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**Working Paper**

# Similar Education - Different Career and Wages?

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# SIMILAR EDUCATION - DIFFERENT CAREER AND WAGES?

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**ABSTRACT:** In this paper male-female wage differentials are studied over the career among industrial white-collar workers. The evolution of gender wage gap is analysed separately at three different levels of education (at basic, secondary and university level). The results show that even though the overall gender wage gap is largest in the group of employees with basic education only, the largest unexplained wage differentials (i.e. due to differences in returns to similar background characteristics) are to be found in the group of educated women. Age and general work experience appear to be the most important single factors behind the observed evolution of the unexplained wage gap. At secondary and university levels of education this wage gap increases over time suggesting that differential movement along job ladders is an important potential factor in explaining the evolution of male-female wage differentials over the career.

**KEY WORDS:** wage discrimination, internal labour markets, career mobility

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**TIIVISTELMÄ:** Tutkimuksessa tarkastellaan sukupuolten välisen palkkaeron kehittymistä työuran aikana teollisuuden toimihenkilöiden keskuudessa. Toimihenkilöt jaetaan kolmeen ryhmään rekrytointihetken koulutustason mukaan: peruskoulun käyneet, keskiasteen ja yliopistotason tutkinnon suorittaneet. Sukupuolten välisiä palkkaeroja tutkitaan kussakin ryhmässä erikseen. Tulokset osoittavat, että vaikka yleinen sukupuolten välinen palkkaero on suurin peruskoulun käyneillä toimihenkilöillä, suurimmat selittämättömät palkkaerot (eli erot siitä, että naisia ja miehiä palkitaan samoista ominaisuuksista eri tavoin) löytyvät koulutettujen naisten ja miesten väliltä. Iästä ja aikaisemmasta työkokemuksesta saadut erilaiset tuotot sukupuolten välillä näyttävät olevan tärkein syy naisten ja miesten selittämättömille palkkaeroille. Keskiasteen ja yliopiston käyneillä toimihenkilöillä havaittu palkkaeron kasvu työuran aikana viittaa siihen, että naisten ja miesten urakehityksen erilaisuus on tärkeä mahdollinen selittäjä sukupuolten välisille palkkaeroille.

**AVAINSANAT:** palkkadiskriminaatio, sisäiset työmarkkinat, urakehitys

## Yhteenveto

Tässä tutkimuksessa selvitetään, miten sukupuolten väliset palkkaerot kehittyvät työuran aikana teollisuuden toimihenkilöiden keskuudessa. Työssä arvioidaan erityisesti koulutuksen merkitystä tässä prosessissa. Tutkimusaineistona käytetään Teollisuuden ja Työnantajain Keskusliiton (TT) keräämää palkka-aineistoa vuosilta 1980-1995. Lopullisissa analyyseissä käytetään sellaisten toimihenkilöiden otosta, jotka on rekrytoitu toimipaikkaansa uusina työntekijöinä vuosina 1980-1986. Kunkin toimihenkilön uraa seurataan 10 vuotta tai niin kauan kuin hän on mukana TT:n aineistossa (jos alle 10 vuotta).

Empiirisiä analyysejä varten toimihenkilöt jaetaan kolmeen ryhmään rekrytointihetken koulutustason mukaan: peruskoulun käyneet, keskiasteen ja yliopistotason tutkinnon suorittaneet. Sukupuolten välisiä palkkaeroja tutkitaan kussakin ryhmässä erikseen sen arvioimiseksi, tuottaako sama koulutustaso yhtäläisen ura- ja palkkakehityksen naisille ja miehille.

Aineistosta ilmenee, että sukupuolten välinen yleinen palkkaero eri koulutustasoilla pysyy melko vakaana työuran 10 ensimmäisen vuoden aikana. Peruskoulun käyneillä toimihenkilöillä miesten palkat ovat 1,5 kertaisia naisten palkkoihin nähden. Keskiasteen tutkinnon suorittaneilla miesten palkat ovat 1,4 ja yliopistotason tutkinnon suorittaneilla 1,2 kertaiset naisten palkkoihin nähden. Näiden lukujen valossa naisten koulutustason nousu näyttäisi edistävän sukupuolten välistä tasa-arvoa. Tässä tutkimuksessa naisten ja miesten palkkaerojen taustoja valotetaan lisää tutkimalla niitä mekanismeja, jotka vaikuttavat sukupuolten välisten palkkaerojen kehittymiseen eri koulutustasoilla.

Peruskoulun käyneillä toimihenkilöillä 17 prosenttia sukupuolten välisestä palkkaerosta selittyy uran alussa naisten ja miesten erilaisilla ominaisuuksilla. Suunnilleen yhtä suuri osuus palkkaerosta, 18 prosenttia, johtuu siitä, että naisia ja miehiä palkitaan samoista taustaominaisuuksista eri tavoin (selittämätön palkkaero). Työuran jatkuessa näissä osuuksissa ei tapahdu suuria muutoksia. Kymmenentenä vuotena erilaisista ominaisuuksista johtuva palkkaero nousee 21 prosenttiin ja selittämätön palkkaero säilyy 18 prosentissa.

Keskiasteen tutkinnon suorittaneiden tilanne muuttuu työuran aikana. Uran alussa 18 prosenttia sukupuolten välisestä palkkaerosta selittyy naisten ja miesten erilaisilla ominaisuuksilla ja 15 prosenttia sillä, että naiset ja miehet eivät saa samaa tuottoa näistä ominaisuuksista. Työuran jatkuessa naiset ja miehet tulevat havaittujen ominaisuuksiensa suhteen aiempaa samankaltaisemmiksi. Erilaisista ominaisuuksista johtuva palkkaero laskee 10. vuotena kahdeksaan prosenttiin. Samaan aikaan selittämätön palkkaero nousee 23 prosenttiin.

Yliopistotutkinnon suorittaneilla palkkaero muuttuu samalla tavoin kuin keskiasteen käyneillä toimihenkilöillä. Sukupuolten välinen palkkaero havaittujen ominaisuuksien suhteen on tässä ryhmässä alunperin jo pieni, mutta laskee edelleen vuosien varrella. Työuran alussa erilaisista ominaisuuksista johtuva palkkaero on kolme prosenttia ja kymmenentenä vuotena enää prosentin. Selittämätön palkkaero kasvaa työuran aikana ollen 16 prosenttia uran alussa nousten 20 prosenttiin kymmenentenä vuotena.

Tulokset osoittavat, että vaikka yleinen sukupuolten välinen palkkaero on suurin peruskoulun käyneillä toimihenkilöillä, suurimmat *selittämättömät* palkkaerot (eli erot siitä, että naisia ja miehiä palkitaan samoista ominaisuuksista eri tavoin) löytyvät *koulutettujen* naisten ja miesten väliltä. Näyttää lisäksi siltä, että naisten kannalta tilanne pahenee ajan mittaan. Keskiasteen tutkinnon suorittaneilla selittämätön sukupuolten välinen palkkaero kasvaa (suhteellisesti) 53 prosenttia kymmenen ensimmäisen työvuoden aikana. Yliopistotason tutkinnon suorittaneilla vastaava nousu on 25 prosenttia.

Tutkimuksesta ilmenee, että iästä ja aikaisemmasta työkokemuksesta saadut erilaiset tuotot naisten ja miesten välillä ovat tärkein syy sille, että sukupuolten väliset palkkaerot kasvavat työuran aikana. Naisia palkitaan selvästi miehiä vähemmän iän ja työkokemuksen karttumisesta. Peruskoulun käyneillä toimihenkilöillä 71 prosenttia selittämättömästä palkkaerosta johtuu iän ja työkokemuksen erilaisista tuotoista naisten ja miesten välillä. Keskiasteen käyneillä vastaava osuus on 92 prosenttia. Yliopistotason tutkinnon suorittaneilla myös muut tekijät vaikuttavat selittämättömän palkkaeron syntyyn: naisia palkitaan yleisistä työtehtävistä ja toimialalla jatkamispäätöksestä eri tavalla kuin miehiä.

Naisten selvästi miehiä heikompi tuotto iän ja työkokemuksen karttumisesta viittaa siihen, että erilainen urakehitys on tärkeä mahdollinen selittäjä havaituille sukupuolten välisille palkkaeroille. Teollisuuden palveluksessa mies löytää naista todennäköisemmin hyvän "uraputken". Keskiasteen ja yliopiston käyneillä toimihenkilöillä selittämättömän palkkaeron kasvu työuran aikana voi juuri heijastaa koulutettujen naisten ja miesten erilaista alttiutta saada ylennyksiä. Perusasteen käyneiden palkkaeron vakaus työuran aikana voi vastaavasti viitata siihen, että näiden toimihenkilöiden todennäköisyys saada ylennyksiä on sukupuolesta riippumatta alhainen.

# 1 Introduction

Since women's participation in the labour market has over the past decades risen in many countries, increased attention has focused on male-female wage differentials. The general notion appears to be that as women become more attached to the labour market and accumulate both general labour market and company-specific experience the gender wage gap should diminish.[1] It has also been argued that one of the reasons why male-female wage differentials persist is that women do not acquire the type of education and skills which are rewarded in the labour market. Does similar education guarantee equal wages and career prospects for men and women is an issue that will be studied in this paper. Potentially important gender differences in labour market attachment are controlled for by following the evolution of wages over the career rather than at a single point of time.

In the theoretical literature several potential explanations have been discussed about the causes of gender wage differentials.[2] In statistical discrimination models the role of imperfect information in the labour market is emphasised. Gender wage differentials can appear if women, due to their higher expected value of domestic work, are more likely to exit from the labour market than men. Earlier empirical research has shown that career interruptions do have a significant effect on women's earnings growth.[3] If the exit propensity is regarded to be higher for women than for men, the threshold levels of ability to promotion are higher for women even though the two sexes have similar treatment within the same job. Lazear and Rosen (1990) and Winter-Ebmer and Zweimuller (1997) suggest that the differential movement along job ladders is essential in explaining the overall male-female wage differential.

The purpose of this paper is to shed light on the potential mechanisms that create gender wage gaps by studying male-female wage differentials at different phases of the career. A panel data set on Finnish industrial white-collar workers, who were new recruits at the beginning of the panel period, is used as a basis for empirical analyses. Each recruit is followed up for ten years or for as long he or she is in the sample. Wage equations are estimated conditional on the level of education at recruitment. Our data allow us to follow the development of gender wage gap over the career and the role of education in this process.[4]

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1 See e.g. Gunderson (1989).

2 Cain (1986) provides an extensive survey on this literature.

3 See e.g. Cox (1984), Mincer and Ofek (1982) and Cocrocan and Duncan (1979).

4 In our evaluations we use the measure of discrimination suggested by Oaxaca (1973).

Thus, our study gives new insights into the dynamic nature of the wage determination process which studies using cross-section data for a single year are not capable of doing.

The paper proceeds as follows. The data is described in the second section. In the third section empirical wage models and the decomposition of gender wage gap are discussed. Estimation results are reported in the fourth section. The fifth section summarises our main results.

## 2 Data

In this paper the evolution of gender wage differentials over the career are studied among Finnish industrial white-collar workers. The data set to be used in empirical analyses is gathered by the Confederation of Finnish Industry and Employers (TT) during the period 1980-1995. The collected sample of employees is representative *in manufacturing sector.*

Employees are divided into three different groups according to their level of education at the beginning of their career. The relevant groups are (i) basic education only, (ii) either lower or upper secondary education, and (ii) university education. To allow for as many observations as possible in subsequent empirical analyses we have collected data on all new recruits during the period 1980-1986, i.e. over a period of seven years. The share of male and female recruits with respect to their educational level at entry is presented in Table 1.

**Table 1. The share of employees at entry, different educational levels**

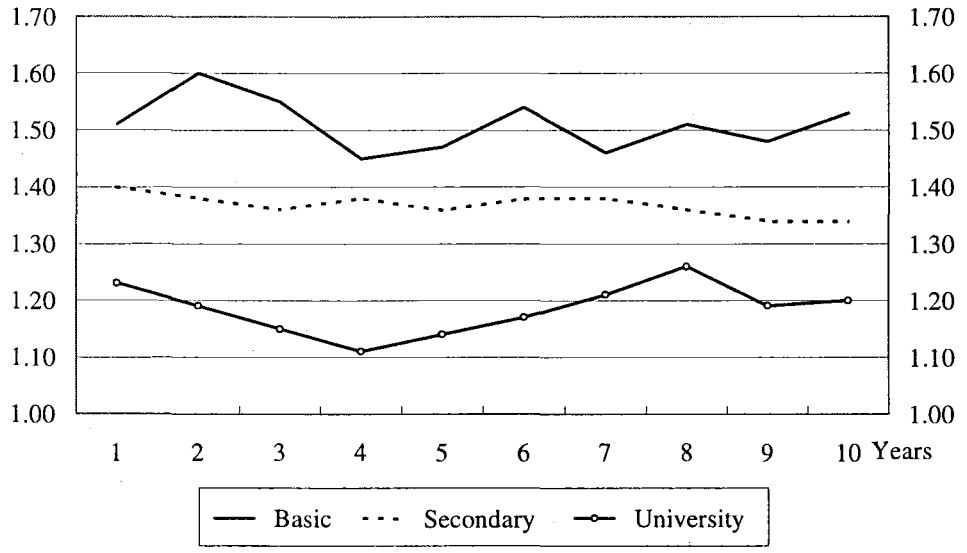
| Educational level | Men N=2100 % | Women N=1227 % | Both N=3327 % | Share of women % |
|---|---|---|---|---|
| Basic | 7.5 | 22.7 | 13.0 | 64.0 |
| Secondary | 49.0 | 61.7 | 53.7 | 42.4 |
| University | 43.5 | 15.6 | 33.3 | 17.4 |
| Altogether | 100.0 | 100.0 | 100.0 | 36.9 |

It appears from Table 1 that during the years 1980-1986 over half of the new recruits had secondary education and about a third had university education. 58 and 83 per cent of these employees were men, respectively. Women dominated the group of employees who had basic education only, 64 per cent in this group were women. There appears to be a strong gender segregation of jobs in Finnish industry. During the observation period the overall recruitment policy favoured well-educated male applicants.

All recruits have been followed up for ten years or for as long as they are present in the TT sample (if less than ten years). The data to be used in empirical analyses is an unbalanced panel data on individuals working at different TT member-firms. Individuals are thus followed at an industry level. This means that as long as an employee stays employed by any TT member-firm he or she will be present in our sample.

In Figure 1 the ratio of male wages to female wages at different employee groups is reported over different phases of the career.[5] Figure 1 shows that among employees, who have basic education only, men's wages are about 1.5 times as high as those of women. In this group, on average, women's hourly wages should increase by 50 per cent in order to reach men's wage level. In the group of employees who have secondary education the male-female differential is smaller. At the beginning of the career men's wages are 1.4 times as high as those of women, and women should get 40 per cent higher wages to get the same average wage level as men. Only in this group the ratio of male wages to female wages shows a slight declining trend over the career. Further, it appears from Figure 1 that the smallest overall difference between male and female wages is among employees who have university education. In this group men's wages are about 1.2 times as high as those of women, and thus women should earn no more than 20 per cent higher wages to reach men's average wage level.

**Figure 1. Ratio of male wages to female wages at different levels of education**




In terms of the gender wage gap the general message from Figure 1 seems to be that education is beneficial for women. The overall male-female gender wage gap is smallest among university educated women and largest among those with basic education only. However, the overall differential does not necessarily reveal the whole picture. Oaxaca (1973) has shown that the gender wage gap can be divided into two components. First, the gap may be caused by the fact that men and women have very different background characteristics. If this is the case comparing men and women with similar characteristics would diminish the wage gap considerably. Secondly, the outcome may be due to the fact that men and women

[5] Because the data set has been collected over a period of seven years wages have been deflated by the consumer price index and are therefore in real terms.

receive different remuneration for their observed characteristics. If this is causing the gender wage gap comparing men and women with similar characteristics would not diminish the gap at all because women and men obtain different remuneration for these characteristics in the labour market.

The observed differences in the male-female wage gap in the above three groups of employees will be divided into these two components in subsequent empirical analyses. Before doing this let us first see, at a very general level, what the basic characteristics of male and female employees have been at the point of recruitment in these three groups.[6]

In Table 2 background information on the group of employees with basic education only is reported. It appears that the average recruitment age is about 33 for male and 30 for female employees. Most of the employees, 58 per cent of men and 65 per cent of women, have less than six years' previous work experience. 17 per cent of men and 11 per cent of women have worked for over 15 years before entry. Women's wages are, on average, about 66 per cent of those of men.

In centralised wage agreements employees are divided into three groups, i.e. into clerical, technical, and managerial[7] employees. Clerical and technical employees' wage agreements specify what kind of skills and responsibilities different jobs require. Managerial employees' wage agreements do not have similar information. For clerical employees jobs are classified into twelve different requirement levels, and for technical employees jobs are classified into six wage groups. These classifications give information on the general skill requirement level on each employee's job. However, their existence does not mean that the centralised wage agreements prohibit individual differences in wages. On the contrary, wages within these classifications seem to vary quite a lot e.g. due to differences in job performance.[8]

It appears from Table 2 that over 81 per cent of women and 42 per cent of men with basic education were recruited to clerical posts. In this group men's share among clerical employees is higher than average, only 14 per cent of all male employees have clerical positions. 43 per cent of men were recruited for technical posts and 15 per cent for managerial posts. The corresponding figures for women were 17 and 2 per cent. There appears to be a clear gender segregation of jobs at entry.

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6 In Appendix 1 the sample means of variables used in the panel data estimations are reported.

7 Top management is excluded from the data set.

8 See Lilja (1995a).

**Table 2. Employees with basic education, sample means of variables at entry**

| Variables | Men N=156 | Women N=278 |
|---|---|---|
| *Age* | 32.7 | 30.3 |
| *Previous work experience, %* | | |
| 0-5 years | 57.7 | 64.7 |
| 6-10 years | 14.7 | 14.0 |
| 11-15 years | 10.9 | 10.1 |
| 15+ years | 16.7 | 11.2 |
| *Real hourly wage* | 55.2 | 36.5 |
| *Level of education, %* | | |
| Basic | 100.0 | 100.0 |
| *Clerical employees, %* | 41.7 | 81.3 |
| Job level 1A-1C | 7.1 | 20.1 |
| Job level 2A-2C | 18.6 | 55.8 |
| Job level 3A-3C | 15.4 | 5.4 |
| Job level 4A-4C | 0.6 | 0.0 |
| *Technical employees, %* | 43.0 | 16.5 |
| Wage group F | 6.4 | 8.3 |
| Wage group E | 9.0 | 6.1 |
| Wage group D | 7.7 | 0.7 |
| Wage group C | 12.2 | 1.4 |
| Wage group B | 5.1 | 0.0 |
| Wage group A | 2.6 | 0.0 |
| *Managerial employees, %* | 15.3 | 2.2 |
| *Job category* | | |
| Administration | 7.7 | 61.9 |
| Production | 31.4 | 2.5 |
| Purchase | 0.0 | 1.1 |
| R&D | 16.7 | 15.1 |
| Sales | 31.4 | 11.5 |

Among clerical employees the job levels are further divided into four main categories (1-4) and three subcategories (A-C). The least demanding job category is 1A and the most demanding is 4C. The jobs for technical employees are similarly grouped into six wage categories. The least demanding jobs belong to the wage group F and the most demanding to group A. It appears from Table 2 that the gender segregation exists also within these two groups; the majority of men are recruited for the most demanding job categories whereas women are recruited for the least demanding jobs.

The gender segregation is reflected also in the typical jobs men and women have been recruited for. Over 62 per cent of women work in administration whereas only 8 per cent of men do similarly. On the other hand, over 31 per cent of men work in production whereas only 3 per cent of women are recruited for these posts. Further, over one third of men do sales work whereas one tenth of women do so. The most even distribution of men and women is in research and development (R&D); 17 per cent of men and 15 per cent of women are involved in R&D at entry. Thus, these figures suggest that in this group a large proportion of the observed gender wage gap can be due to the fact that men and women have very different background characteristics.

When the employees have secondary education the basic set up remains the same. Table 3 shows that there is still a strong gender segregation at entry, and on average, female wages are about 72 per cent of male wages. Employees in this group are somewhat younger than those with basic education only and have less previous work experience. The average age for men at entry is 30 years and for women 27. Over 60 per cent have less than six years' work experience. Most of the employees, over 91 per cent of men and 78 per cent of women, have upper secondary education.

70 per cent of men have technical and 64 per cent of women commercial education. Accordingly 67 per cent of men have technical positions and about 80 per cent of women have clerical positions. 15 per cent of men, the same share as was for men with basic education only, obtain managerial positions at entry. Secondary education brings managerial positions for only 5 per cent of women. Table 3 shows that obtaining more education has not changed the distribution of women in different job categories. Still over 60 per cent of women work in administration and very few in production. For men education changes the situation. Over half of the men with secondary education work in production and one fifth in research and development. Much fewer men with secondary education than with basic education do sales work.

**Table 3. Employees with secondary education, sample means of variables at entry**

| Variables | Men N=1030 | Women N=757 |
|---|---|---|
| *Age* | 30.2 | 27.0 |
| *Previous work experience, %* | | |
| 0-5 years | 60.3 | 63.9 |
| 6-10 years | 16.8 | 21.8 |
| 11-15 years | 10.8 | 7.9 |
| 15+ years | 12.1 | 6.3 |
| *Real hourly wage* | 55.1 | 39.4 |
| *Level of education, %* | | |
| Lower Secondary | 8.7 | 21.8 |
| Upper Secondary | 91.3 | 78.2 |
| *Clerical employees, %* | 18.6 | 79.8 |
| Job level 1A-1C | 0.7 | 8.9 |
| Job level 2A-2C | 6.2 | 53.6 |
| Job level 3A-3C | 10.8 | 17.0 |
| Job level 4A-4C | 0.9 | 0.3 |
| *Technical employees, %* | 66.5 | 15.4 |
| Wage group F | 1.8 | 4.4 |
| Wage group E | 10.0 | 6.7 |
| Wage group D | 22.2 | 2.6 |
| Wage group C | 23.1 | 1.3 |
| Wage group B | 8.6 | 0.4 |
| Wage group A | 0.8 | 0.0 |
| *Managerial employees, %* | 14.9 | 4.8 |
| *Job category* | | |
| Administration | 5.1 | 62.9 |
| Production | 52.8 | 2.8 |
| Purchase | 1.8 | 3.3 |
| R&D | 20.9 | 15.9 |
| Sales | 5.5 | 9.5 |

Gender differences are less prominent among those new recruits who have university education than among other employees. It appears from Table 4 that the average age of recruitment is about 31 for both men and women. Women's wages are 81 per cent of those of men. Previous work experience in Table 4 is potential work experience and is therefore closely related to the age and years of education of the employees.[9]

Most of the new recruits have obtained managerial positions; 76 per cent of men and 51 per cent of women have done this. Over 34 per cent of women have been recruited for clerical positions, mostly for the most demanding job categories. Only 5 per cent of men with university education take a clerical position at entry, and nearly 19 per cent of men and 15 per cent of women are recruited for technical posts. About 82 per cent of men and 32 per cent of women have technical education. Over 2 per cent of men and almost 3 per cent of women have a post graduate degree.

University education has meant for 50 per cent of male and 39 per cent of female employees a work in research and development. 30 per cent of women still work in administration[10] (typical female category) and 25 per cent of men in production (typical male category). Otherwise differences between men and women are smallest in this group of employees. This explains on its own part why the overall gender wage gap is relatively narrow in this group.

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9 Managerial employees were the only group for which direct information on previous work experience was not available.

10 28 per cent of women have commercial education.

**Table 4. Employees with university education, sample means of variables at entry**

| Variables | Men N=914 | Women N=192 |
|---|---|---|
| *Age* | 30.5 | 31.0 |
| *Previous work experience, %* | | |
| 0-5 years | 42.9 | 51.6 |
| 6-10 years | 29.4 | 29.7 |
| 11-15 years | 16.2 | 13.5 |
| 15+ years | 11.5 | 5.2 |
| *Real hourly wage* | 72.3 | 58.7 |
| *Level of education, %* | | |
| University Graduate | 97.9 | 97.4 |
| University Post Graduate | 2.1 | 2.6 |
| *Clerical employees, %* | 5.2 | 34.4 |
| Job level 1A-1C | 0.0 | 0.0 |
| Job level 2A-2C | 0.4 | 5.7 |
| Job level 3A-3C | 3.4 | 27.1 |
| Job level 4A-4C | 1.4 | 1.6 |
| *Technical employees, %* | 18.5 | 14.6 |
| Wage group F | 0.2 | 0.0 |
| Wage group E | 3.0 | 5.2 |
| Wage group D | 5.3 | 6.8 |
| Wage group C | 5.5 | 1.6 |
| Wage group B | 4.2 | 1.0 |
| Wage group A | 0.3 | 0.0 |
| *Managerial employees, %* | 76.3 | 51.0 |
| *Job category* | | |
| Administration | 7.2 | 30.2 |
| Production | 25.1 | 7.3 |
| Purchase | 1.6 | 2.1 |
| R&D | 50.1 | 38.5 |
| Sales | 14.4 | 14.6 |

# 3 Empirical model

A traditional human capital model is used as a basis when we investigate the development of gender wage gaps. The wage equation is specified for three educational levels separately; (i) for employees with basic education only, (ii) for those with secondary education, and (iii) with university education. For all three educational groups the general form of the wage equation for person i at time t is assumed to be as follows

$$(1) \qquad \ln w_{it}^k = \beta_{0t}^k + X_{it}^k \beta^k + u_i^k + \varepsilon_{it}^k, \qquad \text{where } \eta_{it}^k = u_i^k + \varepsilon_{it}^k,$$

and where superscript k=f refers to a female employee and k=m to a male employee. $X_{it}^k$s are vectors of independent explanatory variables and $\beta^k$s are corresponding coefficient vectors. It is assumed that the intercept $\beta_{0t}^k$ is time varying. We assume further that $u_i^k$ and $\varepsilon_{it}^k$ are random disturbances with the following characteristics

$$(2) \qquad E(\varepsilon_{it}^k) = E(u_i^k) = 0$$

$$E(\varepsilon_{it}^{k2}) = \sigma_\varepsilon^2 \qquad E(u_i^{k2}) = \sigma_u^2$$

$$E(\varepsilon_{it}^k u_j^k) = 0 \qquad \text{for all i, t and j}$$

$$E(\varepsilon_{it}^k \varepsilon_{js}^k) = 0 \qquad \text{if } t \neq s \text{ or if } i \neq j,$$

$$E(u_i^k u_j^k) = 0 \qquad \text{if } i \neq j.$$

The assumption that the individual specific effect $u_i^k$ is random in the wage equations can cause a potential bias, if it is correlated with independent explanatory variables in the model. Because the level of education, which is the most likely single variable to be correlated with $u_i^k$, is kept constant in subsequent wage regressions, the use of random effects specification to allow for unobserved individual effects in the data should not be too restrictive. The motivation behind using random effects (rather than fixed effects) model comes from the fact that our panel data set is unbalanced with many individuals for whom we have one or two observations only. With fixed effects specification we would have lost information on these individuals.

Sample selectivity bias arising from the fact that wages in different phases of the career are observed only if persons stay employed is corrected from the second year onwards in line with Heckman (1979). From separate probit model estimations for the pooled sample the inverse of Mills' ratio has been calculated and added as an additional regressor in the wage equations.[11] The use of two-step procedure to correct for the potential sample selectivity

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[11] We also tested whether or not there were individual unobservable effects in the probit

problem has made it possible for us to test for individual random effects in the wage equations.

The results from wage model estimations are used to evaluate how gender wage differential changes over the career in our sample. To evaluate this we use the decomposition of wage gap suggested by Oaxaca (1973). Averaging over all men and women at each year t the following equation holds true

$$(3) \qquad \ln \overline{w}_t^m - \ln \overline{w}_t^f = \sum_{j=1} \hat{\beta}_j^m \left( \overline{X}_{jt}^m - \overline{X}_{jt}^f \right) + \sum_{j=1} \overline{X}_{jt}^f \left( \hat{\beta}_j^m - \hat{\beta}_j^f \right) + \left( \hat{\beta}_{0t}^m - \hat{\beta}_{0t}^f \right) + \left( \overline{\eta}_t^m - \overline{\eta}_t^f \right)$$

where the difference between male and female average log-wages is divided into three parts. The first part on the right hand side can be interpreted as the productivity-adjusted wage gap.[12] It is due to the fact that men and women have different background characteristics, which may lead to differences in productivity and, hence, in wages *(characteristics component)*. The next two parts can be interpreted as the discriminatory, unexplained component of the wage gap, i.e. the wage gap which cannot be explained by differences in productivity *(coefficients component)*. The last part is due to the fact that the individual averages of error terms do not necessarily equal zero at each year even though over the whole panel period this is the case.

To what extent the above two components represent productivity differences and to what extent discrimination has been widely discussed in empirical literature. According to Gunderson (1989) the greater number of variables used to control for differences in productivity-related factors, the smaller the productivity-adjusted wage gap. Thus, the nature and number of background explanatory factors in wage equations affect the measurement of the characteristics and coefficient components in empirical estimations. What is discrimination and what is not is further complicated by the fact that differences in the background variables (e.g. occupation, job requirements etc.) may themselves be the result of discrimination and their inclusion to wage equations may lead to "overjustification" of pay differentials.

Let us define the two central components of the male-female wage differential in the following way

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models but could not find any such effects in estimations.

[12] It is the difference between average male earnings and the average hypothetical female earnings that would prevail if women were paid according to the male pay structure.

(4) $C_t = \left(\overline{X}_t^m - \overline{X}_t^f\right)\hat{\beta}^{m\prime}$ characteristics component

(5) $D_t = \overline{X}_t^f\left(\hat{\beta}^m - \hat{\beta}^f\right)'$ coefficients component[13]

where $\overline{X}_t^m$ and $\overline{X}_t^f$ are the row vectors of sample means of variables at each period t and $\hat{\beta}^m$ and $\hat{\beta}^f$ are estimated row vectors of coefficients from the male and female regressions, respectively. When male and female wage equations are estimated separately (and thus independently of one another), it is possible to calculate the variances of $C_t$ and $D_t$ components as follows

(6) $Var(C_t) = \left(\overline{X}_t^m - \overline{X}_t^f\right) Var\left(\hat{\beta}^m\right)\left(\overline{X}_t^m - \overline{X}_t^f\right)'$

(7) $Var(D_t) = \overline{X}_t^f\left(Var\left(\hat{\beta}^m\right) + Var\left(\hat{\beta}^f\right)\right)\overline{X}_t^{f\prime}$,

where $Var\left(\hat{\beta}^m\right)$ and $Var\left(\hat{\beta}^f\right)$ are the covariance matrices of the estimated coefficients. By using the variances in equations (6) and (7) it is, hence, possible to evaluate which ones of the $C_t$ and $D_t$ components are statistically significantly different from zero and which are not.

Further, to analyse the factors behind the male-female wage differential in a more detailed manner, we also calculate the characteristics and coefficient components for each group of the explanatory variables at different career phases. The components for the jth group of explanatory variables are calculated as follows

(8) $C_{jt} = \left(\overline{X}_{jt}^m - \overline{X}_{jt}^f\right)\hat{\beta}_j^{m\prime}$

(9) $D_{jt} = \overline{X}_{jt}^f\left(\hat{\beta}_j^m - \hat{\beta}_j^f\right)'$,

where $\overline{X}_{jt}^m$ and $\overline{X}_{jt}^f$ are the vectors of sample means for the jth group of explanatory variables at each period t and $\hat{\beta}_j^m$ and $\hat{\beta}_j^f$ are corresponding estimated vectors of coefficients. The variances for these group components are calculated in a similar fashion as for the overall components.

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[13] For simplicity, we include the time varying intercepts into the general formula.

# 4 Results

The wage equations are estimated separately for men and women and for the three educational groups using panel data on white-collar employees in Finnish industry. In Appendix 2 the estimation results are reported in full. It appears from Appendix 2 that quite an extensive set of background characteristics proved to be important explanatory factors for male and female wages. The regressions were able to explain *60-70 per cent* of the observed variation in wages. The LM-test statistics for the random effects specification clearly rejects the null hypothesis of no random effects. Thus, in addition to the observable explanatory variables there appears to be significant unobservable individual effects that influence wages.

The intercept is time variant allowing the overall remuneration to change at different phases of the career. Appendix 2 shows that in most cases the basic wage increases over time, other things being equal. This can be interpreted as a *positive tenure effect* for remaining employed in Finnish industry. This effect seems to be stronger for women than for men.[14] However, it appears that men receive higher compensation for their overall experience than women; the age-earnings profiles for men are much steeper than they are for women. These results are in accordance with evidence form earlier studies in Finland.[15] Previous work experience does not have similar pattern as age and its effect varies within different educational groups.[16] We will return to these issues when discussing the decomposition of gender wage gap later in this section.

Lower secondary and higher university degree have separate indicator variables in estimations when necessary. It appears from Appendix 2 that it is more beneficial for men than for women to get a higher degree. At secondary level *higher degree* brings about 16 per cent higher wage for men and no increase for women.[17] At university level higher degree brings almost 14 per cent increase in wage for men and 12 per cent increase for women.

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[14] The reference groups for different indicator variables vary somewhat at different educational levels. In all cases the reference person is a managerial employee whose work experience is less than six years at recruitment and who lives in an area where local price level is assumed to be higher than average.

[15] See e.g. Asplund (1993).

[16] For managerial employees the work experience is potential work experience and, hence, closely correlated with age and years of schooling.

[17] Some employees who had secondary education at recruitment finish university degree while employed. The wage effect of different variables is calculated as the antilog of the given parameter estimate, i.e. $(e^{\beta}-1)*100$ %. This approach is adopted whenever we discuss

*Field of education* matters but it has different impact depending on the level of education. Among employees with basic education there were few individuals who finished commercial training while employed. It appears from Appendix 2 that for men obtaining the commercial degree meant 19 per cent decrease in wages. There is no such effect for women. This result may be due to the fact that commercial education is required in typical female jobs and that jobs men normally do are different from those and better paid. At secondary level commercial education has no impact whereas at university level commercial education increases the average wage level. If a man has a commercial education at university level his salary will be 13 per cent higher than with similar men with other types of education. For women commercial education brings 5 per cent higher wages than other types of education.[18]

At secondary level general education means for men 3 per cent and for women 2 per cent lower wages than other types of education would give. Medical and technical degrees as such do not bring any additional benefit for men (the wage effects come more from the job descriptions these degrees allow for). Among women the situation is different; medical degree brings about 9 per cent and technical degree about 4 per cent higher wage than other types of education.

*The job requirement level* and *wage group indicators* show how much higher or lower earnings are in different clerical and technical jobs compared with managerial jobs. Appendix 2 shows that among employees with basic education managerial and technical jobs bring a much higher bonus for men than for women. For example, if a man is a clerical employee working at the lowest job levels 1-2 his earnings are 33 per cent less than for an otherwise similar man who has a managerial post. For women this difference is only 16 per cent. At secondary level managerial positions bring about the same wage increase for both men and women. At university level women seem to obtain somewhat higher bonus for managerial posts than men. For example, if a woman is a technical employee belonging to the less demanding wage groups F-E her earnings are 18 per cent lower than those of a an otherwise similar woman with a managerial position. This difference is about 12 per cent for men.

The wages over the career seem to develop somewhat differently depending on *the type of job* employees have. It appears from Appendix 2 that at the basic educational level jobs at research and development (R&D) provide for men about 10 per cent lower earnings than

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the earnings effects of different variables.

[18] Other types of education refer to reference educational categories which are excluded from estimations. For example, compared with humanistic degree the difference in wages for the benefit of commercial education is almost 25 per cent for men and 12 per cent for women.

other jobs would bring.[19] For women working in R&D does not make any difference in terms of wages compared with other jobs. At secondary level obtaining a job in R&D brings about 2 per cent higher wages than other jobs would bring for both men and women. At university level only men benefit from these types of jobs. In R&D men receive over 7 per cent higher wages than they would in other jobs.

Working in sales appears to be beneficial at all educational levels, in particular for men. At basic level sales jobs provide about 11 per cent higher wages for men and 8 per cent higher wages for women than other jobs would provide. At secondary level the corresponding percentages are 10 per cent for men and 3 per cent for women. Sales jobs at university level give a positive bonus only in the case of men; men receive 14 per cent higher wages in these jobs than they would in other jobs.

For men position in directorship at secondary and at university level brings, respectively, 7 and 11 per cent higher wages than other positions. Women in directorship who have secondary level education receive 10 per cent higher wages than they would in other jobs. At university level women do not receive any separate bonus from a position in directorship. The production work at university level brings 6 per cent higher wages for men and 2 per cent higher wages for women than other jobs would bring. Further, job in purchase is beneficial for men at secondary and at university levels bringing, respectively, 5 per cent and 9 per cent higher wages than other jobs. Women do not appear to have similar benefits from working in purchase jobs.

At university level position in administration brings for men 7 per cent higher wages than other positions. For women similar position does not bring any additional bonus.

The estimation results, thus, suggest that the type of job affects the evolution of wages over the career. This is in accordance with the internal labour markets theory which assumes that there are jobs which provide better than average career and earnings prospects.[20] In our sample of industrial employees men seem to benefit more from the specialised job markets than women.

What come to *industry effects* it appears from Appendix 2 that industry matters but not as much as the type of job. Industry effect also varies from one educational level to another. In graphic industry men who have basic education receive 9 per cent higher wages than in other

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[19] Other jobs refer to the reference job types that are not included in the estimations. For example, the wage gap is 21 per cent in favour of sales jobs.

[20] Doeringer and Piore (1971).

industries.[21] For similar women the wage rise is even higher, 11 per cent. At secondary level both men and women receive about 7 per cent higher wages in graphic industry than in other industries. At university level there is no benefit from working in graphic industry. On the contrary, for men wages are 13 per cent lower in this industry than in other industries.

In consultancy male wages are 4 per cent lower than in other industries at secondary and university levels. For women working in consultancy does not produce any significant effects on wages. The same pattern appears to be true in metal industry. Both at secondary and university level male wages are lower than in other industries, 3 and 2 per cent lower, respectively. For women there are no significant industry effects either in this case. At university level working in construction is less beneficial for men. Male wages in construction are 4 per cent lower than in other industries. Female wages do not differ in construction from other industries. The above results suggest that it is more vital for men than women to choose the "right" industry and type of job if they want to have the best possible evolution of wages over the career, and that there are potentially more "good" careers to be picked up for men than for women in Finnish industry.

*The local area indicator* divides Finland in two areas according the estimated general price level in the area.[22] Appendix 2 shows that wages are generally lower in the area where the general price level is lower than average. Time indicators and starting year indicators take into account the fact that our panel data set represents quasi cohorts, which have been collected over a period of seven years. At basic educational level no significant time effects were detected. At secondary level both starting year and general time indicators appear to affect wages. The results suggest that the later in the mid-1980s the career was started the better the general wage level over the career. At university level, however, these effects were not statistically significant.

The general *time indicators* compare observations with those in period 1980-1984. It appears that at secondary level men received higher wages and women lower wages during years 1985-1995 than during 1980-1984. At university level both women and men experienced wage growth at the two later time periods. Thus, during economic slump in years 1990-1995 only women with secondary education adjusted with a wage drop of the magnitude of 3 per cent when other groups were able to increase their wages.

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[21] Other industries refer to the reference industries and the concept varies from one estimation to another, see Appendix 2 for excluded industries.

[22] The indicator equals one if the price level is lower than average and zero otherwise.

*The lambda coefficient* takes into account the potential sample selection bias due to the fact that at different stages of the career some employees exit from TT member-firms.[23] Despite the rough nature of the sample selection term it appears from Appendix 2 that it has significant effect on wages at different wage equations. The sample selection term for the group of men with basic education suggest that, on average, men who remain employed in Finnish industry, earn about 17 per cent more than an average man drawn at random would have earned. Thus, this selected group of men benefit considerably from the decision to remain employed in TT member-firms.

At secondary level the situation is different; men who remain employed in Finnish industry earn about 5 per cent less than an average man drawn at random would have earned in a similar position. Thus, at secondary level men who have decided to remain employed have somewhat lower earnings potential in Finnish industry than an average man drawn at random would have had. There are no sample selection effects on female wages in these two educational groups.

At university level the sample selection has significant effects on both male and female wages. Men who remain employed in Finnish industry earn about 9 per cent more than an average man drawn at random would have earned and women earn 9 per cent less than an average woman would have earned. Thus, the outcome of the selection process is favourable for men and unfavourable for women. Selected men have higher than average and selected women lower than average earnings potential in Finnish industry.

The estimated wage equations allow us to study to what extent gender wage differentials reflect differences in background characteristics (*the characteristics component)* and to what extent they are due to differences in remuneration for these characteristics (*the coefficients component).* In Figure 2 the gender wage gap is divided into these two components. In Appendix 3 the same figures are presented with their estimated standard errors.

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[23] The estimation results of the separate probit models will be provided on request. The probit models were estimated on pooled panel data allowing for the unobserved individual effects at the first stage of estimations. However, these effects did not turn out to be significant and in the final estimations they were left out from the models. All in all, the performance of the probit models were relatively modest, due to the fact that many important variables, such as family background, potentially affecting the selection could not be included as explanatory variables because they were missing from our data.

**Figure 2. Components of the gender wage gap**

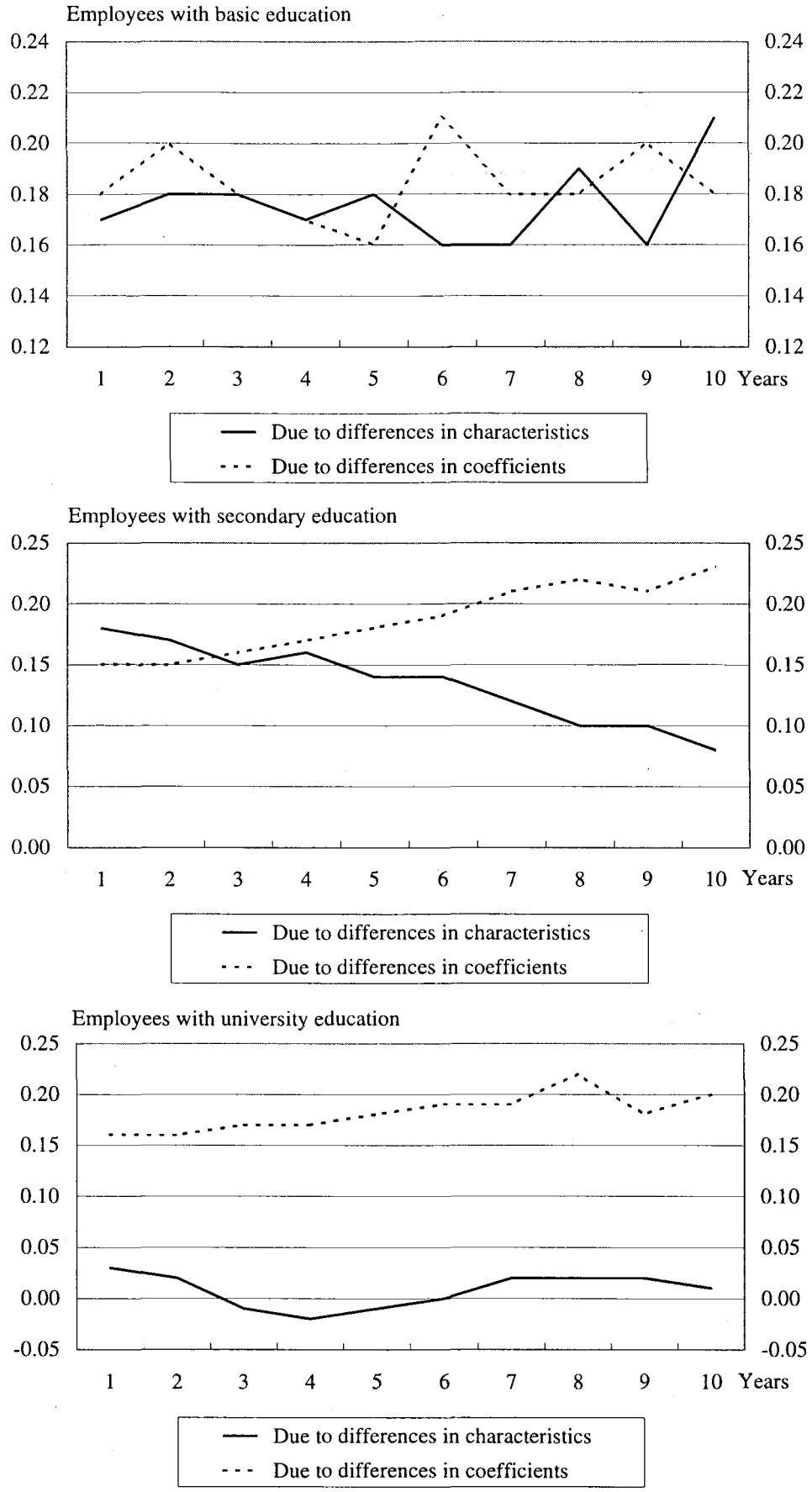

Figure 2 reveals that the decomposed gender wage gap evolves very differently over the career at the three educational levels. *Among employees with basic education* 17 per cent of the gender wage gap is due to different characteristics and about the same amount, 18 per cent, is due to different remuneration for these characteristics (unexplained wage gap) at the beginning of the career. These components stay remarkably stable over time suggesting that during their careers men and women remain equally different both in terms of characteristics as in terms of returns to these characteristics. The tendency in the internal labour markets appears to have been to keep the status quo between the two sexes unattached. Further, Appendix 3 shows that both characteristics and coefficients components are strongly significantly different from zero. This means that both differences in characteristics and in returns to these characteristics are important in explaining the gender wage gap.

*Among employees with secondary education* the situation changes. At the beginning of the career 18 per cent of the gender wage gap is due to different characteristics and 15 per cent, is due to different remuneration for these characteristics. In this group male and female employees become more similar over the years; the gender wage gap due to different characteristics declines. The contrary is true for remuneration coefficients. After ten years of employment in Finnish industry the gender wage gap due to different characteristics has declined to 8 per cent and the wage gap due to different returns to these characteristics has risen to 23 per cent. The evolution of the gender wage gap is markedly different in this group than in the group of employees with basic education only. What could explain this outcome?

Lazear and Rosen (1990) as well as Winter-Ebmer and Zweimuller (1997) suggest that differential movement along job ladders is essential in explaining the male-female wage differential. In particular, they claim that even if men and women are treated similarly within the same job, the ability standard for promotion is higher for women. Thus, it is quite possible that the growth in the unexplained wage gap at the secondary educational level reflects the differential promotion rates between the two sexes. The stability of the corresponding gender wage gap at the basic educational level may simply reflect equally scarce promotion possibilities for both sexes in this group of employees.[24]

The increasing unexplained wage gap also *at university level* supports the idea that the differential promotion treatment between the two sexes may be an important factor explaining the evolution of the gender wage gap over the career. In this group the gender wage gap due to different characteristics is only 3 per cent at the beginning of the career reflecting the fact

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[24] This result is in accordance with those in Lilja (1995b) showing that employees with basic education only have lower than average promotion rates and run a higher than average risk of demotions.

that men and women are at recruitment quite similar in terms of their background characteristics. Over the years the two sexes start to resemble each other even more and after 10 years of employment the wage gap due to different characteristics is only one per cent. The contrary is true for the unexplained wage gap. At the beginning of the career the wage gap due to different remuneration is 16 per cent and after ten years of employment it has risen to 20 per cent.

It is remarkable that even though the overall gender wage gap is largest in the group of employees with basic education only, the largest *unexplained* wage gap is in the group of educated women. Moreover, the time appears to be ticking against educated women; the unexplained wage gap increases over the career. In the group of employees with secondary education the unexplained wage gap increases by 53 per cent during the first ten years of employment. In the group of employees with university education the corresponding increase is 25 per cent.

To be able to explore in more detail the potential mechanisms in the internal labour markets that could explain the above results the decomposition of the wage gap has been calculated for each explanatory variable separately. It appears that age and general work experience are the most important single factors behind the observed evolution of the gender wage gap over the career. In Figure 3 the contribution of age and experience is reported for a reference employee at each educational level.[25]

It appears from Figure 3 that *at the basic educational level* the gender wage differences in returns to age and experience are quite high. The figure suggests that these differences generate around 35 per cent wage gap between men and women among managerial employees. For technical employees the differences in returns are, on average, 4 per cent less and for clerical employees 18 per cent less than that for the managerial employees. When all employee groups are taken together age and work experience explain about 71 per cent of the overall unexplained gender wage gap. Thus, differences in the remuneration for age and work experience appear to be the main cause for the evolution of unexplained gender wage gap at this level of education.[26]

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[25] The reference person is a person for whom all indicator variables equal zero in estimations. E.g. he or she is a managerial employee whose work experience is less than six years at recruitment, and who lives in an area where local price level is assumed to be higher than average. In Appendix 3 these figures with their standard errors are reported.

[26] This result is accordance with the calculations made by Asplund et al. (1996) from different Nordic countries suggesting that the main reason behind unexplained wage gap is that men and women are rewarded differently from their work experience.

**Figure 3. The contribution of age and work experience to gender wage gap**

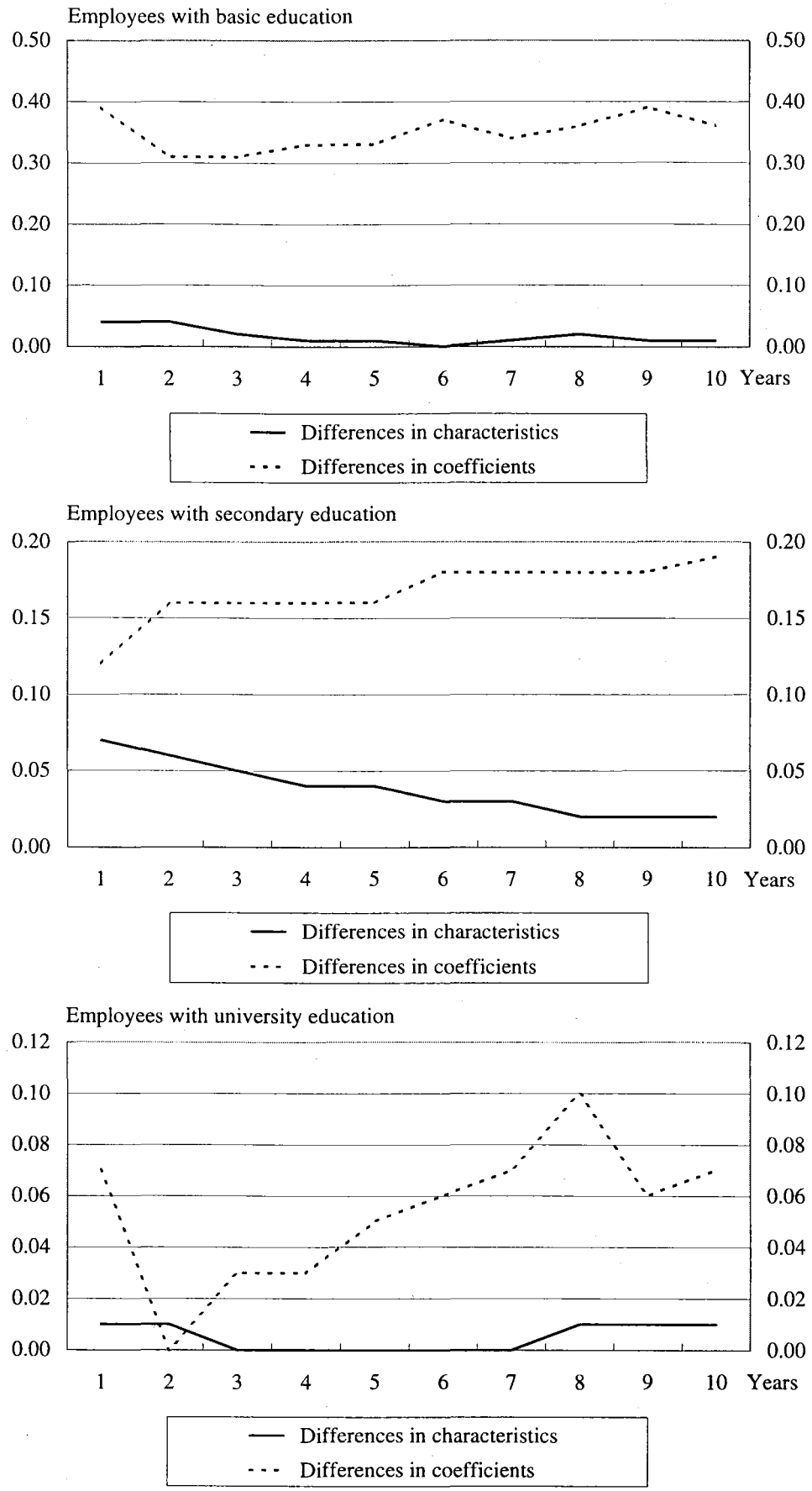

Figure 3 also shows that at the basic educational level the gender wage gap due to observed differences in age and work experience is only 2 per cent among managerial employees. Among clerical employees this figure is as high as 19 per cent reflecting different age structures between clerical men and women. In the group of technical employees the age structure and the distribution of work experience favours women by reducing the gender wage gap by 2 per cent, on average.

*At secondary educational level* the rising trend in the unexplained gender wage gap over the career appears to be mainly due to the fact that women's remuneration for age and work experience becomes over time smaller and smaller relative to that of men. Thus, the phenomenon that at the beginning of the career women's overall experience is rewarded differently from that of men, is strengthened over time.

The rising wage gap due to different remuneration for age and work experience suggests that there are more demanding job opportunities for men than for women in Finnish industry. In fact, Lilja (1995b) has shown that among technical employees, which form the majority of employees with secondary education, it is harder for women than for men to be promoted even when differences in background characteristics are accounted for. Because promotions are an important source for wage increases[27] it is no surprise that the unexplained gender wage gap increases over time. Age and work experience contribute, on average, about 92 per cent of the overall unexplained wage gap in this group of employees. It appears from Appendix 3 that this effect is also statistically significant.

Further Figure 3 shows that at secondary educational level the gender differences in age and work experience become smaller and their contribution to the observed wage gap reduces from 7 to 2 per cent over the period of ten years. The corresponding figures for clerical employees are 26 and 15 per cent. In the group of technical employees the age structure and the distribution of work experience favours women reducing accordingly the gender wage gap by 3 per cent.

The gender wage gap due to differences in remuneration for age and work experience varies around 5 per cent[28] among employees *with university education.* In this group of employees age and work experience explain only 32 per cent of the unexplained wage gap. It appears

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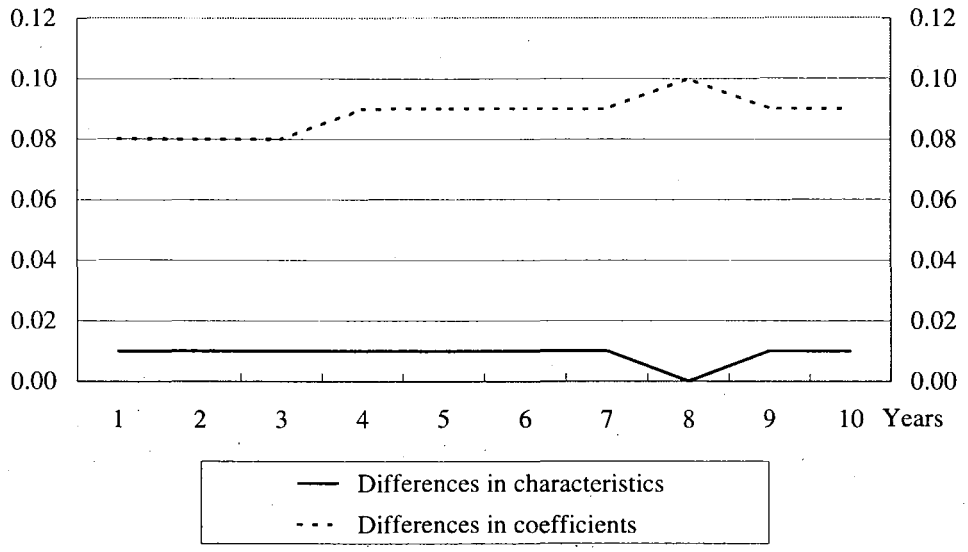
[27] See Lilja (1996).

[28] Contrary to other educational groups, in this group the age and work experience effects are not statistically significantly different from zero at a 5 per cent significance level, see Appendix 3.

that two other factors have a significant effect on the unexplained wage gap; job category and sample selection.

In Figure 4 the effect of job category on gender wage gap is described for employees with university education. It appears that men and women receive different remuneration for the five broad job categories over the years leading to 8-10 per cent gender wage gap.[29] This result reflects men's and women's different job opportunities within the five broad job categories. The rising trend in the unexplained wag gap over the career can, again, reflect differences in promotion possibilities between men and women. The gender wage gap due to the fact that men and women are not equally distributed to different job categories is only about one per cent at different phases of the career.

**Figure 4. The effect of job category on gender wage gap, employees with university education**



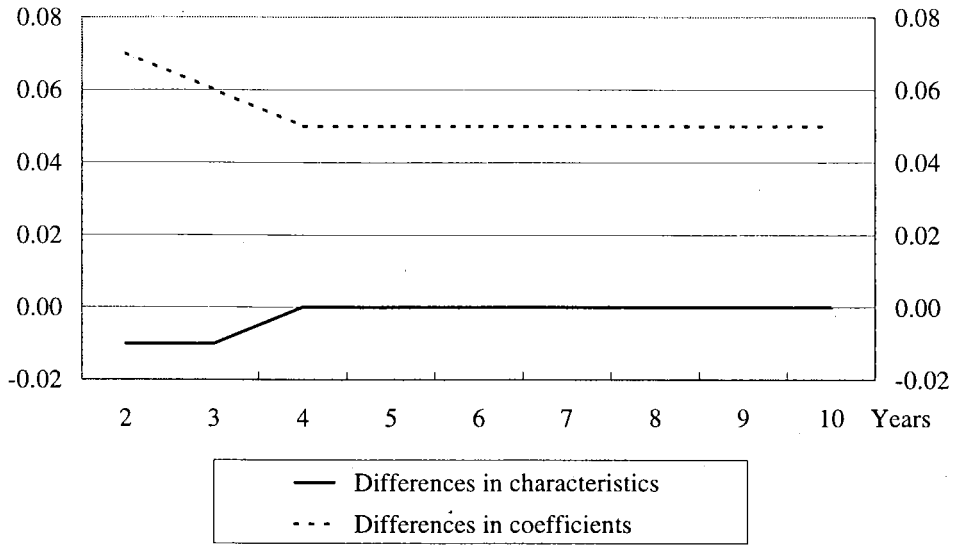

In Figure 5 the effect of sample selection term ($\lambda$) on gender wage gap is reported.[30] This term measures the correlation between unobservable factors affecting the decision to continue employment and the wage level. The estimation results show that men who remain employed earn more than an average man drawn at random would have earned and women earn less than an average woman would have earned in Finnish industry. Thus, the outcome of the

[29] E.g. earlier we showed that for men a position in directorship brings 11 per cent higher wages than other positions and for women this kind of a position brings no bonus whatsoever. In Appendix 4 the figures are presented with their standard errors.

[30] In Appendix 5 the figures are presented with their standard errors.

selection process is favourable for men and unfavourable for women. Selected men have higher than average and selected women lower than average earnings potential in Finnish industry.

**Figure 5. The effect of sample selection on gender wage gap, employees with university education**




The result that women's earnings develop less favourably than those of men may reflect the fact that in Finnish industry typical jobs (often requiring technical skills) are occupied mostly by men. Further, according to Lundberg and Startz (1983) if women find it more difficult to signal about their productivity in the labour market, e.g. because they are holding atypical jobs, they will have a smaller incentive to make *unobservable* productivity-enhancing investments in human capital than men. In this situation women with the same observable characteristics than men would not have equal earnings potential and career prospects.

It is also possible that the sample selection term picks up the effect of variables on wage determination which have not been included in estimations. The job-related variables can take into account career changes only in a limited fashion, in particular, in the group of managerial employees. Therefore, the sample selection term can partly reflect differences in promotion rates between men and women as Lazear and Rosen (1990), and Winter-Ebmer and Zweimuller (1997) suggest.

# 5 Summary

In this paper we have studied male-female wage differentials over the career using data on Finnish industrial white-collar workers. The data set is collected by the Confederation of Finnish Industry and Employers covering the period 1980-1995. The evolution of gender wage gap is analysed separately at three different levels of education (at basic, secondary, and university level) in order to see whether the same level of education provides similar career and earnings prospects for men and women.

According to our data the overall gender wage differentials in the three groups are rather stable over time. Among employees with basic education only men's wages are about 1.5 times as high as those of women throughout the career. In the group of employees with secondary education men's wages are 1.4 times and in the group of employees with university education 1.2 times as high as those of women. These figures clearly suggest that education is beneficial for women. However, a more thorough analysis on the different mechanisms affecting the evolution of gender wage gap over the career is needed for any further conclusions on this matter.

At the beginning of the career among employees with basic education 17 per cent of the gender wage differential is due to the fact that men and women have different characteristics and about the same amount, 18 per cent, is due to different returns to these characteristics (unexplained wage gap). In this group the decomposition of the wage gap remains relatively stable over the career. After 10 years of employment the wage gap due to different characteristics rises to 21 per cent and the gap due to different returns remains at 18 per cent.

Among employees with secondary education 18 per cent of the gender wage gap at the beginning of the career is due to the fact hat men and women have different characteristics and, 15 per cent, is due to differences in remuneration for these characteristics. Over the years male and female employees become more similar in terms of observed characteristics and the gender wage gap due these characteristics declines. The contrary is true for the wage gap which reflects differences in returns to these characteristics. After ten years of employment the characteristics component of the gender wage gap declines to 8 per cent. The wage gap due to differences in remuneration for these characteristics rises to 23 per cent, to a higher figure than that for employees with basic education only.

Similar pattern holds true for employees with university education. On the one hand, the gender wage gap resulting from differences in observed characteristics is rather small and declines over time. At the beginning of the career it is three per cent and after ten years of

employment one per cent. On the other hand, the gender wage gap due to differences in returns to these characteristics rises over time. At the beginning of the career the unexplained wage gap is 16 per cent and after ten years of employment it has risen to 20 per cent.

Our results show that even though the overall gender wage gap is largest in the group of employees with basic education only, the largest *unexplained* wage differentials (i.e. wage gap due to differences in remuneration for similar background characteristics) are to be found in the group of educated women. Further, the time appears to be ticking against these women. In the group of employees with secondary education the unexplained wage gap increases by 53 per cent (in relative terms) during the first ten years of employment. In the group of employees with university education the corresponding increase is 25 per cent.

Age and general work experience appear to be the most important single factors behind the observed evolution of the unexplained gender wage gap over the career. Age and experience explain, on average, about 71 per cent of this wage gap among employees with basic education. The corresponding figure for employees with secondary education is as high as 92 per cent. At university level other factors, in addition to age and work experience, contribute to the unexplained wage gap; differences in remuneration for different job categories and from factors affecting the decision to remain employed in Finnish industry.

The fact that age and general work experience have such a strong impact on the unexplained gender wage gap suggests that differential movement along job ladders is an important potential factor in explaining the evolution of male-female wage differentials over the career. There appears to be more "good" careers for men than for women to be picked up in Finnish industry. The growth in the unexplained wage gap at the secondary and university educational levels is in line with differential promotion rates between the two sexes. At the basic educational level the stability of the corresponding gender wage gap may simply be a reflection of scarce promotion possibilities in this group of employees as a whole.

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## Appendix 1 Sample means of variables

| Variables | Basic education | | Secondary education | | University education | |
|---|---|---|---|---|---|---|
| | Men N=641 | Women N=1114 | Men N=5092 | Women N=3091 | Men N=4969 | Women N=894 |
| *Career phase* | | | | | | |
| 2nd year | 0.1747 | 0.1670 | 0.1544 | 0.1711 | 0.1511 | 0.1667 |
| 3rd year | 0.1373 | 0.1239 | 0.1271 | 0.1323 | 0.1304 | 0.1387 |
| 4th year | 0.1108 | 0.1050 | 0.1092 | 0.1100 | 0.1127 | 0.1119 |
| 5th year | 0.0874 | 0.0898 | 0.0921 | 0.0922 | 0.0954 | 0.0940 |
| 6th year | 0.0733 | 0.0718 | 0.0819 | 0.0738 | 0.0837 | 0.0738 |
| 7th year | 0.0577 | 0.0601 | 0.0723 | 0.0579 | 0.0739 | 0.0615 |
| 8th year | 0.0452 | 0.0521 | 0.0617 | 0.0482 | 0.0644 | 0.0548 |
| 9th year | 0.0390 | 0.0440 | 0.0536 | 0.0385 | 0.0562 | 0.0447 |
| 10th year | 0.0312 | 0.0368 | 0.0456 | 0.0311 | 0.0483 | 0.0392 |
| *Age* | 35.57 | 34.20 | 33.56 | 30.41 | 33.58 | 33.12 |
| *Previous work experience* | | | | | | |
| 6-10 years | 0.2200 | 0.2648 | 0.3111 | 0.3339 | 0.3409 | 0.3658 |
| 11-15 years | 0.1513 | 0.1472 | 0.1779 | 0.1818 | 0.2809 | 0.2539 |
| 16- years | 0.2668 | 0.1822 | 0.2001 | 0.1317 | 0.2143 | 0.1387 |
| *Level of education* | | | | | | |
| Lower secondary | - | - | 0.0760 | 0.2229 | - | - |
| Higher University | - | - | 0.0224 | 0.0113 | 0.3683 | 0.4463 |

**Appendix 1 continues...**

| Variables | Basic education | | Secondary education | | University education | |
|---|---|---|---|---|---|---|
| | Men N=641 | Women N=1114 | Men N=5092 | Women N=3091 | Men N=4969 | Women N=894 |
| *Field of education* | | | | | | |
| Commercial | 0.0312 | 0.0332 | - | - | 0.0779 | 0.2517 |
| General | - | - | 0.0652 | 0.1673 | - | - |
| Humanistic | - | - | - | - | 0.0036 | 0.1141 |
| Medical | - | - | 0.0687 | 0.0172 | - | - |
| Technical | - | - | 0.7622 | 0.1365 | - | - |
| *Job requirement level* | | | | | | |
| Job level 1A-C | | | 0.0022 | 0.0343 | | |
| Job level 2A-C | 0.2012 | 0.7074 | 0.0381 | 0.4578 | 0.0282 | 0.0224 |
| Job level 3A-C | | | 0.0860 | 0.2578 | | |
| Job level 4A-C | 0.1997 | 0.0817 | 0.0141 | 0.0117 | 0.0246 | 0.2215 |
| *Wage group* | | | | | | |
| Wage group F | | | 0.0043 | 0.0162 | | |
| Wage group E | 0.0920 | 0.1499 | 0.0295 | 0.0705 | 0.0076 | 0.0134 |
| Wage group D | | | 0.1249 | 0.0421 | | |
| Wage group C | 0.2356 | 0.0323 | 0.3117 | 0.0239 | 0.0741 | 0.0660 |
| Wage groups B & A | 0.0905 | 0.0135 | 0.2129 | 0.0052 | 0.0401 | 0.0059 |
| *Job category* | | | | | | |
| Administration | - | - | - | - | 0.0767 | 0.2718 |
| Directorship | - | - | 0.1265 | 0.0149 | 0.2093 | 0.1107 |
| Production | - | - | - | - | 0.2258 | 0.0694 |
| Purchase | - | - | 0.0145 | 0.0349 | 0.0260 | 0.0101 |
| R&D | 0.1591 | 0.1715 | 0.2127 | 0.1698 | 0.5069 | 0.4183 |
| Sales | 0.3276 | 0.1266 | 0.1467 | 0.1210 | 0.1429 | 0.1734 |

Job level groups 1A-C & 2A-C, 3A-C & 4A-C, and wage groups F & E and D & C are combined for employees with basic and university education.

**Appendix 1 continues...**

| Variables | Basic education | | Secondary education | | University education | |
|---|---|---|---|---|---|---|
| | Men N=641 | Women N=1114 | Men N=5092 | Women N=3091 | Men N=4969 | Women N=894 |
| *Industry* | | | | | | |
| Construction | - | - | - | - | 0.0884 | 0.0571 |
| Consultant | - | - | 0.0405 | 0.0576 | 0.1091 | 0.1119 |
| Graphic | 0.0842 | 0.0862 | 0.0251 | 0.0851 | 0.0093 | 0.0459 |
| Metal | - | - | 0.2808 | 0.2381 | 0.4168 | 0.2383 |
| *Local area indicator* | 0.4275 | 0.4102 | 0.4707 | 0.4290 | 0.4423 | 0.2740 |
| *Time indicators* | | | | | | |
| 1985-1989 | - | - | 0.4988 | 0.5202 | 0.5120 | 0.4989 |
| 1990-1995 | - | - | 0.1569 | 0.1297 | 0.1648 | 0.1532 |
| *Starting year indicators* | | | | | | |
| 1982 | - | - | 0.1094 | 0.1346 | - | - |
| 1983 | - | - | 0.1355 | 0.1223 | - | - |
| 1984 | - | - | 0.1412 | 0.1643 | - | - |
| 1985 | - | - | 0.1471 | 0.1705 | - | - |
| 1986 | - | - | 0.1153 | 0.1265 | - | - |
| *Lambda* | 0.2800 | 0.6792 | 0.2048 | 0.4076 | 0.0907 | 0.0683 |

## Appendix 2 Estimation results, random effects wage equations

| Variables | Basic education | | Secondary education | | University education | |
|---|---|---|---|---|---|---|
| | Men N=641 | Women N=1114 | Men N=5092 | Women N=3091 | Men N=4969 | Women N=894 |
| Intercept | 2.9784 (0.1267) | 3.0964 (0.0676) | 2.9684 (0.0546) | 3.3474 (0.0578) | 1.5129 (0.0697) | 3.2842 (0.1676) |
| *Career phase* | | | | | | |
| 2nd year | -0.0371 (0.0352) | 0.0522 (0.0203) | 0.0446 (0.0097) | 0.0226 (0.0183) | -0.0195 (0.0070) | 0.0643 (0.0163) |
| 3rd year | -0.0316 (0.0362) | 0.0729 (0.0177) | 0.0652 (0.0086) | 0.0534 (0.0156) | 0.0016 (0.0068) | 0.0834 (0.0166) |
| 4th year | 0.0083 (0.0317) | 0.0988 (0.0139) | 0.0827 (0.0081) | 0.0793 (0.0136) | 0.0144 (0.0075) | 0.1159 (0.0179) |
| 5th year | 0.0121 (0.0389) | 0.1006 (0.0145) | 0.0985 (0.0091) | 0.1032 (0.0141) | 0.0368 (0.0085) | 0.1320 (0.0193) |
| 6th year | 0.0610 (0.0307) | 0.1189 (0.0177) | 0.1175 (0.0090) | 0.1198 (0.0697) | 0.0411 (0.0090) | 0.1387 (0.0225) |
| 7th year | 0.0490 (0.0371) | 0.1304 (0.0178) | 0.1253 (0.0097) | 0.1293 (0.0189) | 0.0567 (0.0103) | 0.1578 (0.0249) |
| 8th year | 0.0860 (0.0391) | 0.1457 (0.0192) | 0.1346 (0.0108) | 0.1446 (0.0178) | 0.0740 (0.0111) | 0.1546 (0.0273) |
| 9th year | 0.1161 (0.0336) | 0.1574 (0.0192) | 0.1418 (0.0113) | 0.1641 (0.0202) | 0.0750 (0.0121) | 0.2005 (0.0300) |
| 10th year | 0.0954 (0.0410) | 0.1636 (0.0205) | 0.1433 (0.0125) | 0.1568 (0.0211) | 0.0906 (0.0131) | 0.2098 (0.0332) |
| *Age* | 0.0605 (0.0068) | 0.0332 (0.0036) | 0.0571 (0.0028) | 0.0299 (0.0034) | 0.1303 (0.0036) | 0.0353 (0.0089) |
| *Age²/100* | -0.0685 (0.0089) | -0.0383 (0.0049) | -0.0629 (0.0036) | -0.0326 (0.0051) | -0.1427 (0.0046) | -0.0358 (0.0121) |
| *Previous work experience* | | | | | | |
| 6-10 years | 0.0161 (0.0144) | 0.0439 (0.0092) | 0.0113 (0.0045) | 0.0070 (0.0060) | 0.0155 (0.0046) | 0.0453 (0.0123) |
| 11-15 years | -0.0130 (0.0228) | 0.0494 (0.0143) | 0.0263 (0.0073) | 0.0171 (0.0094) | 0.0169 (0.0071) | 0.0774 (0.0197) |
| 16- years | 0.0546 (0.0297) | 0.0975 (0.0188) | 0.0520 (0.0104) | 0.0585 (0.0134) | -0.0083 (0.0094) | 0.1248 (0.0273) |
| *Level of education* | | | | | | |
| Lower secondary | - | - | -0.0328 (0.0114) | -0.0574 (0.0099) | - | - |
| Higher University | - | - | 0.1516 (0.0154) | -0.0260 (0.0270) | 0.1280 (0.0086) | 0.1123 (0.0205) |

Standard errors are in parentheses.

**Appendix 2 continues...**

| Variables | Basic education | | Secondary education | | University education | |
|---|---|---|---|---|---|---|
| | Men N=641 | Women N=1114 | Men N=5092 | Women N=3091 | Men N=4969 | Women N=894 |
| *Field of education* | | | | | | |
| Commercial | -0.1720 (0.0349) | -0.0001 (0.0198) | - | - | 0.1201 (0.0177) | 0.0463 (0.0306) |
| General | - | - | -0.0345 (0.0131) | -0.0213 (0.0101) | - | - |
| Humanistic | - | - | - | - | -0.0990 (0.0316) | -0.0640 (0.0309) |
| Medical | - | - | -0.0368 (0.0494) | 0.0881 (0.0273) | - | - |
| Technical | - | - | -0.0123 (0.0108) | 0.0412 (0.0148) | - | - |
| *Job requirement level* | | | | | | |
| Job level 1A-C | | | -0.3789 (0.0425) | -0.4151 (0.0189) | | |
| Job level 2A-C | -0.4069 (0.0287) | -0.1746 (0.0284) | -0.3179 (0.0152) | -0.3106 (0.0130) | -0.1815 (0.0446) | -0.2516 (0.0375) |
| Job level 3A-C | | | -0.1488 (0.0099) | -0.1745 (0.0123) | | |
| Job level 4A-C | -0.3172 (0.0257) | -0.0731 (0.0298) | -0.1004 (0.0153) | 0.0293 (0.0238) | -0.0940 (0.0103) | -0.1099 (0.0166) |
| *Wage group* | | | | | | |
| Wage group F | | | -0.3364 (0.0245) | -0.3798 (0.0242) | | |
| Wage group E | -0.3429 (0.3417) | -0.1686 (0.0360) | -0.2633 (0.0121) | -0.3118 (0.0196) | -0.1282 (0.0166) | -0.1992 (0.0356) |
| Wage group D | | | -0.1963 (0.0089) | -0.1946 (0.0198) | | |
| Wage group C | -0.2321 (0.0262) | -0.0559 (0.0380) | -0.1494 (0.0079) | -0.0909 (0.0228) | -0.1052 (0.0077) | -0.1562 (0.0264) |
| Wage groups B & A | -0.1800 (0.0272) | 0.0481 (0.5322) | -0.1150 (0.0080) | 0.0243 (0.0549) | -0.0897 (0.0080) | 0.0468 (0.0899) |
| *Job category* | | | | | | |
| Administration | - | - | - | - | 0.0643 (0.0138) | 0.0049 (0.0327) |
| Directorship | - | - | 0.0659 (0.0060) | 0.0932 (0.0256) | 0.1074 (0.0489) | -0.0011 (0.0200) |
| Production | - | - | - | - | 0.0564 (0.0121) | 0.0251 (0.0378) |
| Purchase | - | - | 0.0496 (0.0169) | 0.0166 (0.0173) | 0.0903 (0.0169) | -0.0226 (0.0644) |
| R&D | -0.1071 (0.0360) | 0.0311 (0.0246) | 0.0229 (0.0071) | 0.0266 (0.0132) | 0.0718 (0.0117) | -0.0079 (0.0346) |
| Sales | 0.1069 (0.0219) | 0.0769 (0.0162) | 0.0921 (0.0106) | 0.0308 (0.0098) | 0.1321 (0.0128) | 0.0050 (0.0348) |

Job level groups 1A-C & 2A-C, 3A-C & 4A-C, and wage groups F & E and D & C are combined for employees with basic and university education.

**Appendix 2 continues...**

| Variables | Basic education | | Secondary education | | University education | |
|---|---|---|---|---|---|---|
| | Men N=641 | Women N=1114 | Men N=5092 | Women N=3091 | Men N=4969 | Women N=894 |
| *Industry* | | | | | | |
| Construction | - | - | - | - | -0.0372 (0.0119) | 0.0023 (0.0418) |
| Consultant | - | - | -0.0407 (0.0171) | -0.0034 (0.0166) | -0.0416 (0.0098) | -0.0153 (0.0310) |
| Graphic | 0.0863 (0.0433) | 0.1079 (0.0250) | 0.0682 (0.0219) | 0.0730 (0.0136) | -0.1426 (0.0332) | 0.0397 (0.0393) |
| Metal | - | - | -0.0257 (0.0061) | 0.0004 (0.0078) | -0.0151 (0.0047) | -0.0193 (0.0149) |
| *Local area indicator* | 0.0151 (0.0192) | -0.0525 (0.0126) | -0.0258 (0.0050) | -0.0790 (0.0072) | -0.0311 (0.0043) | -0.0218 (0.0177) |
| *Time indicators* | | | | | | |
| 1985-1989 | - | - | 0.0165 (0.0046) | -0.0047 (0.0066) | 0.0354 (0.0037) | 0.0568 (0.0116) |
| 1990-1995 | - | - | 0.0231 (0.0082) | -0.0310 (0.0125) | 0.0117 (0.0067) | 0.0430 (0.0209) |
| *Starting year indicators* | | | | | | |
| 1982 | - | - | 0.0303 (0.0158) | 0.0449 (0.0137) | - | - |
| 1983 | - | - | 0.0232 (0.0150) | 0.0720 (0.0139) | - | - |
| 1984 | - | - | 0.0446 (0.0148) | 0.0457 (0.0132) | - | - |
| 1985 | - | - | 0.0876 (0.0149) | 0.0593 (0.0139) | - | - |
| 1986 | - | - | 0.0523 (0.0162) | 0.0905 (0.0150) | - | - |
| *Lambda* | 0.1578 (0.0830) | -0.0415 (0.0352) | -0.0498 (0.0222) | 0.0294 (0.0355) | 0.0874 (0.0215) | -0.0936 (0.0355) |
| $R^2$ | 0.6093 | 0.6066 | 0.6251 | 0.7308 | 0.6184 | 0.6252 |
| LM-test for random effects (1 df) | 346.02 | 1881.88 | 6857.50 | 3417.19 | 7482.16 | 962.85 |

## Appendix 3 The decomposition of male-female wage gap*

| Variables | Basic education | | Secondary education | | University education | |
|---|---|---|---|---|---|---|
| | Different characteristics | Different coefficients | Different characteristics | Different coefficients | Different characteristics | Different coefficients |
| *General* | | | | | | |
| 1st year | 0.1737 (0.0138) | 0.1806 (0.0226) | 0.1781 (0.0094) | 0.1451 (0.0116) | 0.0290 (0.0064) | 0.1569 (0.0155) |
| 2nd year | 0.1812 (0.0184) | 0.1987 (0.0263) | 0.1733 (0.0095) | 0.1473 (0.0119) | 0.0153 (0.0063) | 0.1571 (0.0161) |
| 3rd year | 0.1765 (0.0154) | 0.1763 (0.0249) | 0.1479 (0.0088) | 0.1609 (0.0118) | -0.0080 (0.0058) | 0.1711 (0.0163) |
| 4th year | 0.1749 (0.1587) | 0.1645 (0.0260) | 0.1573 (0.0088) | 0.1666 (0.0120) | -0.0214 (0.0050) | 0.1649 (0.0167) |
| 5th year | 0.1837 (0.0199) | 0.1633 (0.0295) | 0.1422 (0.0085) | 0.1754 (0.0121) | -0.0078 (0.0050) | 0.1844 (0.0172) |
| 6th year | 0.1619 (0.0150) | 0.2075 (0.0268) | 0.1367 (0.0088) | 0.1919 (0.0127) | -0.0015 (0.0054) | 0.1864 (0.0181) |
| 7th year | 0.1590 (0.0149) | 0.1749 (0.0276) | 0.1217 (0.0091) | 0.2055 (0.0133) | 0.0167 (0.0059) | 0.1913 (0.0189) |
| 8th year | 0.1872 (0.0166) | 0.1756 (0.0304) | 0.1029 (0.0084) | 0.2175 (0.0134) | 0.0179 (0.0056) | 0.2240 (0.0194) |
| 9th year | 0.1600 (0.0138) | 0.2041 (0.0300) | 0.0972 (0.0087) | 0.2122 (0.0142) | 0.0217 (0.0052) | 0.1790 (0.0202) |
| 10th year | 0.2091 (0.0150) | 0.1769 (0.0323) | 0.0772 (0.0082) | 0.2320 (0.0145) | 0.0100 (0.0044) | 0.1965 (0.0208) |
| *Age, career phase, and experience* | | | | | | |
| 1st year | 0.0419 (0.0044) | 0.3896 (0.0414) | 0.0662 (0.0028) | 0.1226 (0.0212) | 0.0134 (0.0008) | 0.0654 (0.0397) |
| 2nd year | 0.0373 (0.0047) | 0.3137 (0.0564) | 0.0574 (0.0026) | 0.1599 (0.0279) | 0.0109 (0.0007) | 0.0041 (0.0413) |
| 3rd year | 0.0242 (0.0038) | 0.3076 (0.0556) | 0.0448 (0.0024) | 0.1629 (0.0255) | 0.0016 (0.0005) | 0.0288 (0.0413) |
| 4th year | 0.0048 (0.0020) | 0.3304 (0.0512) | 0.0425 (0.0020) | 0.1640 (0.0239) | -0.0012 (0.0006) | 0.0295 (0.0418) |
| 5th year | 0.0094 (0.0026) | 0.3327 (0.0556) | 0.0409 (0.0019) | 0.1643 (0.0242) | 0.0017 (0.0006) | 0.0524 (0.0424) |
| 6th year | 0.0026 (0.0012) | 0.3650 (0.0506) | 0.0332 (0.0018) | 0.1764 (0.0253) | 0.0022 (0.0004) | 0.0607 (0.0437) |
| 7th year | 0.0132 (0.0025) | 0.3400 (0.0536) | 0.0271 (0.0019) | 0.1829 (0.0262) | 0.0029 (0.0005) | 0.0694 (0.0451) |
| 8th year | 0.0193 (0.0036) | 0.3624 (0.0549) | 0.0210 (0.0019) | 0.1839 (0.0258) | 0.0073 (0.0007) | 0.0965 (0.0457) |
| 9th year | 0.0049 (0.0024) | 0.3860 (0.0512) | 0.0205 (0.0013) | 0.1772 (0.0272) | 0.0012 (0.0010) | 0.0584 (0.0465) |
| 10th year | 0.0103 (0.0056) | 0.3594 (0.0557) | 0.0160 (0.0010) | 0.1914 (0.0278) | 0.0116 (0.0009) | 0.0694 (0.0472) |

* Standard deviations of the parameters are in parentheses.

## Appendix 4 The decomposition of male-female wage gap with respect to job category, employees with university education*

| Career phase | Job category | |
|---|---|---|
| | Different characteristics | Different coefficients |
| 1st year | 0.0132 (0.0026) | 0.0770 (0.0307) |
| 2nd year | 0.0129 (0.0024) | 0.0777 (0.0311) |
| 3rd year | 0.0111 (0.0024) | 0.0807 (0.0313) |
| 4th year | 0.0088 (0.0020) | 0.0856 (0.0315) |
| 5th year | 0.0080 (0.0020) | 0.0877 (0.0316) |
| 6th year | 0.0073 (0.0019) | 0.0897 (0.0319) |
| 7th year | 0.0054 (0.0019) | 0.0928 (0.0326) |
| 8th year | 0.0032 (0.0018) | 0.0969 (0.0325) |
| 9th year | 0.0106 (0.0017) | 0.0919 (0.0327) |
| 10th year | 0.0099 (0.0013) | 0.0927 (0.0330) |

* Standard deviations of the parameters are in parentheses.

**Appendix 5 The decomposition of male-female wage gap with respect to sample selection, employees with university education***

| Career phase | Sample selection | |
|---|---|---|
| | Different characteristics | Different coefficients |
| 1st year | 0.0000 (0.0000) | 0.0000 (0.0000) |
| 2nd year | -0.0068 (0.0017) | 0.0661 (0.0152) |
| 3rd year | -0.0067 (0.0016) | 0.0585 (0.0134) |
| 4th year | -0.0038 (0.0009) | 0.0524 (0.0120) |
| 5th year | -0.0014 (0.0003) | 0.0497 (0.0114) |
| 6th year | -0.0047 (0.0011) | 0.0496 (0.0114) |
| 7th year | -0.0012 (0.0003) | 0.0481 (0.0110) |
| 8th year | -0.0021 (0.0005) | 0.0495 (0.0113) |
| 9th year | 0.0003 (0.0001) | 0.0448 (0.0103) |
| 10th year | -0.0034 (0.0008) | 0.0523 (0.0120) |

* Standard deviations of the parameters are in parentheses.

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