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THE GENDER WAGE GAP
AND SEX SEGREGATION
IN FINLAND

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ABSTRACT: This paper investigates how the segregation of women and men into certain occupations, industries, firms and jobs within the firms is reflected in the gender wage gap in the Finnish manufacturing sector. Using matched employer-employee data we evaluate wage differentials between men and women doing the same kind of job for the same employer. This allows us to differentiate between wage differentials caused by human capital differences, wage differentials resulting from labour market segregation and within-job wage differentials. We find that at least half of the gender wage gap can be attributed to labour market segregation while human capital differences by sex account for less than 10 percent.

Keywords: Gender wage gap, wage discrimination, sex segregation

TIIVISTELMÄ: Tutkielmassa tarkastellaan, miten työmarkkinoiden segregoituminen eli naisten ja miesten valikoituminen eri ammatteihin, toimialoille, yrityksiin ja työtehtäviin yritysten sisällä heijastuu naisten ja miesten välisiin palkkaeroihin teollisuudessa. Hyödyntämällä aineistoa, joka sisältää tiedot teollisuusyritysten kaikista työntekijöistä, voidaan arvioida palkkaeroja naisten ja miesten välillä, jotka tekevät samankaltaista työtä saman työnantajan palveluksessa. Tämä on oleellista, kun palkkakuilu halutaan hajottaa erillisiin komponentteihin, jotka heijastelevat työmarkkinoiden segregoitumista, eroja työntekijöiden taustaominaisuuksissa ja palkkaeroja samankaltaista työtä tekevien naisten ja miesten välillä. Tulosten mukaan ainakin puolet naisten ja miesten välisestä palkkakuilusta voidaan selittää työmarkkinoiden segregoitumisella sukupuolen mukaan, kun taas erot taustaominaisuuksissa selittävät alle 10 prosenttia.

Asiasanat: Sukupuolten välinen palkkakuilu, palkkasyrjintä, segregoituminen

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1 Introduction

The huge body of literature shows that women are paid less on average than men in virtually all labour markets.¹ The Finnish labour market is no exception and women are found to receive wages that are some 15–30 percent lower than men’s wages. A gender wage gap of this size is well in line with evidence from other advanced countries. Wage differentials between women and men can arise in a variety of ways. Identifying the different sources of wage differentials is crucial for explaining and understanding why the gender gap in pay persistently exists.

One common finding is that women and men are unevenly allocated to different segments of the labour market; that is, the distribution of sexes varies across occupations, industries, firms and jobs. This kind of *labour market segregation* would result in gender wage differentials if the labour market segments occupied primarily by women were lower paid on average than those dominated by men.² Additionally, employers may simply pay lower wages to their female workers than their male workers for the same type of job. This causes *within-job wage differentials* between women and men. Such differentials, to the extent that they do not arise from differences in human capital, can be interpreted as wage discrimination against women.

International evidence shows that sex segregation is extensive and accounts for a large fraction of the gender wage gap. Groshen (1991) and Petersen and Morgan (1995) find that the segregation of women into lower-paying occupations, industries and establishments essentially explains all of the gender wage differentials in the U.S. labour market. These findings are challenged by a recent study of Bayard et al. (1999), who report large and significant within-job wage differentials in the U.S. labour market, even though gender segregation accounts for at least half of the gender wage gap. The findings from Scandinavian labour markets also support the importance of sex segregation in explaining the gender wage gap. According to Gupta and Rothstein (2001), roughly half of the wage gap in the Danish private sector can be explained by sex segregation. By contrast, Meyersson-Milgrom et al. (2001) find for Sweden and Peterson et al. (1997) for Norway much smaller within-job wage differentials, almost all of the gender wage gap being attributable to the

¹For international evidence see Blau and Kahn (1995, 2000).

²Of course, the process that allocates women to lower-paying jobs may also involve discrimination through differential access to jobs at the point of hire and subsequent promotions.

segregation of women into lower-paying occupations and establishments. Although the extent of within-job wage differentials differs between the studies, they all suggest that accounting for sex segregation reduces the gender wage gap considerably.

This study provides an empirical investigation into the extent to which the gender wage gap in Finland can be attributed to labour market segregation by sex.³ Using matched employer-employee data we evaluate wage differentials between women and men who are doing the same kind of job within the Finnish manufacturing firms. By applying regression methods in identifying the different sources of wage differentials, we are able to decompose the gender wage gap into (i) wage differentials reflecting differences in human capital characteristics, (ii) wage differentials resulting from sex segregation among industries, occupations, firms and job cells, and (iii) wage differentials existing within narrowly defined job cells.

In the Finnish manufacturing sector white-collar women earn roughly 24 percent less than their male counterparts. The corresponding wage gap among blue-collar workers is 17 percent. For both groups of workers, we find that the human capital differences by sex explain less than 10 percent of the gender wage gap while at least one-third of the gap remains attributable to wage differentials within narrowly defined job cells. In the case of blue-collar workers the allocation of women to lower-paying industries, occupations, firms and job cells accounts for some 60 percent of the gap. In particular, sex segregation by all considered dimensions appears to be equally important, each of which explains roughly 15 percent. Among white-collar workers, sex segregation by occupation and job cell accounts for almost half of the wage gap while industry and firm segregation have no effect at all. This is in contrast with the observation that as much as one-third of the wage gap among blue-collar workers is associated with interindustry and interfirm wage differentials. These findings may be related to a high concentration of white-collar women in administrative support and service jobs. These are jobs which are relatively homogeneous and dispersed across different industries and firms.

The rest of the paper proceeds as follows: In the next section we introduce statistical procedures to decompose the gender wage gap. This is followed by a section describing

³Previous Finnish studies have emphasized the impact of occupational differences on the gender wage differentials (see Hauhio and Lilja, 1996, Lilja, 1997, and Vartiainen, 2002). However, none of these studies has looked at wage differentials between women and men who are doing the same kind of job for the same employer.

the data. Section 4 reports the results of empirical analysis and the final section contains our concluding discussion.

2 Decomposing the gender wage gap

Following Groshen (1991), Bayard et al. (1999) and Gupta and Rothstein (2001), we write the log wage of individual i as

$$w_i = \alpha + \eta s_i + \mathbf{x}_i' \boldsymbol{\beta} + \mathbf{z}_i' \boldsymbol{\delta} + \varepsilon_i, \quad (1)$$

where s_i is the female dummy; \mathbf{x}_i is a vector of human capital variables; \mathbf{z}_i is a vector of segregation variables, as measured by the ratio of women to all employees in individual i 's occupation, industry, firm and job cell (= an occupation within a firm); and ε_i is a stochastic error term.

The gender wage gap is defined as the difference in mean log wages between women and men. This can be expressed as follows:

$$\bar{w}_f - \bar{w}_m = \hat{\eta} + (\bar{\mathbf{x}}_f - \bar{\mathbf{x}}_m)' \hat{\boldsymbol{\beta}} + (\bar{\mathbf{z}}_f - \bar{\mathbf{z}}_m)' \hat{\boldsymbol{\delta}}, \quad (2)$$

where the bars above the variables with subscripts f and m indicate sample means for females and males respectively; and hats above the Greek letters indicate parameter estimates from the OLS regression of (1). This decomposition is similar to the classical Oaxaca (1973) decomposition where the regression coefficients are restricted to be equal for women and men.

The decomposition outlined in (2) breaks the gender wage gap into three separate terms. The last term on the right-hand side, $(\bar{\mathbf{z}}_f - \bar{\mathbf{z}}_m)' \hat{\boldsymbol{\delta}}$, is the contribution of sex segregation to the wage gap, whereas the middle term, $(\bar{\mathbf{x}}_f - \bar{\mathbf{x}}_m)' \hat{\boldsymbol{\beta}}$, is the contribution of sex differences in human capital. These two terms jointly represent the 'explained' part of the gender wage gap. The remaining term, $\hat{\eta}$, corresponds to the 'unexplained' part of the wage gap, picking up the gender wage differentials not accounted for by the variables included in \mathbf{x} and \mathbf{z} . This can be thought of as the wage gap that results from within-job wage differentials between women and men. However, as any approach relying on the statistical residual is open to the question as to whether all relevant explanatory variables were included in the regression, one should not take $\hat{\eta}$ as a measure of wage discrimination. Perhaps a more proper interpretation of $\hat{\eta}$ might be an estimate of the *upper bound* of wage discrimination.

We can disaggregate the segregation term in (2) to the separate contributions of segregation among occupations, industries, firms and job cells by writing $(\bar{z}_f - \bar{z}_m)' \hat{\delta} = \sum_k (\bar{z}_f^k - \bar{z}_m^k) \hat{\delta}^k$, where \bar{z}_f^k and \bar{z}_m^k are the mean ratio of women to all employees in labour market structure k among women and men respectively, and $\hat{\delta}^k$ is the coefficient of z_i^k from the OLS regression of (1). For example, if k refers to the occupational structure, the difference $\bar{z}_f^k - \bar{z}_m^k$ will measure the extent of occupational segregation by gender. This difference would be zero if women and men were randomly distributed across occupations, and one if women and men were completely segregated among occupations. The regression coefficient $\hat{\delta}^k$ is the estimated wage effect of working in an all-female rather than all-male occupation. A negative value of $\hat{\delta}^k$ implies that the wage rate is negatively associated with the degree of 'femaleness' in the occupation or that occupations dominated by women pay lower wages on average.

3 Data

Our data come from the records of the Confederation of Finnish Industry and Employers (TT). TT is the central organization of manufacturing employers, the member firms of which account for more than three quarters of the value added of the Finnish manufacturing sector. Each year TT conducts three surveys covering basically all employees of its member firms.⁴ All surveys are directed to the employer. One asks information about white-collar workers and two others about blue-collar workers. These surveys contain detailed information on wages, working hours and occupations as well as some demographic background information. Each individual in the records is associated to his or her employer with a unique firm identifier. This allows us to group workers by their employer, which is essential for comparing workers doing similar jobs.

In this study we focus on the cross-section of workers employed by the TT member firms in 2000. Due to differences in the available records and in order to allow for some additional heterogeneity, white- and blue-collar workers are kept in different samples and will be analyzed separately. Blue-collar workers are paid on an hourly basis, whereas white-collar workers receive a monthly salary. The wage variable of blue-collar workers is the hourly wage of regular working time in the last quarter of 2000, excluding premium pay for overtime and work on Sundays, holidays and late shifts. For white-collar workers

⁴Top management and workers who belong to, or are related to, the owners of the firm are excluded.

we construct the hourly wage variable by dividing the monthly salary in December 2000 (bonuses etc. excluded) by regular working hours. Thus, our wage data exclude pay earned from overtime and irregular hours, which are usually paid at a higher rate. Including such pay components would overstate wage differentials between sexes because men typically work more overtime hours (see Table 2 below).

We pay particular attention to how women and men are distributed across different industries, occupations, firms and job cells within the firms. In the case of both worker groups the manufacturing sector is divided into 49 industries. The occupational classification differs for the two groups of workers, however. For the blue-collar workers we apply an industry-specific occupational code with a total of 491 occupational categories. The white-collar workers are classified into 79 occupation groups based on a less detailed code common to all industries. A job cell is defined as an occupation within a given firm. Segregation variables are constructed by computing the female share of all (white-collar or blue-collar) workers in each industry, occupation, firm and job cell.

In the subsequent analysis we include all individuals aged between 18 and 65 who work full-time within a job cell of size greater than one in a firm employing at least 5 workers. This left us 165,658 observations for blue-collar workers and 124,005 observations for white-collar workers. It should be stressed that the data in hand are of high quality and have several advantages over most of the data sets employed in previous research on the topic. First, our data can be regarded as highly reliable since all information comes directly from the employer records. This means that there is practically no response bias and all information is reported with a high accuracy compared with the standard employee surveys. Second, the data cover all the employees of each firm surveyed, so we get rid of the measurement error issues which are common, for example, in the U.S. data sets. If only a sample of a firm's workforce is available, the segregation variables (i.e. female shares in firm and job cell) are measured with error which tends to bias the regression coefficients toward zero. Third, in addition to the segregation variables, we have some information on the standard human capital characteristics, such as education (level and field), firm tenure and age. This makes our analysis less prone to omitted variable bias and allows us to identify the gender wage differentials which are related to human capital differences between sexes.

Before proceeding to the wage decompositions, Tables 1–3 show some sample statistics

Table 1: Sample statistics for white-collar workers

	<i>Women</i>		<i>Men</i>		<i>All</i>	
Hourly wage, euro	12.58	(3.94)	16.50	(5.38)	15.10	(5.26)
Log hourly wage	2.49	(0.27)	2.76	(0.29)	2.66	(0.31)
Age	40.87	(9.58)	41.25	(9.86)	41.12	(9.76)
Job tenure, years	12.43	(10.68)	11.56	(10.37)	11.87	(10.49)
Employer size	1,835	(2,844)	1,920	(3,140)	1,890	(3,038)
<i>Education level, %</i>						
Basic or unknown	16.12		8.12		10.97	
Upper secondary	28.54		20.55		23.40	
First stage of tertiary	33.69		29.41		30.94	
Bachelor's degree	9.09		24.61		19.08	
Master's degree	11.95		16.18		14.67	
Ph.D.	0.60		1.12		0.94	
<i>Field of education, %</i>						
General	8.72		6.02		6.98	
Education	0.40		0.07		0.19	
Humanities and art	3.05		0.41		1.35	
Social sciences, business and law	42.92		9.29		21.27	
Science	3.28		2.84		3.00	
Technical	18.85		68.89		50.70	
Agriculture	1.08		3.24		2.47	
Health and welfare	2.72		0.39		1.22	
Services	3.85		0.72		1.83	
Unknown	16.13		8.12		10.97	
<i>Female share in</i>						
Industry	0.421	(0.141)	0.337	(0.122)	0.367	(0.135)
Occupation	0.630	(0.318)	0.205	(0.177)	0.356	(0.312)
Firm	0.448	(0.178)	0.322	(0.140)	0.366	(0.116)
Job cell	0.737	(0.299)	0.146	(0.191)	0.356	(0.368)
Sample size	44,174		79,831		124,005	

Notes: Unless otherwise indicated, the figures in the table are means. Standard errors are in parentheses. Hourly wage is computed dividing the monthly wage by regular working hours. Employer size is the average firm size over workers. The mean firm size in the data is 114.

by sex. As can be seen in the tables, the female share is 24 percent among blue-collar workers and 36 percent among white-collar workers. These low figures reflect the fact that the manufacturing sector has been traditionally dominated by men, rather than a low labour force participation rate by the Finnish women. The higher female share of white-collar workers results from strong female dominance in typical office work.

From Table 1 it can be seen that white-collar women earn on average 24 percent less than their male counterparts, which equals the difference of 0.27 in the mean log wages. There are no large differences in the average age or tenure by gender. Educational attainments clearly differ between women and men, however. White-collar men are slightly more educated as measured by the education level but in terms of the field of education,

Table 2: Sample statistics for blue-collar workers

	<i>Women</i>		<i>Men</i>		<i>All</i>	
Hourly wage, euro	9.86	(1.87)	11.90	(7.94)	11.41	(7.04)
Log hourly wage	2.27	(0.18)	2.45	(1.19)	2.41	(0.20)
Age	42.56	(10.70)	40.43	(10.56)	40.94	(10.63)
Job tenure, years	12.53	(10.13)	14.11	(11.02)	13.73	(10.84)
Employer size	824	(1,241)	1,008	(1,550)	964	(1,485)
<i>Distribution of hours, %</i>						
Commission hours	33.02	(45.95)	33.44	(46.46)	33.34	(46.34)
Sunday hours	2.95	(6.06)	4.80	(7.46)	4.36	(7.19)
Piece rate hours	13.85	(31.92)	12.61	(31.38)	12.90	(31.52)
Overtime hours	1.97	(4.03)	3.52	(5.41)	3.15	(5.16)
<i>Education level, %</i>						
Basic or unknown	45.70		29.77		33.57	
Upper secondary	49.00		66.58		62.38	
First stage of tertiary	4.81		3.28		3.64	
Bachelor's degree	0.41		0.32		0.34	
Master's degree	0.09		0.05		0.06	
<i>Female share in</i>						
Industry	0.346	(0.205)	0.204	(0.126)	0.238	(0.161)
Occupation	0.461	(0.251)	0.168	(0.171)	0.238	(0.230)
Firm	0.459	(0.247)	0.169	(0.172)	0.238	(0.229)
Job cell	0.648	(0.283)	0.110	(0.185)	0.239	(0.312)
Sample size	39,544	39,544	126,114		165,658	

Notes: Unless otherwise indicated, the figures in the table are means. Standard errors are in parentheses. Hourly wage excludes pay earned from overtime and irregular hours. Employer size is the average firm size over workers. The mean firm size in the data is 114.

educational differences by sex are much more substantial. Almost 70 percent of men have received a technical education, compared with 19 percent of women. Women are also highly concentrated in terms of the educational field as 43 percent have a degree from social sciences, business or law.

Segregation variables in Table 1 indicate that white-collar women and men are relatively equally distributed across industries and firms (i.e. the means are close to the female share in the data).⁵ However, sex segregation appears to be much more extensive at the occupation and job cell levels, perhaps reflecting large differences in the educational field. An average woman belongs to an occupation group where 63 percent of all employees are women. The female share in the job cell of an average woman is as high as 74 percent. Women are especially concentrated in administration support and service occupations (see Table 3). Column 3 of Table 3 shows the gender wage gap within occupations for white-

⁵Note that indices of gender segregation are sensitive to the degree of aggregation in the underlying labour market structure.

Table 3: Female share and gender wage ratio by occupation for white-collar workers

<i>Occupation group</i>	<i>N</i>	<i>Female share</i>	$\overline{W}_f/\overline{W}_m$
R&D	40,999	0.234	0.801
R&D management	1,346	0.140	0.834
Product design	29,488	0.172	0.845
Quality management	4,534	0.479	0.795
Research	5,631	0.382	0.782
Production	31,717	0.097	0.755
Production and maintenance management	21,924	0.069	0.846
Production support	9,793	0.158	0.862
Logistics	5,271	0.407	0.790
Materials and logistics	2,019	0.237	0.819
Purchasing	2,535	0.439	0.732
Shipping	717	0.771	0.814
Sales and marketing	22,532	0.499	0.661
Sales	19,661	0.531	0.643
Sales promotion	1,266	0.497	0.901
Production and marketing co-operation	1,605	0.338	0.773
PR	4,110	0.511	0.812
PR	1,084	0.743	0.793
Information technology	3,026	0.428	0.772
Juridical and tax assistance	540	0.387	0.899
Administration	15,321	0.866	0.684
Administration management	1,270	0.509	0.786
Pay office	1,517	0.931	0.793
Bookkeeping	2,519	0.929	0.842
Accounting	2,130	0.607	0.800
Secretarial work	5,674	0.987	0.899
Office services	1,312	0.861	0.953
Clerical work, small firms	899	0.933	0.859
Human resources	3,515	0.727	0.694
HR management	331	0.544	0.837
Competence development	563	0.520	0.866
Recruitment and employment	293	0.700	0.788
Payroll administration	1,227	0.974	0.824
Safety and health care	655	0.499	0.729
Personal services	446	0.800	0.805
All	124,005	0.356	0.762

Notes: N = Number of observations. The last column expresses women's mean wage as a proportion of men's mean wage.

collar workers. The gender wage ratio within occupations ranges from 0.72 to 0.95, being clearly higher on average than the raw wage gap in the bottom line. In other words, the gender wage gap seems to be smaller within occupations.

From Table 2 we see that the gender wage gap among blue-collar workers is much lower than among white-collar workers, being 0.18 log points, which amounts to a 17 percent lower mean wage for women. Blue-collar women are less educated, slightly older and have less job tenure as compared with men. There is no evidence on strong industry segregation, which is in accordance with the findings for the white-collar workers. Interestingly, sex segregation among firms appears to be as extensive as among occupations.

4 Empirical results

As shown in the previous section, there exists a large degree of sex segregation among both groups of workers. This suggests the possibility that sex segregation accounts for a significant part of the gender wage gap. In this section we report the results from decomposing the wage gap using the statistical procedures outlined in Section 2.

4.1 White-collar workers

Since many other segregation studies lack controls for individual characteristics other than sex, we begin with specifications that omit human capital characteristics (i.e. the explanatory variables in \mathbf{x} are excluded). The upper panel of Table 4 reports these results for white-collar workers. The top row of the table shows that the raw wage gap to be decomposed is -0.265 log points. This equals the difference in the mean log wages between women and men in Table 1 and can be obtained from a regression of log wages on the female dummy only. By regressing log wages against the female dummy and various sets of segregation measures, we aim to distinguish parts of the wage gap resulting from different dimensions of sex segregation.

In rows *a* to *e* we report the decomposition results when only one dimension of segregation is taken into account at a time. Column 1 shows the coefficient on the female dummy (η), and coefficients on the female share in industry, occupation, firm and job cell (δ^k 's) are given in Columns 2 to 5. Column 6 shows the extent of sex segregation for each labour market structure ($\Delta\bar{z}^k \equiv \bar{z}_f^k - \bar{z}_m^k$). The product of this and the associated coefficient ($\delta^k \Delta\bar{z}^k \equiv \delta^k (\bar{z}_f^k - \bar{z}_m^k)$) is found in Column 7, which equals the absolute contribution of

sex segregation by this labour market structure to the wage gap. This is also the amount by which the wage gap would shrink if one were able to remove this source of segregation. The final column shows this amount as a fraction of the raw wage gap.

All coefficients in Columns 1 to 5 of Panel A are statistically highly significant. Segregation by sex among industries or firms alone accounts only for a moderate part of the wage gap (around 5 percent). At first sight, this may seem surprising, as the coefficients on the female share in industry and firm are relatively high in absolute terms. For example, a hypothetical switch from an all-female to all-male industry would cause a wage loss of 0.166 log points (or 15 percent),⁶ so that industries dominated by men pay wages that are clearly higher. But this does not result in a large gender wage gap because the degree of sex segregation among industries is relatively low (see Column 6).

Controlling for occupational segregation drops the coefficient of the female dummy from -0.265 to -0.139. So occupational differences by sex can account for almost half of the gender wage gap among the white-collar workers. From row *e* we see that segregation among job cells explains close to two-thirds of the wage gap. This stronger effect is what one should expect, as the job cells are defined by interacting the occupation codes with firm identifiers. From the estimated coefficients we can see that there is a strong negative association between the expected wage and the female share in one's occupation and job cell. Taken together with the large degree of sex segregation among occupations and job cells this acts to extend the wage gap between women and men.

Row *f* shows the regression results with a full set of segregation measures included in the regression, and the rows below report the components for the wage gap decomposition. The bottom row of Panel A gives further support to the view that sex segregation among occupations and job cells is an important source of wage differentials between white-collar women and men. Once all segregation measures are added to the regression, 61 percent of the gender wage gap is captured by labour market segregation. While sex segregation among occupations and job cells plays an almost equally important role, the contributions of industry and firm segregation are close to zero.

Before drawing any conclusions, we need to address the role of human capital differences as well. It seems obvious that any wage decomposition which neglects differences in background characteristics can be misleading. In search for new employees the employer

⁶Of course, there are no perfectly segregated industries in the real world.

Table 4: Wage gap decompositions for white-collar workers

	Female (1)	Female share in				$\Delta \bar{z}^k$ (6)	$\delta^k \Delta \bar{z}^k$ (7)	Explained (8)
		Ind. (2)	Occ. (3)	Firm (4)	Job (5)			
<i>Panel A: Segregation variables only</i>								
(a)	-2652 (.0017)							
(b)	-2513 (.0018)	-1659 (.0062)				.0837	-.0139	.0524
(c)	-1398 (.0021)		-.2953 (.0033)			.4244	-.1253	.4726
(d)	-2512 (.0018)			-.1109 (.0052)		.1260	-.0140	.0527
(e)	-1031 (.0026)				-.2744 (.0033)	.5907	-.1621	.6112
(f)	-1030 (.0025)	-.1021 (.0087)	-.2051 (.0048)	.0445 (.0075)	-.1222 (.0050)			
$\Delta \bar{z}^k$.0837	.4244	.1260	.5907			
$\delta^k \Delta \bar{z}^k$		-.0086	-.0871	.0056	-.0722			
Explained	.3884	.0323	.3283	-.0211	.2721			.6116
<i>Panel B: Human capital variables included</i>								
(g)	-2075 (.0016)							[.2173]
(h)	-2061 (.0061)	-.0339 (.0051)				.0837	-.0028	.0107 [.2120]
(i)	-1364 (.0018)		-.2343 (.0029)			.4244	-.0994	.3750 [.1105]
(j)	-2046 (.0016)			-.0382 (.0042)		.1260	-.0048	.0181 [.2103]
(k)	-1086 (.0020)				-.2081 (.0028)	.5907	-.1230	.4637 [.1269]
(l)	-1104 (.0020)	.0013 (.0070)	-.1675 (.0038)	.0099 (.0060)	-.0991 (.0039)			
$\Delta \bar{z}^k$.0837	.4244	.1260	.5907			
$\delta^k \Delta \bar{z}^k$.0001	-.0711	.0012	-.0586			
Explained	.4163	-.0004	.2680	-.0047	.2209			.4940 [.0898]

Notes: Standard errors in parentheses. Column 8 reports the proportion of the wage gap explained by sex segregation. In addition, the proportion of the wage gap explained by human capital differences is given in the square brackets in Column 8 of Panel B. Human capital variables include job tenure, indicator for capital region, educational level and field, age and its square interacted with educational level.

typically sets some requirements (regarding education, work experience etc.) that each candidate has to fulfil in order to be considered for a given vacancy. It follows that differences in background characteristics by sex affect the allocation of women and men to different industries, occupation, firms, and job cells. Moreover, some wage differentials between labour market structures are likely to arise from skill differences. If we do not control for human capital differences, our segregation measures in the regression are likely to pick up their effect indirectly.

These issues can be illustrated by a simple example. Suppose that there are two types of occupations: low-skill occupations with no educational requirements and high-skill occupations which require special skills that need to be acquired by education. The high-skill occupations pay better wages only because of the higher skill level of workers who hold them. Now, if women were less educated on average, their proportion in high-skill occupations would be lower than in low-skill occupations. In what follows, the coefficient on the female share in occupation will take a negative value in the regressions where education is not controlled for. This effect is simply a reflection of the gap in human capital between sexes. More generally, in the absence of human capital controls the female share in the regression may simply pick up some unmeasured skill differences among workers.

The lower panel of Table 4 shows the results when we add a set of control variables for individual background characteristics to the regressions. These explanatory variables include job tenure, indicator for the capital region, education (level and field), age and its square with interactions with educational level. Row *g* shows the coefficient on the female dummy when the human capital variables are included but all segregation measures are left out from the regression. A drop of 0.057 log points compared with the coefficient estimate in row *a* suggests that roughly one-fifth of the gender wage gap can be attributed to differences in background characteristics between women and men. Adding the female share in industry or firm to the model does not reduce the gender wage gap practically at all. Their coefficients are some one-fourth of the corresponding estimates in Panel A. The estimated effects of sex segregation among occupations and firms remain strong, although their coefficients are decreased by one-third, once we control for human capital. These findings suggest that lower wages in labour market structures – especially in industries and firms – dominated by women stems partly from women’s lack of human capital.

Our preferred specification that contains the human capital variables and full set of

segregation measures is given in the bottom rows of Panel B. The coefficient on the female dummy now takes value of -0.110, which is marginally higher than the corresponding estimate in row *f*. In terms of the wage decomposition, sex segregation among industries and firms is unimportant, but the allocation of women and men to different occupations and job cells explains roughly half of the gender wage gap. The proportion of the gap explained by human capital differences is only about 9 percent.

To summarize, roughly 60 percent of the gender wage gap among white-collar workers is attributable to human capital differences (9 percent) and sex segregation among occupations (27 percent) and job cells (22 percent). However, over 40 percent of the wage gap remains unexplained. In terms of our decomposition, this implies that wage differentials by sex within job cells result in the gender wage gap of 0.110 log points.

4.2 Blue-collar workers

The results of wage gap decompositions for blue-collar workers are shown in Table 5. The upper panel of the table reports the results based on the specifications that exclude the human capital variables. By comparing figures in rows *a* and *b* we see that sex segregation among industries alone accounts for one-fourth of the raw wage gap of 0.180 log points. Moreover, segregation among firms can explain over 45 percent of the wage gap. These strong effects are in contrast with the findings that industry and firm segregation do not play an important role for white-collar workers. The explanation is twofold. First, among blue-collar workers there exists a stronger negative association between the wage rate and female share in industry and firm, as the coefficients are over two times higher in absolute terms than those in Table 4. Second, these stronger relationships for blue-collar workers are enforced in the wage gap decomposition owing to a larger degree of sex segregation, especially among firms.

The segregation of blue-collar women into lower-paying occupations accounts for one-third of the wage gap (see row *c*), which is clearly less than was the case with white-collar workers. This is somewhat surprising as the occupational classification of blue-collar workers is much more detailed than that of white-collar workers. From row *e* we see that segregation among job cells has a very strong effect, as the wage gap falls by some 67 percent, once we control for it. When the full set of segregation measures is added to the model, the coefficient on the female dummy drops to -0.058. This is roughly one-third of

Table 5: Wage gap decompositions for blue-collar workers

	Female share in				$\Delta \bar{z}^k$	$\delta^k \Delta \bar{z}^k$	Explained
	Female (1)	Ind. (2)	Occ. (3)	Firm (4)			
<i>Panel A: Segregation variables only</i>							
(a)	-.1804 (.0011)						
(b)	-.1296 (.0011)	-.3557 (.0029)			.1426	-.0507	.2813
(c)	-.1233 (.0012)		-.1951 (.0023)		.2925	-.0570	.3163
(d)	-.0966 (.0012)			-.2886 (.0023)	.2904	-.0838	.4646
(e)	-.0589 (.0015)				-.2260 (.0021)	-.1214	.6732
(f)	-.0583 (.0015)	-.1937 (.0037)	-.0458 (.0028)	-.1215 (.0033)	-.0852 (.0029)		
$\Delta \bar{z}^k$.1426	.2925	.2904	.5373		
$\delta^k \Delta \bar{z}^k$		-.0276	-.0134	-.0353	-.0458		
Explained	.3233	.1532	.0743	.1955	.2537		.6767
<i>Panel B: Human capital variables included</i>							
(g)	-.1611 (.0010)						[.1066]
(h)	-.1165 (.0010)	-.3218 (.0026)			.1426	-.0459	.2544 [.0997]
(i)	-.1042 (.0011)		-.2012 (.0020)		.2925	-.0588	.3262 [.0962]
(j)	-.0921 (.0011)			-.2533 (.0020)	.2904	-.0736	.4079 [.0816]
(k)	-.0630 (.0013)				-.1887 (.0018)	-.1014	.5621 [.0887]
(l)	-.0615 (.0013)	-.1774 (.0033)	-.0944 (.0025)	-.1062 (.0029)	-.0373 (.0025)		
$\Delta \bar{z}^k$.1426	.2925	.2904	.5373		
$\delta^k \Delta \bar{z}^k$		-.0253	-.0276	-.0308	-.0200		
Explained	.3407	.1403	.1530	.1709	.1111		.5754 [.0839]

Notes: Standard errors in parentheses. Column 8 reports the proportion of the wage gap explained by sex segregation. In addition, the proportion of the wage gap explained by human capital differences is given in the square brackets in Column 8 of Panel B. Human capital variables include job tenure, educational level, age and its square interacted with educational level, number of shifts and days worked per week, proportion of Sunday, overtime, commission and piece rate hours.

its initial value in row *a*, a drop of the same magnitude as we found for white-collar workers in the upper panel of Table 4. It appears that sex segregation among industries and firms both account for over 15 percent of the wage gap. The allocation of women to lower-paying job cells explains 25 percent of the raw wage gap, but occupational segregation explains less than 8 percent.

Of course, our concern that omitting human capital measures from the regressions may bias conclusions is relevant in this case as well. So we should pay more attention to the results reported in the lower panel of the table. From row *g* we observe that gender differences in background characteristics explain some 10 percent of the gender wage gap among blue-collar workers. Adding segregation measures to the analysis one by one produces a pattern of coefficients very similar to what we saw in the upper panel of the same table. However, once all the segregation and human capital variables are included, the coefficient on the female share in occupation is two times higher in absolute terms and the coefficient on the female share in job cell is reduced by half when compared with the values in Panel A. Interestingly, the segregation of blue-collar workers among industries, firms, occupations and job cells all have roughly the same impact on the gender wage gap, each dimension of sex segregation accounting for some 15 percent. Consistently with our previous findings for white-collar workers, human capital differences play only a minor role, as only 8 percent of the wage gap can be attributed to them. The within job cell wage gap is -0.061 log points, which corresponds to one-third of the raw wage gap.

5 Concluding remarks

In this paper we have shown that a large degree of sex segregation among industries, occupations, firms and job cells accounts for a substantial part of the gender wage gap in the Finnish manufacturing sector. While the human capital differences were found to explain less than 10 percent, some 50 to 60 percent of the gender wage gap is attributable to sex segregation. Among blue-collar workers each dimension of sex segregation turned out to be an equally important source of gender wage differentials. By contrast, the segregation of white-collar workers among industries and firms does not affect the gender wage gap, but the segregation effect works entirely through occupation and job cell segregation.

Equal pay issues have traditionally attracted considerable interest in public debate in Finland. Our findings add some useful insights to this debate. Given that a large

fraction of the gender wage gap is attributable to sex segregation, any successful policy for narrowing the wage gap should go along the lines of comparable worth and equal opportunities in education, hiring and promotion. The importance of segregation issues has been already recognized by the Government and labour market organisations. As a part of EU-wide employment strategy, the National Action Plan of Finland includes a number of policy proposals to reduce sex segregation in the labour market (see Ministry of Labour, 2002). In the light of our results such measures, if put into action, serve as an effective way of narrowing the gender wage gap.

After all, it is notable that as much as one-third of the gender wage gap arises from wage differentials within job cells. In other words, a substantial part of the wage gap remains attributable to a worker's sex, which brings into question whether women and men are equally rewarded by employers. The crucial question that arises is whether or not the jobs performed by women and men within job cells require equal skill, effort and responsibility. This is a topic we wish to address more carefully in our future work by incorporating more detailed measures of job characteristics into the analysis.

References

- [1] BAYARD, KIMBERLY – HELLERSTEIN, JUDITH – NEUMARK, DAVID – TROSKE, KENNETH (1999): "New Evidence on Sex Segregation and Sex Differences in Wages from Matched Employee-Employer Data", NBER Working Paper 7003.
- [2] BLAU, FRANCINE – KAHN, LAWRENCE (1995): "Wage Structure and Gender Earnings Differentials: an International Comparison", *Economica* 63, S29-S62.
- [3] BLAU, FRANCINE – KAHN, LAWRENCE (2000): "Gender Differences in Pay", *The Journal of Economic Perspectives* 14(4), 75-100.
- [4] GROSHEN, ERICA (1991): "The Structure of the Female/Male Wage Differentials: Is It Who You Are, What You Do, or Where You Work?" *Journal of Human Resources* 26(3), 457-472.
- [5] GUPTA, NABANITA DATTA – ROTHSTEIN, DONNA (2001): "The Impact of Worker and Establishment-Level Characteristics on Male-Female Wage Differentials: Evidence from Danish Matched Employee-Employer Data", CLS Working Paper 01-09-2001.
- [6] HAUHIO, NINA – LILJA, REIJA (1996): "The Evolution of Gender Wage Differentials Over the Career", ETLA Discussion Paper 573, Helsinki.

- [7] LILJA, REIJA (1997): "Similar Education – Different Career and Wages?", ETLA Discussion Paper 606.
- [8] MEYERSSON-MILGROM, EVA – PETERSEN, TROND – SNARTLAND, VEMUND (2001) "Equal Pay for Equal Work? Evidence from Sweden and a Comparison with Norway and the U.S.", *Scandinavian Journal of Economics* 103(4), 559-583.
- [9] Ministry of Labour (2002): "Suomen työllisyyspolitiikan toimintasuunnitelma 2002", Helsinki.
- [10] OAXACA, RONALD (1973): "Male-Female Wage Differentials in Urban Labour Markets", *International Economic Review* 14(3), 693-709.
- [11] PETERSEN, TROND – MORGAN, LAURIE (1995): "Separate and Unequal: Occupation-Establishment Sex Segregation and the Gender Wage Gap", *American Journal of Sociology* 101(2), 329-365.
- [12] VARTIAINEN, JUHANA (2002): "Gender Wage Differentials in the Finnish Labor Market", Gender Equality Publications No 2, Ministry of Social Affairs and Health, Helsinki.

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