	1.142**	0.210**
Wholesale & retail trade	U-	O+	0.999	1.991**	1.218**	1.490**
Hotels, restaurants	U+	O+	1.638**	0.720**	1.190	0.298**
Transp, stor & commun.	U+	O-	1.200	2.149**	0.668**	2.854**
Financial & insurance	U+	O-	2.357**	0.345**	1.793**	0.733**

Real est, business serv	U-		1.511**	0.877*	1.893**	0.994
Public admin & defence		O-	2.109**	0.887	1.540**	1.641**
Education & research	U-		1.336**	0.633**	2.193**	0.681**
Health care & soc. serv.	U-	O-	0.901	0.541**	1.489**	0.837*
Recreational & cult serv		O-	1.696**	0.527**	1.338**	1.336**
Sector						
Central government			0.817	0.670**	0.834*	0.805**
Local government		O-	0.678**	0.910	0.556**	1.150*
Private						
Country of birth						
Sweden						
NW Eur., N. Am., Aus.			0.809**	1.073	0.875*	1.072
Rest of the world			0.618**	1.294**	0.586**	1.449**
Region						
Stockholm			1.345**	0.743**	1.532**	0.827**
Göteborg, Malmö	U-	O-	1.030	0.765**	1.267**	0.891*
Medium-sized cities	U-		0.906	0.902**	1.076	0.944
Southern Sweden						
Densely pop N Sweden			0.977	1.105	0.902	1.038
Sparsely pop N Sweden			0.920	1.082	0.869	1.048
Family						
Not married						
Married/cohabiting	U-	O+	1.070	0.918*	1.507**	0.769**
No children						
Children 0–6 years			1.002	0.886**	0.922*	0.966
Children 7–17 years			0.967	0.961	1.078*	1.017
Part time	U-	O-	0.571**	1.443**	0.698**	1.764**
Woman		O+	-	-	-	-
N			42 954		40 692	
Wald chi^2			7 106 093		17 682	
Pseudo R^2			0.211		0.208	

** Significant at 1%-level, * Significant at 5%-level

Notes: Year-dummies were included but not reported since apart from a significant increase in the probability of undereducation for women, there was very little difference between the years. The gender difference columns refer to estimates when each variable in the models was interacted with gender and shows whether the probability of being overeducated (O) or undereducated (U) was significantly larger (+) or smaller (-) for women.

Both over- and undereducation are more common in the private than in the public sector, for men as well as for women and in local as well as in central government, with the higher probability of men working in local government being overeducated as the only exception. To some extent, this may be an effect of more exact definitions of occupations and positions in the public sector and more formalised hiring procedures.

Both women and men are less likely to be overeducated if they are married/cohabitating, but it makes a significantly larger difference for men. Women with children of pre-school age are less likely to be overeducated than women without children. Thus, our findings do not support the hypothesis that restrictions on women's job choices either due to being married or to having young children constitute a major explanation of female overeducation.

Individuals born outside Sweden have a lower probability of being undereducated and, if born in one of countries that, for brevity, we call "non-Western", a larger probability of being overeducated.

6 Results

6.1 Returns to education

This section will mainly focus on the parameters for education, over- and undereducation. We will also compare estimates of the return to education in models with and models without controls for over- and undereducation. The wage equation estimated also included work experience and its square, industry, country of birth and residence in Stockholm or the two other largest cities in Sweden, being married/cohabitating and number of children.

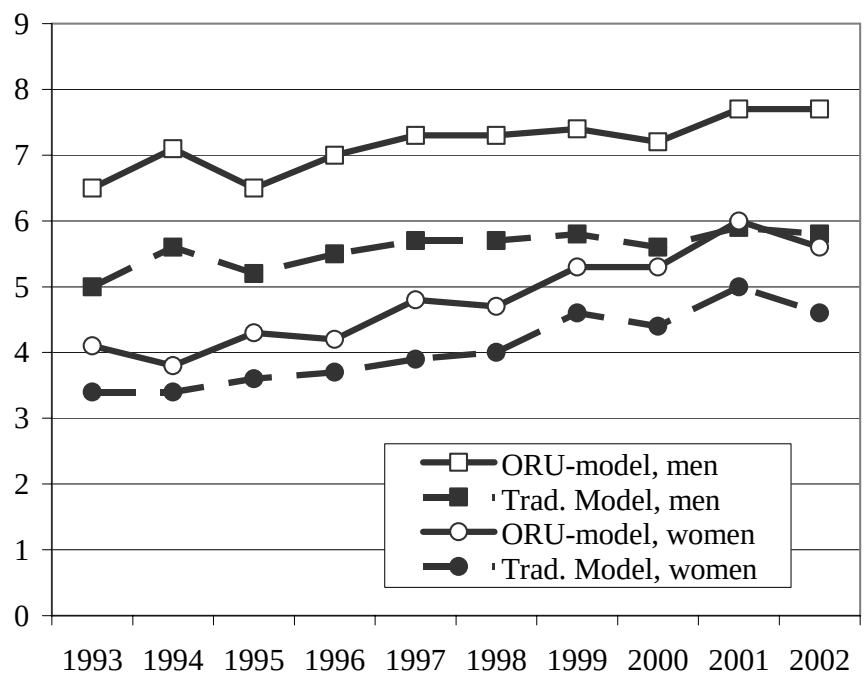
As mentioned in section 5, we have imputed years of schooling from the respondent's level of education[20]. The variable "education" in the estimates is equal to this number minus six (minimum compulsory schooling for the oldest cohorts). Its parameter should be interpreted as the return to each year of education (beyond the first six) for a person whose education matches that required by her/his occupation. The parameter for the variable "under-education" should be interpreted as the additional wage-premium the under-educated receive for each year of education that the occupation normally requires above that actually attained by the individual. The parameter for

[20] We have also run regressions and decompositions (as in sections 6.2 and 6.3) with years of education replaced by level of education. The results were very similar.

"overeducation" should be interpreted as the reduction of returns to schooling for each year of overeducation, when an individual has an occupation normally requiring a lower educational level than she or he actually has.

For women, the earnings premium for each year of education increases from about 4 percent at the beginning of the period to about 6 percent at the end of the period. (In Figure 6.1, these are shown as education parameters from the ORU-model. For the full estimates of the model, we refer to Tables A5 and A6.) The returns for each year of undereducation vary between 2 and 3 percent per year of undereducation. For each year of overeducation, the returns to education decrease by 2–3.5 percentage points, with a higher "penalty" towards the end of the period. Nevertheless, the net return to each year of overeducation (i.e. "education"+"overeducation") increases from about 1.5 to 2.5 percent during the period of study.

Figure 6.1 Premium for education in a traditional wage model and for education equal to the normally required in the ORU-models. Percentage points per year of schooling.*



* All parameters are significant at 5%-level.

For men, the earnings premium for each year of education increases from about 6.5 percent at the beginning of the period to about 7.5 percent at its end. The premium for each year of undereducation varies between 3.5 and just over 4 percent. For each year of overeducation, the returns to education decrease by 3–4.5 percentage points, with no visible trend over the period. The net return to a year of overeducation is about 2.5–3.5 percent.

To summarise, the returns to education above what is required are positive, but smaller than the returns to required education. The returns to undereducation are positive, but lower than those for actual years of education. This agrees well with the earlier literature, cited in section 3.1 above.

We also estimated a model without controls for over- and undereducation, but otherwise identical to the wage equation described above, separately for women and men in each of the years 1993–2002. Figure 6.1 shows the parameters for years of schooling in this "traditional model" and the parameter for years of schooling when education matches the normal requirements of the occupation is reported from the ORU-model. As may be seen in the diagram, controlling for mismatch increases the estimated education parameter by a half to one percentage point for women and by one to two percentage points for men. Thus, both the traditional model and the ORU-model indicate a higher education premium for men.[21] In fact, the gender difference is slightly larger in the ORU-model. The wage premiums for education/required education both increase by 1–2 percentage points over the period, for both genders.

6.2 Oaxaca-decompositions

In this section, we present results from the Oaxaca-decompositions of the gender wage differential in each year. Tables 6.1 and 6.2 show the decomposition of the endowment term into parts attributable to different groups of characteristics, evaluated according to the parameters of the female and male equations, respectively, as described in section 4 above.[22]

A positive number may be interpreted as the amount by which the gender wage gap would be reduced if men and women were equal in terms of this

[21] When the wage model was estimated for men and women together and with interaction terms between "female" and all other variables, the parameter for the interaction term for years of education and female was negative and significant for all years.

[22] As explained in section 2, the two terms in the Oaxaca-decomposition should not be identified as "due to productivity differences" and "due to discrimination".

characteristic and if the characteristic were rewarded according to the estimated wage function for women/men. If a term is negative, it means that if women acquired characteristics more similar to those of men in this respect, but the wage function remained the same, the gender gap would actually increase.

The third column in Table 6.1 shows the part of the gender wage gap which can be attributed to the variables included in our wage equation, if the female wage equation is applied. The results indicate that if qualifications were rewarded according to the female wage equation, differences in characteristics would account for between 0.035 and 0.050 (with the exception of 1994) of the (log) gender wage gap. This amounts to between one fourth and one third of the gap. The rest remains unexplained by the variables in this model.

Table 6.1 Decomposition of the gender gap in log wages using the parameters estimated for women.

	Total wage gap	**Total endow-ments**	Work exper-ience	Educa-tion	Skill mis-match	Industry	Other
1993	**0.163**	**0.042**	0.008	-0.005	0.014	0.026	-0.001
1994	**0.155**	**0.018**	0.006	-0.004	0.015	0.001	-0.001
1995	**0.161**	**0.039**	0.005	-0.008	0.014	0.029	-0.002
1996	**0.148**	**0.049**	0.005	-0.007	0.009	0.041	0.000
1997	**0.150**	**0.035**	0.000	-0.006	0.013	0.030	-0.002
1998	**0.169**	**0.049**	0.000	-0.005	0.014	0.042	-0.001
1999	**0.162**	**0.050**	0.001	-0.008	0.014	0.042	0.000
2000	**0.151**	**0.046**	0.003	-0.016	0.014	0.048	-0.002
2001	**0.158**	**0.045**	0.000	-0.019	0.020	0.046	-0.001
2002	**0.142**	**0.037**	0.005	-0.014	0.015	0.032	0.000

According to the third column in Table 6.2, where the male wage equation is used as a benchmark, a larger part of the gender wage gap is ascribed to the variables in the wage equation. About 40 percent of the log wage gap is connected to differences in characteristics in this specification. Such a difference between the endowment terms indicates that the increase in female wages if women had the same means values for variables in the model as men, but retained the same wage function, would be smaller than the fall in male average wage if their characteristics changed to those of women.

On average, women have more years of education throughout the period. Therefore, the difference in education between men and women tends to decrease the gender wage gap. As both the difference in, and the returns to, education grow throughout the period, the impact of education on the gender wage gap increases, irrespective of whether the female or the male wage function is used for evaluation.[23]

Table 6.2 Decomposition of the gender gap in log wages using the parameters estimated for men.

	Total wage gap	**Total endow-ments**	Work exper-ience	Educa-tion	Skill mis-match	Industry	Other
1993	**0.163**	**0.057**	0.013	-0.008	0.022	0.032	-0.002
1994	**0.155**	**0.066**	0.015	-0.008	0.029	0.029	0.000
1995	**0.161**	**0.066**	0.008	-0.011	0.019	0.052	-0.002
1996	**0.148**	**0.070**	0.008	-0.011	0.022	0.054	-0.002
1997	**0.150**	**0.062**	0.000	-0.009	0.022	0.053	-0.004
1998	**0.169**	**0.073**	0.004	-0.008	0.023	0.059	-0.004
1999	**0.162**	**0.065**	0.001	-0.011	0.021	0.058	-0.003
2000	**0.151**	**0.057**	0.005	-0.022	0.022	0.056	-0.004
2001	**0.158**	**0.052**	0.000	-0.024	0.028	0.051	-0.003
2002	**0.142**	**0.055**	0.000	-0.020	0.021	0.055	-0.001

Nevertheless, the decreasing effect of women's longer schooling on the gender wage gap is outweighed by the increase due to skill mismatch. In other words, although women in the labour force have invested as much time in their education as men, their wages are depressed both because their returns to jobs requiring more education are lower than for men, and because women get less qualified jobs than men with the same length of schooling.

The size of the skill mismatch term in the decomposition is sufficiently large to invest the issue of over- and undereducation with far greater interest than it has hitherto been given in the literature on gender wage differentials. We can add that a decomposition made from the wage equation without skill

[23] The relatively large and persistent increase from 2000 may, however, be connected to the change in the SUN classification system for education, which was implemented from that year.

mismatch variables resulted in a smaller endowment term – the difference was of almost the same size as for skill mismatch in the decompositions that include them. Skill mismatch is one of the mechanisms of "unequal treatment" that show up as "unexplained" in traditional decompositions of the gender wage gap. It is also interesting to note that undereducation constitutes about two thirds, and overeducation about one third, of the term "skill mismatch".

The other variables included in the wage equation[24] make very small contributions to the endowment term, mainly because the differences between female and male averages are small. The great exception is industry, which accounts for a substantial gender wage differential.

6.3 JMP-decompositions

In this section, we analyse changes in the gender wage gap between 1993 and 2002 by making a JMP-decomposition, as described in section 4.

Table 6.3 reports some summary statistics on the gender wage gap in 1993 and 2002. As mentioned, the overall gap decreases by about one eighth from 1993 to 2002, from log 0.163 to log 0.142. Women improved their position in the male residual distribution (the mean percentile ranking of women increased from the 36th to the 40th percentile), while men's position in the female residual distribution deteriorated. This indicates that the unobserved characteristics of women became more favourable, relative to those of men and/or that the extent of discrimination decreased. For both women and men, residual dispersion increases, but not a great deal.

Table 6.3 Summary statistics of the gender wage gap 1993 and 2002

	1993	2002
Log wage gap	0.163	0.142
Mean female residual percentile in male residual distribution	36	40
Mean male residual percentile in female residual distribution	65	62
Female residual wage inequality	0.328	0.347
Male residual wage inequality	0.332	0.337

[24] That is, family variables, region and country of birth.

Table 6.4 shows JMP-decompositions of changes in the gender wage gap, based on the female and male wage equations, respectively. While the log wage gap decreased by a slight 0.021 log points, gender-specific factors called for a substantially larger decrease of 0.111 log points when the female wage equation was applied and 0.059 log points when the male wage equation was used. This was counteracted by changes in the wage structure which, *ceteris paribus*, would have increased the gender wage gap by 0.091 log points and 0.039 log points according to the female and male wage equations, respectively.

Among gender-specific factors, the "gap effect" (unobserved skills) dominates, as it reduces the gap by 0.099 log points if the female wage equation is used and 0.032 log points if the male wage equation is used, while observed changes in the gender-specific factors are relatively small. Work experience, education and undereducation all work in the direction of decreasing the gender wage gap, since these variables have increased more for women than for men. As may be seen from table 6.4, the difference in overeducation is stable during the period. Changes in industrial composition work in the direction of increasing the gender wage gap, if the female wage equation is applied, but decrease the wage gap if the male equation is used.

Changes in the observed as well as the unobserved wage structure tend to increase the gender wage gap during the period, irrespective of which wage equation is applied. When the female wage equation is used, changes in unobserved prices are dominant. This is not the case when the male wage equation is used. Here, the changes in relative wages between industries were working in the direction of a large increase in the gender wage gap. A closer investigation reveals that falling relative wages in the industries "education and research" and "health care and social services" (two heavily female dominated industries, mainly in the public sector) constitute the driving force. Since the result could not be found using the wage parameters for women, it indicates that men in the public sector are falling behind men in the private sector, but women in the public sector are not falling behind women in the private sector, or at least not to the same extent.

The development of gender differences in education and undereducation leads in the direction of a decreasing gender wage gap. This is as expected, since women increased their average years of education slightly more than men, and the differences in undereducation narrowed somewhat during the

period of study. The difference in frequency of overeducation changes too little over the period to be of any importance in the decomposition.

Table 6.4 JMP-decomposition of the change in the gender wage gap 1993–2002

	Female wage equation	Male wage equation
Changes in gender-specific factors		
Work experience	-0.0056	-0.0087
Education	-0.0053	-0.0084
Undereducation	-0.0034	-0.0054
Overeducation	0.0000	0.0001
Industry	0.0014	-0.0059
Other	0.0002	0.0007
Unobserved skills	-0.0988	-0.0316
Changes in wage structure		
Work experience	0.0031	-0.0039
Education	-0.0039	-0.0032
Undereducation	0.0023	0.0025
Overeducation	0.0017	0.0014
Industry	0.0045	0.0296
Other	0.0001	0.0000
Unobserved prices	0.0832	0.0123
Total change in gender-specific factors	-0.1114	-0.0592
Total change in wage structure	0.0908	0.0387
Total change in gender wage gap	-0.0206	-0.0206
Changes in observed gender-specific factors	-0.0126	-0.0277
Changes in unobserved gender-specific factors	-0.0988	-0.0316
Changes in observed wage structure	0.0076	0.0264
Changes in unobserved wage structure	0.0832	0.0123

Since women on average have a longer formal education than men, the increase in returns to schooling over the period tends to decrease the wage gap. Increases in the reward for undereducation and in the penalty for overeducation

work in the opposite direction. As a result, changes in the wage structure add up close to a zero effect for these variables, irrespective of which wage equation is used.

Behind the small net change in the gender wage gap 1993–2002, there seem to be two forces working in opposite directions. The characteristics for women and men become more and more similar in terms of human capital factors such as work experience and educational level, decreasing the gender wage gap, while changes in the wage structure work in the opposite direction.

7 Summary and conclusions

Our primary purpose was to investigate to what extent skill mismatch had an impact on the development of the gender wage gap during the period 1993–2002. A main objective was to see whether the lower education premiums for women, found in previous Swedish studies, were due to women being less likely to get jobs where their education was required and the importance of this as an explanation of part of the gender wage gap in Sweden.

As in other countries, women in Sweden are more often overeducated (have an education that is higher than what is normally required for their occupation) than men, and less often undereducated (have an education that is lower than what is normally required for their occupation), and we show that this does indeed contribute to the gender wage gap. But independently of skill mismatch, women received smaller rewards to education than men. When both women and men have the appropriate level of education for their jobs, the reward to each year of this education (above 6 years of schooling) is in the 6–8 percent range for men and the 4–6 percent range for women. The wage effects of gender differences in skill mismatch are in addition to this. Interesting topics for further study are how this gender difference in education premiums is linked to industry and to level and field of education, to compare skill mismatch for women and men in the public and private sectors and of different ethnicity.

Skill mismatch is widespread. Only about half the employed women and men have an occupation matching their level of education. However, one woman out of seven is undereducated, as compared to one man out of four. Furthermore, more than one third of the women are overeducated as compared to one fourth of the men.

When industry is controlled for, formal educational requirements and the education of the employee correspond more closely in the public than in the private sector. For women in the health care and education industries, the likelihood of overeducation is smaller than in manufacturing.

Industrial segregation and skill mismatch account for considerably larger shares of the endowment term than traditional human capital variables. Gender segregation into different industries plays a quantitatively larger part than over- and undereducation, but the order of magnitude is comparable: In the Oaxaca decompositions, the skill mismatch variables account for endowment terms about a half or a third of the size of that attributable to industry variables. Nevertheless, in research on – as well as in political discussion of – gender wage equality, the attention paid to discrepancies between schooling and job-level has been miniscule as compared to what has been devoted to segregation by industry.

The overall gender wage gap was almost constant over the period studied. Thus, the JMP-decomposition is of a very small total change. What we do find is that the stand-still is due to almost equal forces of opposite directions: Changes in observed and unobserved characteristics tended to decrease the gender gap, while changes in wage structure tended to increase it. Methodologically, the different size of these effects, depending on whether the male or female equation was applied, raises questions about the interpretation of such difference and about whether it is appropriate to only use the male equation.[25]

The substantial gender difference in the extent and the form of mismatch is not explained by the general ORU-literature. The only theory that would imply a gender difference, i.e. that women are more limited in their choice of jobs because of marriage and/or the care of young children, do not receive support in our data.

The observed extent of under- and overeducation largely depends on how they are defined. Our estimates are similar to those of le Grand et al. (2001), who use self-reporting to assess educational requirements. Oscarsson & Grannas (2001), however, use both the same classification as applied in this study (SEI/SUN) and an alternative classification (SSYK/SUN), which results in a smaller share of overeducation and a larger share of undereducation. Yet,

[25] In our case, some parameters in the female equation have low precision due to the small number of women in certain industries, but that does not explain the entire difference.

both classifications indicate similar relative gender differences. It is conceivable that classifications have an unintended gender bias. This could be due to an increase in the skill level of female dominated occupations over time, which the classifications have not kept up with. It could also be interpreted in line with the theory of value discrimination. If something of the perceived skill level is in the eye of the beholder, it is quite possible that skills traditionally or culturally conceived as "female" are undervalued, by employers, experts, colleagues and even by women workers themselves. Such undervaluation and classification bias would tend to reduce both wage offers and wage demands.

Today, more women than men in the labour force have a tertiary education, and gender differences in work experience are small. Traditional human capital variables explain almost nothing of the gender wage gap. Indeed, with a model including only education and experience, the endowment term in the decomposition is nil or negative! We compared Oaxaca-decompositions of the gender wage gap for each year using models with and without variables for over- and undereducation. We found the part of the gap attributable to actual education to be of very similar size when the two models are used. According to our model, if women were undereducated to the same extent as men, the gender wage gap should decrease about 0.9 percentage points. If women and men were overeducated to the same extent, the gender wage gap should decrease another half percentage point, according to the female wage equation. If the male wage equation is used, the figures are 1.6 and 0.7 percentage points, respectively. Compared with a raw wage gap of around 14 percent, the part that may be attributed to skill mismatch is relatively large.

Thus, controlling for skill mismatch adds an endowment term of 1.5–2.5 percentage points, and it is therefore a definite improvement of the wage model for the purpose of analysing gender differentials. We would expect it to be similarly useful for analysing differences between immigrants and natives. It would also be of great interest to see and make comparisons with similar analyses for countries with a different economic, institutional and cultural framework.

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Appendix

Table A1 Definitions of variables in wage equations*

Variable	Definition of variable
LnWH	Natural logarithm of wage per hour Working time is defined as the number of hours a person is usually gainfully employed including holidays, sickness periods, and periods of parental leave. The wage includes pay for work as well as holiday pay, benefits for sickness absenteeism and parental leave. (With a rough adjustment for replacement ratio.)
Wexp	Years of work experience
Education[26]	Years of education (minus six). Transformed from level of education, as: - 0 years Compulsory school, six years - 3 years Compulsory school, nine years - 4 years Secondary school, short - 6 years Secondary school, long - 7 years University, short - 9 years University, long - 11 years Ph.D.
Undereducation	Normally required education for occupation (years) minus actual years of education (if positive, otherwise zero)
Overeducation	Actual years of education minus normally required education for occupation (years) minus (if positive, otherwise zero)
Agriculture etc	Industry A and B according to SNI92
Mining, manufact-uring etc	Industry C, D and E according to SNI92
Construction	Industry F according to SNI92
Wholesale trade, retail trade	Industry G according to SNI92
Hotels, restaurants	Industry H according to SNI92
Transp and comm	Industry I according to SNI92
Finance and ins	Industry J according to SNI92

[26] When transforming from level to years of education, we follow Oscarsson & Grannas (2001).

Variable	Definition of variable
Real estate etc	Industry K according to SNI92 (except research and development (73))
Pub adm, defence	Industry L according to SNI92
Education and research	Industry M according to SNI92 (plus research and development (73) and child care (85.321 and 85.322))
Health care and social services	Industry N (except child care (85.321 and 85.322)) according to SNI92
Recreational and cultural services	Industry O according to SNI92
Born Sweden	Born in Sweden
Born "western "country	Born in Denmark, Finland, Norway, Iceland, Austria, BeNeLux, France, Germany, Great Britain, Ireland, Switzerland, Australia, Canada, New Zealand and USA
Born rest of the World	Born in rest of the world
Stockholm	Stockholm (H-region 1)
Göteborg, Malmö	Göteborg and Malmö (H-region 2)
Married	Married or cohabiting
Children	Children under age 18 in household

* Of the original HEK-variables used, yearly earnings, level and field of education, country of birth and region of residence are from register data. Hours of work, work experience, occupation (on which the SEI-coding is used), industry, marital status and the number and age of children are interview-based. The remaining variables are derived from these.

Table A2 Definitions of variables in multinomial logit equation*

Variable	Definition of variable
0–9 years	Between 0 and 9 years of work experience
10–19 years	Between 10 and 19 years of work experience
20–29 years	Between 20 and 29 years of work experience
30–39 years	Between 30 and 39 years of work experience
40–50 years	Between 40 and 50 years of work experience
General education	Educational field 0 in SUN-classification
Humanities and art	Educational field 1 in SUN-classification
Teacher/education	Educational field 2 in SUN-classification
Social sciences, law, Commerce	Educational field 3 in SUN-classification
Sciences, technology and Manufacturing	Educational field 4 in SUN-classification
Transport and Communication	Educational field 5 in SUN-classification
Health care and social Service	Educational field 6 in SUN-classification
Agriculture, forestry	Educational field 7 in SUN-classification
Service	Educational field 8 in SUN-classification
Central government	Employed by central government
Local government	Employed by local government
Private	Employed in private sector
Stockholm	Stockholm (H-region 1)
Göteborg, Malmö	Göteborg and Malmö (H-region 2)
Medium-sized cities	Medium-sized cities (H-region 3)
Southern Sweden	Southern Sweden (H-region 4)
Densely pop northern Sw	Densely populated northern Sweden (H-region 5)
Sparsely pop northern Sw	Sparsely populated northern Sweden (H-region 6)
Children 0–6 years	Children 0–6 years in household
Children 7–17 years	Children 7–17 years in household
Full time	Work time at least 90% of full-time full-year empl.
Part time	Work time less than 90% of full-time full-year empl.

*For origin of variables, see Table A1.

Table A3 Mean values, women

	1993	1994	1995	1996	1997	1998	999	2000	2001	2002	All years
Log wage	4.446	4.490	4.505	4.573	4.589	4.613	4.646	4.703	4.746	4.796	4.613
Work experience	18.625	19.190	19.038	19.495	20.155	19.835	20.344	19.763	19.981	19.369	19.571
Education, years (minus six)	4.828	4.965	4.996	5.114	5.169	5.262	5.288	5.515	5.595	5.595	5.239
Overeducation, years	0.651	0.676	0.667	0.672	0.680	0.702	0.656	0.751	0.814	0.804	0.709
Undereducation, years	0.367	0.340	0.354	0.376	0.394	0.413	0.392	0.392	0.385	0.391	0.380
Agriculture, fisheries, hunting	0.006	0.006	0.005	0.001	0.004	0.004	0.005	0.003	0.003	0.003	0.004
Mining, manufacturing, electricity and gas	0.112	0.116	0.115	0.101	0.119	0.110	0.116	0.109	0.110	0.102	0.111
Construction	0.012	0.007	0.009	0.009	0.007	0.006	0.007	0.006	0.009	0.009	0.008
Wholesale trade, retail trade	0.111	0.102	0.096	0.108	0.109	0.100	0.091	0.102	0.105	0.103	0.103
Hotels, restaurants	0.026	0.023	0.027	0.025	0.027	0.024	0.023	0.025	0.021	0.023	0.024
Transport, storage, communication	0.045	0.038	0.041	0.042	0.041	0.043	0.045	0.040	0.038	0.037	0.041
Financial and insurance	0.022	0.032	0.027	0.030	0.027	0.024	0.025	0.032	0.026	0.026	0.027
Real estate and business service	0.054	0.056	0.064	0.066	0.068	0.071	0.084	0.095	0.097	0.091	0.075
Public administration and defence	0.067	0.063	0.052	0.043	0.041	0.046	0.039	0.041	0.044	0.037	0.047
Education and research	0.230	0.245	0.249	0.284	0.250	0.242	0.235	0.212	0.195	0.221	0.236
Health care and social services	0.263	0.267	0.274	0.248	0.272	0.294	0.298	0.300	0.321	0.310	0.285
Recreational and cultural services	0.050	0.046	0.043	0.043	0.035	0.035	0.032	0.035	0.032	0.036	0.039
Born in Sweden	0.907	0.911	0.920	0.919	0.914	0.914	0.907	0.899	0.891	0.888	0.907

	1993	1994	1995	1996	1997	1998	999	2000	2001	2002	All years
Born in western country	0.059	0.061	0.045	0.049	0.051	0.049	0.047	0.049	0.047	0.044	0.050
Born in rest of the world	0.034	0.028	0.035	0.032	0.035	0.037	0.046	0.052	0.062	0.068	0.043
Stockholm-region	0.205	0.202	0.207	0.210	0.197	0.206	0.194	0.220	0.228	0.205	0.208
Göteborg and Malmö	0.154	0.145	0.143	0.144	0.136	0.135	0.150	0.157	0.164	0.157	0.149
Married/cohabiting	0.707	0.729	0.717	0.738	0.726	0.732	0.730	0.728	0.724	0.709	0.724
Children	0.437	0.455	0.441	0.462	0.443	0.446	0.481	0.483	0.474	0.473	0.460

Table A4 Mean values, men

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	All years
Log wage	4.609	4.645	4.666	4.721	4.739	4.782	4.808	4.854	4.904	4.938	4.771
Work experience	21.358	21.638	21.141	21.453	21.449	21.480	21.908	21.324	20.904	20.513	21.302
Education, years (minus six)	4.698	4.856	4.821	4.955	5.051	5.148	5.141	5.209	5.280	5.335	5.057
Overeducation, years	0.498	0.468	0.506	0.536	0.521	0.519	0.546	0.537	0.556	0.649	0.535
Undereducation, years	0.861	0.857	0.775	0.766	0.747	0.787	0.813	0.770	0.725	0.729	0.782

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	All years
Agriculture, fisheries, hunting	0.022	0.023	0.015	0.012	0.010	0.014	0.010	0.011	0.008	0.011	0.014
Mining, manufacturing, electricity and gas	0.310	0.321	0.322	0.316	0.342	0.328	0.319	0.318	0.299	0.297	0.317
Construction	0.125	0.109	0.099	0.115	0.095	0.094	0.090	0.091	0.095	0.088	0.100
Wholesale trade, retail trade	0.123	0.111	0.132	0.119	0.124	0.129	0.132	0.123	0.121	0.131	0.124
Hotels, restaurants	0.016	0.013	0.015	0.014	0.015	0.013	0.016	0.012	0.014	0.017	0.015
Transport, storage, communication	0.090	0.084	0.085	0.097	0.083	0.094	0.080	0.084	0.081	0.088	0.086
Financial and insurance	0.018	0.025	0.020	0.023	0.020	0.020	0.018	0.020	0.022	0.016	0.020
Real estate and business service	0.087	0.095	0.103	0.094	0.089	0.105	0.116	0.128	0.137	0.132	0.110
Public administration and defence	0.063	0.057	0.052	0.044	0.048	0.041	0.042	0.039	0.043	0.044	0.047
Education and research	0.064	0.072	0.073	0.083	0.080	0.077	0.082	0.069	0.070	0.075	0.075
Health care and social services	0.044	0.046	0.046	0.043	0.058	0.055	0.067	0.076	0.074	0.071	0.059
Recreational and cultural services	0.037	0.045	0.039	0.039	0.036	0.030	0.028	0.030	0.035	0.030	0.035
Born in Sweden	0.920	0.920	0.926	0.925	0.921	0.924	0.908	0.903	0.902	0.901	0.915
Born in western country	0.042	0.049	0.041	0.043	0.041	0.038	0.045	0.043	0.042	0.041	0.043
Born in rest of the world	0.037	0.032	0.033	0.032	0.038	0.038	0.047	0.054	0.057	0.058	0.043
Stockholm-region	0.196	0.199	0.205	0.196	0.173	0.187	0.180	0.193	0.203	0.200	0.194
Göteborg and Malmö	0.148	0.145	0.139	0.149	0.134	0.152	0.150	0.160	0.158	0.157	0.149
Married/cohabiting	0.705	0.724	0.693	0.718	0.699	0.694	0.707	0.726	0.725	0.693	0.709
Children	0.387	0.423	0.400	0.424	0.396	0.398	0.431	0.444	0.432	0.416	0.416

Table A5 Regression results, female wage equation

	1993	1994	1995	1996	1997
Wexp	0.014**	0.017**	0.012**	0.012**	0.018**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Wexp2 x 1 000	-0.190**	-0.248**	-0.153**	-0.157**	-0.250**
	(0.050)	(0.054)	(0.049)	(0.051)	(0.049)
Education	0.041**	0.038**	0.043**	0.042**	0.048**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
Undereducation	0.022**	0.024**	0.022**	0.015*	0.021**
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Overeducation	-0.023**	-0.013	-0.029**	-0.019**	-0.035**
	(0.006)	(0.007)	(0.006)	(0.007)	(0.005)
Agriculture, fisheries,	-0.239*	-0.128	-0.076	-0.037	-0.179
hunting	(0.104)	(0.067)	(0.128)	(0.084)	(0.159)
Construction	-0.100*	-0.158*	0.001	0.062	-0.099
	(0.050)	(0.067)	(0.082)	(0.070)	(0.067)
Wholesale trade,	-0.056*	-0.012	-0.007	-0.032	-0.040*
retail trade	(0.026)	(0.027)	(0.026)	(0.026)	(0.020)
Hotels, restaurants	-0.136*	-0.031	-0.100*	-0.093*	-0.124**
	(0.065)	(0.042)	(0.043)	(0.043)	(0.033)
Transport and	-0.032	0.106**	-0.025	0.051	-0.044
communication	(0.031)	(0.036)	(0.026)	(0.035)	(0.030)
Financial and	0.013	0.042	0.082**	0.066	0.073*
insurance	(0.033)	(0.041)	(0.025)	(0.042)	(0.029)
Real estate and	-0.054	0.066	0.017	-0.052	-0.047
business service	(0.029)	(0.033)	(0.030)	(0.031)	(0.027)
Public administration	-0.110**	-0.042	-0.063*	-0.062	-0.091**
and defence	(0.023)	(0.026)	(0.028)	(0.034)	(0.023)
Education and	-0.120**	-0.042*	-0.091**	-0.092**	-0.142**
research	(0.021)	(0.020)	(0.018)	(0.021)	(0.017)
Health care and	-0.103**	-0.017	-0.061**	-0.072**	-0.090**
social services	(0.021)	(0.021)	(0.017)	(0.021)	(0.017)
Recreational and	-0.060*	-0.081**	-0.064*	-0.036	-0.167**
cultural services	(0.029)	(0.031)	(0.031)	(0.034)	(0.029)
Born in western country	0.000	0.014	-0.018	-0.041	-0.016
	(0.024)	(0.027)	(0.024)	(0.027)	(0.025)

	1993	1994	1995	1996	1997
Born rest of the	-0.027	-0.014	0.012	-0.036	-0.031
world	(0.036)	(0.043)	(0.039)	(0.046)	(0.027)
Stockholm	0.025	0.071**	0.058**	0.041**	0.076**
	(0.014)	(0.017)	(0.013)	(0.015)	(0.014)
Göteborg Malmö	0.005	0.041*	0.033*	0.015	0.064**
	(0.013)	(0.019)	(0.016)	(0.018)	(0.014)
Married	0.016	0.003	0.012	-0.004	0.009
	(0.013)	(0.016)	(0.014)	(0.017)	(0.012)
Children	0.007	0.004	0.035**	-0.015	0.004
	(0.012)	(0.013)	(0.011)	(0.013)	(0.011)
Intercept	4.153**	4.094**	4.159**	4.266**	4.170**
	(0.033)	(0.032)	(0.030)	(0.034)	(0.029)
N	4 948	3 505	4 970	3 432	4 778
R^2	0.103	0.120	0.121	0.107	0.183
σ	0.328	0.331	0.313	0.321	0.299

Standard error in parenthesis

** Significant at 1%-level, * Significant at 5%-level

Tabe A5 (cont) Regression results, female wage equation

	1998	1999	2000	2001	2002
Wexp	0.018**	0.018**	0.018**	0.019**	0.010**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Wexp2 x 1 000	-0.278**	-0.246**	-0.282**	-0.289**	-0.089*
	(0.051)	(0.045)	(0.045)	(0.044)	(0.043)
Education	0.047**	0.053**	0.053**	0.060**	0.056**
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
Undereducation	0.022**	0.027**	0.017**	0.029**	0.029**
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Overeducation	-0.032**	-0.027**	-0.035**	-0.037**	-0.034**
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
Agriculture, fisheries,	-0.082	-0.018	-0.129	-0.213	0.073
hunting	(0.090)	(0.067)	(0.108)	(0.159)	(0.216)
Construction	-0.128	0.069	-0.004	-0.051	-0.095
	(0.067)	(0.070)	(0.047)	(0.067)	(0.069)
Wholesale trade,	-0.063*	-0.038	-0.044*	-0.057*	-0.067**
retail trade	(0.025)	(0.024)	(0.021)	(0.022)	(0.025)
	1998	1999	2000	2001	2002
Hotels, restaurants	-0.230**	-0.089	-0.189**	-0.142**	-0.180**
	(0.046)	(0.046)	(0.046)	(0.048)	(0.046)
Transport and	-0.040	-0.020	-0.029	0.021	-0.025
communication	(0.034)	(0.022)	(0.032)	(0.025)	(0.029)
Financial and	0.038	0.101**	0.029	0.088**	0.077*
insurance	(0.032)	(0.031)	(0.039)	(0.029)	(0.031)
Real estate and	-0.058*	-0.004	0.010	-0.024	0.008
business service	(0.029)	(0.023)	(0.025)	(0.024)	(0.026)
Public administration	-0.123**	-0.036	-0.101**	-0.101**	-0.075*
and defence	(0.026)	(0.027)	(0.022)	(0.023)	(0.031)
Education and	-0.172**	-0.128**	-0.151**	-0.154**	-0.135**
research	(0.020)	(0.016)	(0.018)	(0.019)	(0.021)
Health care and	-0.113**	-0.084**	-0.118**	-0.130**	-0.089**
social services	(0.018)	(0.016)	(0.017)	(0.017)	(0.019)
Recreational and	-0.181**	-0.146**	-0.137**	-0.034	-0.099*
cultural services	(0.038)	(0.032)	(0.032)	(0.041)	(0.043)
Born in western	-0.027	0.020	0.010	-0.014	-0.060*
country	(0.028)	(0.025)	(0.025)	(0.025)	(0.028)

	1998	1999	2000	2001	2002
Born rest of the	-0.031	0.002	-0.043	-0.044	-0.027
world	(0.036)	(0.027)	(0.030)	(0.027)	(0.026)
Stockholm	0.087**	0.054**	0.086**	0.096**	0.082**
	(0.015)	(0.014)	(0.013)	(0.014)	(0.015)
Göteborg Malmö	0.051**	0.025	0.024	0.019	0.036*
	(0.016)	(0.014)	(0.015)	(0.014)	(0.017)
Married	0.031*	0.006	-0.006	-0.006	-0.008
	(0.014)	(0.012)	(0.013)	(0.014)	(0.014)
Children	-0.010	-0.018	0.001	-0.024	0.012
	(0.012)	(0.010)	(0.011)	(0.012)	(0.012)
Intercept	4.226**	4.199**	4.288**	4.282**	4.410**
	(0.031)	(0.028)	(0.026)	(0.028)	(0.031)
N	3 365	4 315	4 231	4 217	5 193
R^2	0.180	0.186	0.190	0.214	0.156
σ	0.307	0.296	0.308	0.320	0.347

Standard error in parenthesis

** Significant at 1%-level, * Significant at 5%-level

Table A6 Regression results, male wage equation

	1993	1994	1995	1996	1997
Wexp	0.017**	0.017**	0.017**	0.016**	0.020**
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Wexp2 x 1 000	-0.210**	-0.183**	-0.210**	-0.198**	-0.269**
	(0.046)	(0.058)	(0.046)	(0.055)	(0.037)
Education	0.065**	0.071**	0.065**	0.070**	0.073**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Undereducation	0.034**	0.038**	0.034**	0.043**	0.043**
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
Overeducation	-0.036**	-0.043**	-0.030**	-0.037**	-0.041**
	(0.007)	(0.007)	(0.006)	(0.007)	(0.005)
Agriculture, fisheries,	0.010	-0.116*	-0.203**	-0.207**	-0.161**
hunting	(0.051)	(0.054)	(0.052)	(0.063)	(0.062)
Construction	-0.014	-0.029	-0.091**	-0.114**	-0.133**
	(0.018)	(0.025)	(0.021)	(0.022)	(0.019)
Wholesale trade,	-0.062**	-0.027	-0.039	-0.052*	-0.072**
retail trade	(0.022)	(0.023)	(0.022)	(0.023)	(0.018)
Hotels, restaurants	-0.226**	-0.241**	-0.144**	-0.142*	-0.266**
	(0.070)	(0.058)	(0.052)	(0.069)	(0.045)
Transport and	0.003	-0.048	-0.070**	-0.025	-0.026
communication	(0.020)	(0.025)	(0.019)	(0.022)	(0.019)
Financial and	0.199**	0.059	0.161**	0.161**	0.173**
insurance	(0.040)	(0.043)	(0.044)	(0.046)	(0.042)
Real estate and	-0.041	0.059*	-0.052*	-0.052*	-0.010
business service	(0.022)	(0.027)	(0.021)	(0.025)	(0.022)
Public administration	-0.042	-0.005	-0.088**	-0.126**	-0.044*
and defence	(0.021)	(0.023)	(0.025)	(0.026)	(0.020)
Education and	-0.138**	-0.166**	-0.220**	-0.213**	-0.235**
research	(0.026)	(0.025)	(0.022)	(0.026)	(0.021)
Health care and	-0.043	-0.014	-0.128**	-0.134**	-0.126**
social services	(0.026)	(0.038)	(0.030)	(0.030)	(0.022)
Recreational and	-0.113**	-0.119**	-0.082*	-0.176**	-0.196**
cultural services	(0.035)	(0.033)	(0.034)	(0.036)	(0.036)
Born in western	0.028	-0.048	-0.008	-0.106**	-0.012
country	(0.025)	(0.032)	(0.033)	(0.032)	(0.026)

	1993	1994	1995	1996	1997
Born rest of the	-0.047	0.000	-0.146**	-0.141**	-0.050
world	(0.032)	(0.054)	(0.036)	(0.035)	(0.036)
Stockholm	0.094**	0.070**	0.080**	0.101**	0.084**
	(0.016)	(0.019)	(0.015)	(0.018)	(0.016)
Göteborg Malmö	0.043**	0.035	0.050**	0.058**	0.057**
	(0.016)	(0.019)	(0.018)	(0.018)	(0.015)
Married	0.070**	0.080**	0.065**	0.091**	0.066**
	(0.016)	(0.019)	(0.017)	(0.019)	(0.014)
Children	0.000	-0.015	0.020	0.001	0.003
	(0.014)	(0.016)	(0.014)	(0.016)	(0.013)
Intercept	4.024**	4.002**	4.104**	4.122**	4.097**
	(0.030)	(0.035)	(0.029)	(0.031)	(0.025)
N	4 524	3 187	4 529	3 066	4 621
R^2	0.235	0.265	0.242	0.273	0.305
σ	0.332	0.343	0.329	0.327	0.318

Standard error in parenthesis

** Significant at 1%-level, * Significant at 5%-level

Table A6 (cont) Regression results, male wage equation

	1998	1999	2000	2001	2002
Wexp	0.019**	0.024**	0.022**	0.019**	0.023**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Wexp2 x 1 000	-0.249**	-0.347**	-0.319**	-0.292**	-0.368**
	(0.047)	(0.042)	(0.042)	(0.042)	(0.039)
Education	0.073**	0.074**	0.072**	0.077**	0.077**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Undereducation	0.040**	0.039**	0.040**	0.050**	0.042**
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Overeducation	-0.046**	-0.039**	-0.034**	-0.045**	-0.045**
	(0.007)	(0.006)	(0.007)	(0.006)	(0.005)
Agriculture, fisheries,	-0.272**	-0.091*	-0.291**	-0.165**	-0.133*
hunting	(0.073)	(0.038)	(0.046)	(0.040)	(0.054)
Construction	-0.186**	-0.076**	-0.136**	-0.062**	-0.090**
	(0.020)	(0.018)	(0.021)	(0.019)	(0.019)
Wholesale trade,	-0.076**	-0.054**	-0.079**	-0.081**	-0.093**
retail trade	(0.019)	(0.020)	(0.019)	(0.020)	(0.019)
	1998	1999	2000	2001	2002
Hotels, restaurants	-0.331**	-0.262**	-0.349**	-0.319**	-0.295**
	(0.101)	(0.064)	(0.060)	(0.047)	(0.047)
Transport and	-0.030	-0.043*	-0.078**	-0.006	-0.070**
communication	(0.020)	(0.019)	(0.022)	(0.020)	(0.022)
Financial and	0.119*	0.165**	0.151**	0.097*	0.125**
insurance	(0.056)	(0.048)	(0.042)	(0.038)	(0.038)
Real estate and	-0.069**	-0.026	-0.016	-0.003	-0.017
business service	(0.024)	(0.022)	(0.020)	(0.020)	(0.019)
Public administration	-0.084**	-0.036	-0.027	-0.042	-0.053*
and defence	(0.026)	(0.022)	(0.027)	(0.024)	(0.023)
Education and	-0.261**	-0.228**	-0.240**	-0.193**	-0.240**
research	(0.025)	(0.021)	(0.020)	(0.024)	(0.023)
Health care and	-0.150**	-0.146**	-0.168**	-0.133**	-0.143**
social services	(0.031)	(0.022)	(0.025)	(0.019)	(0.020)
Recreational and	-0.188**	-0.097**	-0.134**	-0.125**	-0.137**
cultural services	(0.033)	(0.032)	(0.029)	(0.043)	(0.034)
Born in western	-0.003	-0.024	-0.040	-0.043	0.006
country	(0.030)	(0.034)	(0.035)	(0.038)	(0.029)

	1998	1999	2000	2001	2002
Born rest of the	-0.134**	-0.084**	-0.173**	-0.132**	-0.107**
world	(0.035)	(0.030)	(0.033)	(0.025)	(0.029)
Stockholm	0.087**	0.124**	0.126**	0.132**	0.123**
	(0.017)	(0.016)	(0.017)	(0.016)	(0.015)
Göteborg Malmö	0.050**	0.065**	0.026	0.092**	0.051**
	(0.018)	(0.016)	(0.015)	(0.015)	(0.016)
Married	0.085**	0.043**	0.070**	0.090**	0.047**
	(0.016)	(0.014)	(0.016)	(0.016)	(0.014)
Children	0.005	0.005	0.014	-0.005	0.016
	(0.014)	(0.013)	(0.013)	(0.013)	(0.012)
Intercept	4.154**	4.101**	4.195**	4.213**	4.275**
	(0.030)	(0.027)	(0.026)	(0.026)	(0.025)
N	3 186	4139	4 217	4 198	5 025
R^2	0.313	0.310	0.294	0.297	0.302
σ	0.317	0.323	0.341	0.331	0.337

Standard error in parenthesis

** Significant at 1%-level, * Significant at 5%-level

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