Size and Causes of the Occupational Gender Wage-gap in the Netherlands

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Research from the United States consistently shows that female-dominated occupations generally yield lower wages than male-dominated occupations. Using detailed occupational data, this study analyses the size and causes of this occupational gender wage-gap in the Dutch labour market using multi-level modelling techniques. The analyses show that both men and women earn lower wages if they are employed in female-dominated occupations. This especially indicates the significance of gender in Western labour markets, since overall levels of wage inequality are relatively small in the Netherlands compared to, for example, the United Kingdom and the United States. Differences in required responsibility are particularly important in accounting for this occupational wage-gap. Nonetheless, we find large wage penalties for working in a female-dominated instead of a male-dominated occupation for occupations that require high levels of education, skills, and responsibility.

Introduction

There is a large and persistent sex gap in wages in all industrialized countries; women (still) earn much lower wages than men. This gap is well-documented, and there is an ongoing debate about the causes of the persistence of wage differences between men and women. Research consistently shows that differences in human capital do not account for the total sex gap in wages (e.g. Bakker, Tijdens and Winkels, 1999; England, 1992; Tomaskovic-Devey and Skaggs, 1999). Rather, contextual factors are important. Many researchers in the United States (e.g. England, Reid, and Kilbourne, 1996; Tomaskovic-Devey, 1995; Treiman and Hartmann, 1981) have documented the role of sex segregation in maintaining the sex gap in wages by demonstrating that female-dominated jobs and occupations are characterized by lower pay than male-dominated jobs and occupations, even if these occupations entail comparable work roles. This study analyses the wage-gap between male- and female-dominated occupations in the Netherlands.

This paper makes several contributions to the existing literature. As one of the first (with the exception of Cohen and Huffman, 2001, and Haberfeld, Semyonov and Addi, 1998), multi-level analyses techniques are used to analyse the occupational gender wage-gap. These techniques recognise the empirical reality that individuals are nested in occupations, and enable us to make an empirical distinction between composition and context effects of sex composition on wages.[1]

Due to the lack of suitable data, there have not been many studies of wage differences between male- and female-dominated occupations in the Netherlands (exceptions are Bakker *et al.*, 1999, who analysed the importance of occupational contexts for the sex wage-gap in wages; and Kraaykamp and Kalmijn, 1997, who performed a case study of the sex gap in wages for Dutch managers). Appropriate national data have recently become available which include reliable measures of wages and detailed occupations of approximately 120,000 Dutch individuals: the 'Loon Structuur Onderzoek' (Structure of Earnings Survey, Statistics Netherlands, 1997).

Furthermore, because levels of (occupational) wage inequality are relatively small in the

Netherlands (especially compared to the United Kingdom and the United States, see e.g. Blau, 1996), the Dutch situation is an interesting case. The Netherlands is often characterized as a conservative welfare state that favours women's economic dependence on their husbands and stimulates their part-time employment (Dulk, 2001). As a matter of fact, the Dutch labour force has a relatively large share of part-time working women, especially compared to other industrialized countries. Nonetheless, part-time jobs in the Netherlands are not 'marginal' (e.g. Pfau-Effinger, 1998; De Ruijter, 2002).

Occupations versus Jobs

This study focuses on the analysis of (detailed) occupations. Occupations consist of similar sets of tasks that are performed independent of the organizational context, while jobs are similar sets of tasks performed within an organizational context. The choice to study (detailed) occupations is made for several reasons.

First, looking at occupations offers an overview of occupational wage differences in the (Dutch) labour market as a whole, while studying jobs limits comparisons to the organizational context (Tomaskovic-Devey, 1995). In addition, social stratification research has consistently shown the importance of occupations as a stratifying mechanism in contemporary society: the context of the occupation one works in is very important for one's position within as well as outside the labour market (e.g. Ganzeboom, De Graaf and Treiman, 1992; Mastekaasa and Dale-Olsen, 2000).

A more pragmatic reason for our focus on the occupational instead of the job level is that the strong segregation of organizations by sex makes it difficult to find enough male- and female-dominated jobs within one organization. Moreover, it is almost impossible to obtain data at the job level (with the exception of for instance Huffman and Velasco, 1997 and Cohen and Huffman, 2001 in the USA).

However, one should not neglect the fact that using aggregate occupational measures can raise some problems. Research shows that more precise occupational measures result in higher levels of observed sex segregation (e.g. Birkelund and Sorenson, 2000): occupational groups (e.g. service occupations) are less segregated by sex than detailed occupations (e.g. nurse or mechanic), while jobs appear to be most strongly segregated by sex. This implies that using more aggregate measures will lead to underestimation of the occupational gender wage-gap. We will therefore use occupational measures that are as detailed as possible (five-digit occupations), which reduces the risk of underestimating the occupational gender wage-gap.

Theory

Why do workers in female-dominated occupations earn lower wages than workers in male-dominated occupations? The present section answers this question, using insights from both economic and sociological theory (please note that these theories are not mutually exclusive).

Human-Capital Theory

Human-capital theory ascribes wage differences between male- and female-dominated occupations to individual-level differences in the stock of human capital. The wage penalty associated with being employed in a female-dominated occupation is due to differences in the human-capital composition of male- and female-dominated occupations.

Men and women differ in their human-capital investments, because women have a comparative advantage in the domestic sphere, while men have a comparative advantage in paid labour (i.e. the specialization argument). These different comparative advantages result in a sexual division of labour in the household, where the man performs paid labour and the woman carries out the domestic work.

Because of women's family responsibilities, they expect to (partly) terminate their labour-market participation when they get married or have children. This affects negatively their opportunities to recoup investments in human capital (e.g. Tolbert and Moen, 1998; Grand, 1991; Schippers and Siegers, 1989). Men, on the other hand, expect to participate in the labour market for a long and continuous period of time. This implies that men generally

have more opportunities to recoup their investments in labour-market human capital than women. Because of this, women generally invest less in human capital than men. For the same reason, employers generally invest less in the human capital of female employees.

Explaining Wage Differences between Male- and Female-Dominated Occupations

Human-capital theory assumes that there is a perfect fit between workers' characteristics and the characteristics demanded by the occupations they hold (Schippers, 1998). Therefore, if we want to explain occupational wage differences using insights from human-capital theory, the allocation of men and women to different occupations is important.

Since men and women are at variance in their investments in human capital, they are generally allocated to occupations that differ regarding their marginal productivity. Marginal productivity refers to the productivity of the marginal employee in the occupation. This marginal employee can be visualized as 'the last worker hired'. Kilbourne *et al*. (1994: 690) describe it as follows: 'marginalism is best understood by imagining workers lined up in order of how much compensation they would require to invest in human capital, with those requiring no wage premium first'. Market forces determine that the wage paid to the marginal worker (i.e. 'the last worker hired') in an occupation will be paid to all otherwise equivalent workers in the job.

Human capital is often used as a proxy of marginal productivity, for example education and labour-market experience. Because the stock of human capital of workers in female-dominated occupations is generally lower than that of workers in male-dominated occupations, the wage-gap between male- and female-dominated occupations can be explained by differences in marginal productivity between occupations.

Assuming that all workers are employed in their 'equilibrium occupation', the following hypothesis can be derived:

> H1. Wages of individuals who work in male-dominated occupations are generally higher than wages of individuals who work in female-dominated occupations, because individuals who are

employed in these male-dominated occupations generally possess more human capital than individuals who are employed in female-dominated occupations.

Please note that the human-capital hypothesis assumes that the occupational gender wage-gap is due to a composition effect. Because wages of individuals who possess more human capital are higher, and because the workers in female-dominated occupations possess less human capital than workers in male-dominated occupations, lower wages can be observed in female-dominated occupations.

The Crowding Hypothesis

Human-capital theory rests on a strong assumption, namely that the labour market is transparent and competitive and that every worker holds his or her 'equilibrium job'. This free labour market guarantees that men and women in occupations with higher marginal productivity earn higher wages. Unexplained wage differences between workers in male- and female-dominated occupations are fully attributed to unmeasured differences in human capital (Tam, 1997). However, the assumption of a competitive labour market has proved not to be relevant in all cases. Men and women cannot move freely across the labour market, simply because of the existence of institutional barriers like formal educational systems, government regulation, internal labour markets, statistical and other forms of discrimination.

Crowding theory addresses the consequences for wages of women's restricted access to occupations. In the first place, Edgeworth (1922) pointed out the phenomenon that a group of employees that relies on a restricted segment of the labour market has higher chances of receiving lower wages than a group of employees that can move freely across the labour market. If a group is concentrated on a restricted segment of the labour market, an artificially high supply of labour may arise which, in accordance with the principles of market mechanisms, results in a decrease of wages to under the level of a 'normal' division – i.e. a division more spread across different segments of the labour market.

Bergmann (1986) has given renewed attention to the crowding hypothesis. She argues that the amount of supply in female-dominated occupations is artificially high because of discriminatory forces. In other words, the supply of labour in these occupations is higher than it would have been if women could move freely across the labour market. This lowers the equilibrium market wage in female-dominated occupations to below what it would have been in the absence of discrimination in male occupations. Please note that this crowding effect is purely contextual: all individuals (both men and women) earn lower wages if they work in crowded occupations.

According to crowding theory, wages in each of the segments of the labour market are set according to the principles of supply and demand. The economic approach would assume that wage differences between the different segments of the labour market will disappear through mobility between the different segments. This would result in adjustments in demand and supply so that the same equilibrium wage would arise in each segment. According to crowding theory, this last mechanism does not work: men and women cannot move freely across the different segments of the labour market. According to crowding theory, men and women are in some sense 'non-competing groups', which means that there are boundaries between segments that prevent a reallocation of men and women over the different segments (De Ruijter, Van Doorne-Huiskes and Schippers, 2001). Thus, the following hypothesis is derived:

> H2. Wages of individuals who work in male-dominated occupations are generally higher than wages of individuals who work in female-dominated occupations, because female-dominated occupations are generally more crowded than male-dominated occupations.

Comparable Worth or Gender Bias

Crowding theory addresses the consequences of the different allocations of men and women to occupations: it is assumed that women's disadvantaged position in the labour market lies on their restricted access to (desirable) occupations. This theory does not address the different valuation of male and female labour, which is the key issue in the compar-

able worth tradition (e.g. England, 1992). According to this approach, the value of labour is gendered, which results in lower wages for both men and women who work in female-dominated occupations. Because of the assumed gender bias, the comparable worth movement advocates measuring the value or worth of labour using formal, objective (i.e. gender-neutral) administrative procedures. Worth is assumed to be a characteristic of jobs and occupations, not of individuals.

In practice, occupational worth is often defined (following Treiman and Hartmann, 1981) as the sum of required human capital (required education, skills, effort, and responsibility) and occupational working conditions. Vertical segregation of men and women in occupations of unequal worth, with men being concentrated in occupations of higher worth, might explain (part of) the wage-gap between male- and female-dominated occupations. This is essentially an issue of the allocation of men and women to different occupations.

However, if occupations of equal worth yield different wages, comparable worth researchers do not attribute these unexplained wage differences to unmeasured differences in required human capital. Rather, they attribute this wage-gap to a different cultural valuation of male and female labour: the gender-typing of occupations is assumed to have a direct effect on wages in these occupations.

This gender typing assumes that wages are determined not by market forces alone, but by institutionalized norms as well. Occupations that are disproportionately female or male become stereotyped, and the work process itself begins to reflect the social value of the master status of typical incumbents. This is not an argument about discrimination against individuals but against jobs (Tomaskovic-Devey, 1995: 29). This influence of gender concepts on wages is often taken as a matter-of-course, which is a central characteristic of social norms in general. Most people are not even aware of the existence of gender concepts, let alone their influence on wages.

Past research shows that both men and women attribute less value to work performed by women, and occupations requiring typically female skills yield lower wages than occupations that require typically male skills (e.g. England, Herbert, Kilbourne, Reid and Megdal, 1994). The work women are concentrated in is undervalued relative to its true

productive contribution. As Jacobs and Steinberg (1995: 117) say: 'women's jobs do not fit neatly into well-established frameworks for evaluating and valuing jobs, developed for historically male work'. Female skills often remain invisible in contemporary wage-setting practices and job evaluation systems.

> H3. Wages of individuals who work in male-dominated occupations are generally higher than wages of individuals who work in female-dominated occupations, because the type of labour involved in female-dominated occupations is generally valued as lower than the type of labour involved in male-dominated occupations.

Data and Variables

The Sample

To address our research questions and test our hypotheses, we analyse the LSO 1997 (Loon Structuur Onderzoek or Structure of Earnings Survey) collected by Statistics Netherlands (Centraal Bureau voor de Statistiek or CBS). This data-set contains information about approximately 140,000 individuals and is the largest data-set with labour-market information available in the Netherlands. It combines information from three sources: the Enquête Werkgelegenheid en Lonen (EWL), the Enquête Beroepsbevolking (EBB) and the Verzekerdenadministratie (VZA) (Schulte Nordholt and Ruijs, 2000). The EWL is a large-scale survey held amongst companies about wages and length of employment. The data are collected mainly in electronic form at companies, establishments and salary administrations, resulting in very reliable wage measures. The EBB is a survey of individuals aged 15 and older, who are questioned about their occupation and education. The VZA includes information about all employees who are insured for the obligatory Dutch workers' insurance (unemployment and disability). Data from EWL and VZA are matched to the individual-level observations in EBB, which is a 1 per cent sample of all workers in the Netherlands. Sampling thus occurred at the individual level.

For our analyses, we select individuals participating in the labour market in 1997 (excluding the self-employed). This resulted in a total of 130,271

individuals, of whom 51,867 are female and 78,404 are male. We have information about the occupation of as many as 120,088 of these individuals.

Measures

For all analyses, the dependent variable is the logarithm of the gross hourly wage (excluding overtime), an individual-level variable.

Occupational Sex Composition

Our main independent variable is sex composition, an occupational-level variable. Most previous studies measure sex composition as the share of women employed in an occupation. These studies analyse the linear relation between the percentage of women and wages, which assumes that each increase of 1 percent in the share of women in an occupation results in an equivalent decrease in wages.

Nonetheless, there are some theoretical reasons for believing that there is in fact no linear relation between the share of women in an occupation and wages. As Kanter (1977) suggests, being a member of a numerical majority or minority has consequences for one's position only when a certain numerical threshold is achieved.[2] We assume that a female majority in an occupation results in a wage penalty for all incumbents, and that the wage penalty associated with this female majority will be most profound if it concerns a large enough majority. In occupations that are only slightly numerically dominated by men (such as occupations with 15 per cent women), we do not necessarily expect a wage penalty associated with an increasing share of women.

Additionally, the percentage of women in an occupation is often (if not always) not normally distributed, especially for detailed occupational categories. Most occupations are either dominated by men or by women. Also, mixed-sex occupations or occupations that are dominated only slightly by men or by women often comprise male- and female-dominated fields. For example, within the mixed-sex occupation of sales representative, women often sell typically female products, like beauty supplies, while men tend to sell electronic equipment or construction materials. The fact that mixed-sex occupations often comprise male- and

female-dominated jobs makes it difficult to interpret wage differences between mixed-sex and either male- or female-dominated occupations.

Based on these arguments, we choose to compare wages between male-dominated and female-dominated occupations. We consider an occupation to be numerically dominated by one sex if this sex is employed disproportionately in an occupation relative to the sex ratio of the total labour force. In the Netherlands in 1997, approximately 40 per cent of the labour force was female. According to our definition, all occupations with more than 65 per cent women are female-dominated, while all occupations with less than 15 per cent women are considered male-dominated. We consider the remaining occupations to be of mixed sex.[3]

Our definition closely resembles that of Jacobs and Steinberg (1995), in the sense that it is asymmetric and not static, but can vary according to the sex ratio of the labour force and the chosen boundaries. Since most male- and female-dominated occupations are either strongly dominated by men or women, the choice of different boundaries does not make a large difference to the number of male- and female-dominated occupations one finds.

To obtain reliable estimates of sex composition, we exclude occupations with fewer than 300 incumbents.[4] This results in measures for 122 five-digit occupations (from the total population of 1,211 five-digit occupations as given in Statistics Netherlands 1992). In total, 89,835 of the total number of 120,088 respondents are employed in one of these 122 five-digit occupations.

With respect to the effect on wages of working in a mixed-sex occupation, we have to note that this effect is difficult to interpret since these occupations often comprise both male- and female-dominated jobs (Tomaskovic-Devey, 1995).

Human Capital

We also include measures of an individual's human capital. These are education (highest completed educational level, recoded in years), full-time work status (a dummy variable coded 1 if the respondent works full-time and 0 otherwise), employment seniority (number of months employed by current employer), supervisory duties (coded 1 if the respondent's job involves supervising other workers, 0

otherwise) and respondent's age (in years). We also include a quadratic function of age in the models, since the (expected) positive effect of age on wages decreases with age. If this is true, we find a significant positive influence of the variable age on wages, and a significant negative effect of the quadratic function on wages. Unfortunately, the Structure of Earnings Survey does not include measures of labour-market experience. Nevertheless, we assume that including both employment seniority and age in our models offers a satisfying proxy of labour market experience (even though using age as a single proxy would result in an overestimation of the experience of women, since a relatively large number of women either work part-time or interrupt their careers).[5]

Female Crowding

The crowding hypothesis will be tested using a measure for the concentration of women in a restricted number of occupations. This measure relates the number of women in an occupation to the total number of women in the labour force, and measures absolute crowding. However, the measure does not take into account the fact that occupations differ in size. If women are (heavily) concentrated in an occupation, it might be due to the large size of the occupation (i.e. it also employs a relatively large number of men). We therefore divide the absolute measure of occupational crowding by the absolute degree of crowding of all individuals in the labour market, i.e. the number of individuals employed in an occupation relative to the total number of individuals in the labour force. This division results in a measure of the relative degree of crowding in an occupation, i.e. the degree of crowding of the female labour force conditional on the (absolute) size of that occupation (labelled as relative crowding).

Worth or Gender Bias

We also include three composite measures of occupational worth: (1) required education and skills, (2) responsibility, and (3) effort. These measures were developed using the results of expert research (see De Ruijter, 2001, and Appendix A). Up to now such measures have not been available. These

measures enable us to test the comparable worth or gender bias hypothesis: do workers in male-dominated occupations earn significantly lower wages than individuals in female-dominated occupations, even though these are of equal worth? The three indexes of occupational worth were created by first standardizing each item (mean = 0, sd = 1), adding them, dividing them by the total number of items, and then standardizing these indexes too.

To test the gender bias hypothesis, both the net negative effect of occupational sex composition on wages and differences in returns to occupational worth between occupations of varying sex composition are examined. Thus our models also include occupational-level interactions (occupational worth×occupational sex composition) in order to test whether the returns to worth differ between male-dominated, female-dominated, and mixed-sex occupations.

Individual-Level Controls

Several important individual-level control variables are also included. First, we have one available measure of (onerous) working conditions: whether one works regular hours (coded 1 if the respondent works regular hours and 0 for work in shifts). We also include a variable for organizational size (a dummy variable for more than 500 employees) for two reasons (Huffman and Velasco, 1997). First, large organizations are more visible than smaller firms and might therefore tend to discriminate against women less because of increased vulnerability to government scrutiny. Secondly, large organizations tend to legitimate their personnel practices and compensation policies. Additionally, we include 24 dummy variables to capture differences across the 25 sectors developed by Statistics Netherlands (2000). It is important to control for sector, since collective labour agreements in the Netherlands (of which wages are an important element) are often negotiated at the sector level.

To simplify presentation of the results, the sector coefficients are omitted from all tables in this paper (but are available upon request). The descriptive statistics of the variables are presented in Table 1.

Table 1. *Descriptive statistics of the relevant variables*

Variable	Mean	Standard deviation	N
Five-digit occupational-level variables			
% female	40.43	34.18	122
< 16% female	0.35	0.48	122
16–65% female in occupation	0.34	0.48	122
> 65% female in occupation	0.31	0.47	122
Required education and skills	0.00	1.00	122
Responsibility	0.00	1.00	122
Effort	0.00	1.00	122
Occupational crowding	0.94	0.79	122
Individual-level variables			
Female	0.41	0.49	120,088
Education in years	11.70	2.54	120,088
Full-time work	0.60	0.49	120,088
Regular services	0.83	0.38	120,088
Seniority (in months)	95.30	99.39	120,088
Supervision	0.23	0.42	111,458
Age	37.12	10.50	120,088
Organisational size (categories 0–1000)	442.13	441.86	120,088

Source: Authors' calculations based on the Structure of Earnings Survey 1997.

Statistical Models

The data have a multi-level nature: individuals are nested in occupations, in sectors, and in organizations. To account for this multi-level structure, we estimate a series of hierarchical linear models (see Bryk and Raudenbush, 1992; Snijders and Bosker, 1999). Previous research has often shown no direct empirical assessment of the composition versus the contextual effect of occupational sex composition on wages. One reason for this is that common analytical strategies (such as appending occupational characteristics to individual-level records and treating these as independent observations) obscure the fact that individuals are nested within occupations and could introduce bias into the analyses.

First, conventional models that do not leave the individual level neglect the fact that individuals are nested within occupations and that these occupations are a sample of an underlying population of occupations (Woodhouse, Rasbash, Goldstein, and Yang, 1995). Moreover, the inclusion of occupational-level variables as contextual variables will

cause the disturbances for individuals in the same occupation to be correlated, resulting in a violation of OLS assumptions. As a consequence, both the regression coefficients and their standard errors may be biased (Haberfeld, Semyonov, and Addi, 1999). Importantly, conventional approaches, by ignoring the hierarchical nature of the data, assume many more degrees of freedom than actually exist. As a result, the standard errors of the estimated parameters are biased downwards (thereby increasing the likelihood of a Type I error). In other words, ignoring the fact that individuals are nested within occupations leads to the 'miraculous multiplication of the number of units' (Snijders and Bosker, 1999: 15), which increases the risk of overstating the contextual effect of occupational sex composition on wages.

One major advantage of multi-level models is that they recognize the existence of variation in wages at both the individual and the occupational levels, enabling us to separate the contextual effect of occupational sex composition from the individual sex effect on wages. Our model can be written as follows:

Overall model: $Y_{ij} = \beta_{0j} + \Sigma\beta_k x_{ijk} + \Sigma\alpha_k z_{jk} + (\mu_{0j} + \varepsilon_{ij})$ (1)

Individual-level model: $Y_{ij} = \beta_{0j} + \Sigma\beta_k x_{ijk} + \varepsilon_{ij}$ (2)

Occupational-level model: $\beta_{0j} = \beta_0 + \Sigma\alpha_k z_{jk} + \mu_{0j}$ (3)

Where: Y_{ij} = log of the hourly wage of individual i in occupation j; x_{ijk} = kth explanatory variable at the individual level (the value of this variable varies between individuals i in occupation j); z_{jk} = kth explanatory variable at the occupational level (the value of this variable varies between occupations j while it is constant for individuals in occupation j); β_0 = 'overall' intercept (the 'basic' [log of the hourly] wage across occupation j); β_{0j} = intercept (the 'basic' [log of the hourly] wage in occupation j); β_k = effect of the kth individual-level explanatory variable on the log of the hourly wage of individual i in occupation j; α_k = effect of the kth occupational-level explanatory variable on β_{0j}; ε_{ij} = individual-level residual; μ_{0j} = occupational-level residual.

The assumptions of this model are discussed extensively by Bryk and Raudenbush (1992) and Snijders and Bosker (1999). The effects of individual-level variables can be interpreted as effects of individuals on wages, while the effects of occupational-level variables can be interpreted as effects on the 'basic' wage of individuals in an occupation who are equal with respect to the individual-level variables included as model controls. Because we centred the continuous individual-level variables (education, seniority, and age), we can interpret the estimate of β_0 as the 'basic' wage of the average individual across occupations. We can then easily calculate the 'basic' wage of this 'average' individual in occupation j (β_{0j}) by 'filling in' the occupational-level equation.

In our models we do not empirically address the matter of individuals being not only nested within occupations, but also within sectors and organizations. We do include sector and organization as individual-level controls, so that variation in wages between sectors and organizations is modelled at the individual level. We also estimated some cross-classified hierarchical linear models to test if including sector as a separate level would alter our findings in any way, but this was not the case.

Results

For illustrative purposes, we first give some examples of male- and female-dominated five-digit occupations for the Netherlands. Table 2 presents the top 10 male- and female-dominated five-digit occupations in our sample. The occupation with the highest share of women in our sample is nursery-school teacher. Another occupation with a very large share of women is medical receptionist (99 per cent female). Other female-dominated occupations are home-care workers, secretaries, home-care assistants, pharmaceutical assistants, medical secretaries, geriatric helpers, orderlies, and beauticians. In total, 12 per cent of our female respondents are employed in one of these 10 occupations.

In the top-10 male-dominated five-digit occupations in the right-hand panel of the same table, we see that practically none of the Dutch construction carpenters or road-workers are female. Only 1 percent of all construction works foremen or road construction engineers in our sample are female. In total, 6,133 male respondents are employed in these occupations, accounting for 8 per cent of the total male labour force.

Table 2. *Top 10 of female- and male-dominated five-digit occupations in our sample*

Female-dominated occupations			Male-dominated occupations		
Occupation	% women	% of fem. LF	Occupation	% men	% of male LF
Nursery school teacher	100	0.43	Const. carpenter	100	1.52
Medical receptionist	99	1.19	Road worker	100	0.56
Homecare worker	98	0.90	Bricklayer	99	0.91
Secretary	98	3.58	Sanitary installer	99	0.98
Homecare assistant	98	0.87	Shutter carpenter	99	1.06
Pharmaceutical assistant	97	0.65	Const. works foreman	99	0.43
Medical secretary	97	0.86	Road engineer	99	0.43
Geriatric helper	96	1.19	Welder	99	0.38
Orderly	95	1.92	Mech. eng. foreman	99	0.52
Beautician	94	0.81	Electrician	99	1.02
Total		12.40	Total		7.82

Source: Authors' calculations based on the Structure of Earnings Survey 1997.

In line with Bergmann's crowding hypothesis, we observe that a relatively large share of all women in our sample are employed in the top-10 of female-dominated occupations (12 per cent versus 8 per cent of the male respondents who are employed in the top-10 male-dominated occupations). This indicates that, compared to men, women in the Dutch labour market are concentrated in a relatively small segment of the labour market.

Hierarchical Linear Models

Table 3 presents the results of our hierarchical linear models. First, we estimate a basic model including only sex composition and sex as explanatory variables (Model 1). This model answers our first research question: do men and women earn lower wages if they are employed in a female-dominated instead of a male-dominated occupation? Models 2 through 7 provide tests of our hypotheses, allowing us to answer our second research question: why do women and men earn lower wages if they are employed in female-dominated instead of male-dominated occupations? Model 2 includes measures of quantity of human capital as well as other relevant individual-level controls, model 3 includes a measure of occupational crowding, Model 4 measures of occupational worth. Models 5 through 7 include occupational-level interactions to test whether returns to occupational worth differ between male- and female-dominated occupations. We do not estimate a full model including all occupational-level variables since this results in too many empty cells and thus unreliable estimates (remember that our occupational-level number of observations is 122).

The Occupational Gender Wage-gap in the Netherlands

Do men and women earn significantly lower wages if they work in a female-dominated occupation? As we can see in Model 1, the effect of being employed in a female-dominated occupation instead of a male-dominated occupation is negative and significant.[6]

$$\text{Overall model: } Y_{ij} = (3.38 + [0.05*\text{mixed-sex occ.}] - [0.09*\text{fem.-dom. occ.}]) - (0.16*\text{female})$$

$$\text{Individual level: } Y_{ij} = \beta_{0j} - (0.16*\text{female})$$

$$\text{Occupational level: } \beta_{0j} = 3.38 + (0.05*\text{mixed-sex occ.}) - (0.09*\text{fem.-dom. occ.})$$

Using this formula, one can calculate that men in female-dominated occupations generally earn €12.21 per hour, while men who work in male-dominated occupations generally earn €13.35. Women in male-dominated occupations earn €11.39 per hour (i.e. $\beta_0 - 0.16$ in the model), while women in female-dominated occupations generally earn only €10.40 (i.e. $\beta_0 - 0.09 - 0.16$). Thus men and women who work in female-dominated occupations earn 91 per cent of the wage of men and women who are employed in male-dominated occupations.

Table 3. *Results of multi-level analyses for both women and men, with the logarithm of the gross hourly wage (excluding overtime) as the dependent variable, for five-digit occupations,[a] N = 89,835*

	Model 1	Model 2[a]	Model 3[a]	Model 4[a]	Model 5[a]	Model 6[a]	Model 7[a]
Constant β_0	3.38**	3.44**	3.43**	3.56**	3.47**	3.44**	3.44**
Occupational-level variables							
<16% female[b]							
16–65% female	0.05	0.02	0.00	0.02	−0.01	0.03	0.02
>65% female	−0.09*	−0.07*	−0.11*	−0.02	−0.07*	−0.04∼	−0.07*
Occupational crowding			0.03				
Required education and skills				0.09**	0.17**		
Required responsibility				0.08**		0.18**	
Required effort				0.00			0.04
Occupational-level interactions							
Education+skills* mixed-sex occup.					−0.02		
Education+skills* female-dom. occup.					−0.10**		
Responsibility*mixed-sex occupation						−0.08∼	
Responsibility*female-dom. occup.						−0.12*	
Effort*mixed-sex occupation							0.10∼
Effort*female-dominated occupation							−0.01
Individual-level variables							
Male[b]							
Female	−0.16**	−0.10**	−0.10**	−0.10**	−0.10**	−0.10**	−0.10**
Education in years (centred)		0.02**	0.02**	0.02**	0.02**	0.02**	0.02**
Part-time work[b]							
Full-time work		0.02**	0.02**	0.02**	0.02**	0.02**	0.02**
Shift work[b]							
Regular services		−0.06**	−0.05**	−0.05**	−0.05**	−0.05**	−0.05**
Seniority in months (centred)		0.00**	0.00**	0.00**	0.00**	0.00**	0.00**
No supervision[b]							
Supervision		0.07**	0.07**	0.07**	0.07**	0.07**	0.07**
Age (centred)		0.01**	0.01**	0.01**	0.01**	0.01**	0.01**
Age^2		−0.00**	−0.00**	−0.00**	−0.00**	−0.00**	−0.00**
Corporate size (500 or less)[b]							
Corporate size (>500)		0.02**	0.02**	0.02**	0.02**	0.02**	0.02**
Variance components							
Occupational level	0.05**	0.02**	0.02**	0.02**	0.01**	0.01**	0.02**
Individual level	0.14**	0.10**	0.10**	0.10**	0.10**	0.10**	0.10**

[a]Coefficients for the 24 dummy variables for the industrial sector are not presented for convenience sake.
[b]Reference category.
**p < 0.01, *p < 0.05, ∼p < 0.10.
Source: Authors' calculations based on the Structure of Earnings Survey 1997.

Human-capital Theory

Human-capital theory argues that the wage penalty associated with working in a female-dominated instead of a male-dominated occupation is due to differences in the stock of human-capital between workers in male- and female-dominated occupations (i.e. a composition effect). To test this

hypothesis, Model 2 also includes relevant human-capital variables.

Again, Model 2 shows that wages of both men and women are significantly lower in female-dominated than in male-dominated occupations. Although all human-capital variables have the expected effect on wages (the more human capital, the higher the wage), the wage penalty for being employed in a female-dominated occupation is -0.07 and significant (it was -0.09 in model 1). Differences in the human capital composition of occupations account for approximately one-fifth of the original negative effect on one's wage of working in a female-dominated occupation. That is, because the workers in female-dominated occupations generally possess less human capital than the workers in male-dominated occupations, wages in these occupations are also lower. This only partially confirms the human-capital hypothesis. Nonetheless, we still observe a significant wage penalty for working in a female-dominated occupation after including relevant human-capital controls.

The Crowding Hypothesis

According to the crowding hypothesis, the wages of men and women are lower if they work in female-dominated occupations because these occupations are crowded by women. Model 3 tests this hypothesis. The results show that the concentration of women in a restricted number of occupations does not affect wages. Two explanations might account for the absence of crowding effects on wages in the Netherlands. First, female-dominated fields, like healthcare and education, are particularly characterized by (large and persistent) labour shortages in the current Dutch labour market (SZW, 2001). Secondly, centralized wage bargaining in the Netherlands might result in a smaller influence of market forces on wages compared to, for instance, the United States or the United Kingdom. Social partners (organizations of employers and workers) have the primary responsibility for wage-setting in the Netherlands, and even though this does not eliminate the influence of (excess) labour supply on wages, it probably does limit the influence of crowding on wages.

Differences in Worth or Gender Bias?

Model 4 includes measures of occupational worth, i.e. the required education and skills, effort, and responsibility, to test whether men's and women's wages are higher in male-dominated rather than female-dominated occupations because these occupations are of higher worth. This model tells us that wages are significantly higher in occupations that require more education, skills, and responsibility. The amount of required effort, consisting of both mental and physical effort, does not appear to have any effect on wages. That is, occupational differences in effort do not seem to account for any of the observed between-occupation variance in wages.

But what happens to the effect of occupational sex composition after the inclusion of our measures for occupational worth? Can differences in occupational worth explain wage differences between men and women who are employed in either male- or female-dominated occupations? The answer is affirmative: indeed, the original negative effect of working in a female-dominated occupation on wages disappeared. These results confirm the hypothesis that differences in occupational worth account for (part of) the occupational gender wage-gap. However, Model 4 might obscure part of the undervaluation of female labour since our measures of worth might be gender-biased as well. In addition, the model assumes that the returns to occupational worth are the same for male- and female-dominated occupations, while this is not true according to the gender bias hypothesis. To test this assumption, Models 5 through 7 include interaction effects between worth and sex composition.

Model 5 tells us that the returns to education and skills are significantly lower in female-dominated than in male-dominated occupations. Model 6 shows that the returns to required responsibility are also significantly smaller in female-dominated than in male-dominated occupations. This corroborates the findings of Kraaykamp and Kalmijn (1997) that, in the Netherlands, supervision pays off for men but not for women. We can extend their conclusion with the observation that supervision pays off for men and women in male-dominated occupations but not for both in female-dominated occupations.

In Model 7 we see that required effort does not seem to explain much of the variation in wages between occupations, but does seem to explain variance in wages between mixed-sex occupations: wages of men and women are significantly higher in mixed-sex occupations that require much effort than in those requiring little effort. This underlines the special position of mixed-sex occupations, that often include both male- and female-dominated fields.

In sum, the occupational gender wage-gap is especially large for male- and female-dominated occupations of high worth, i.e. occupations that require relatively high levels of education, skill, and responsibility. Returns to occupational worth are low for men and women who work in female-dominated occupations. This strongly indicates that female labour is undervalued in the Netherlands.

Conclusion and Discussion

Because of the relevance of occupational contexts for wages of men and women, this study examined to what extent men and women earn lower wages if they work in female-dominated instead of male-dominated contexts in the Netherlands. Using multi-level analysis techniques, we estimated the context effect of the sex composition of detailed five-digit occupations on hourly wages. Our results show that both men and women experience a wage penalty if they work in female-dominated instead of male-dominated occupations.

Even though this study reveals an occupational gender wage-gap in the Netherlands, the effects of working in a female-dominated occupation we found is smaller than those consistently found in the United States (e.g. England, 1992). We believe that the main explanation for this difference is that in the Netherlands, compared to the United States, wages are compressed at the bottom (Blau, 1996). Because levels of (occupational) wage inequality are much smaller in the Netherlands than in the United States, the effect of occupational sex composition on wages one finds is also (much) smaller. Besides, the relatively good jobs in the Dutch labour market for women who work part-time (who constitute the majority of working women in the Netherlands) might also result in a smaller occupational gender

wage-gap compared to other countries (as is the case with the United Kingdom, where female part-timers are often employed in poorly-paying jobs; Elliot *et al.*, 2001).

Based on our results, the human-capital hypothesis is partly confirmed. Differences in the stock of human capital between workers in male- and female-dominated occupations explain part of the original wage penalty found for being employed in female-dominated contexts. Nonetheless, differences in the type of human capital do not account for the total occupational gender wage-gap.

We did not find support for the crowding hypothesis either, which assumes that wages are lower in female-dominated fields because the supply of labour is artificially high. This is probably due to the current tight Dutch labour market. In particular, female-dominated fields like healthcare and education are characterized by (large) labour shortages. Since especially female-dominated occupations face problems finding enough personnel, one would expect (contrary to our findings) wages to be (significantly) higher in such occupations. Thus, even though wages in female-dominated occupations might be sensitive to excess labour supply (which lowers wages), they do not seem to increase in response to (large) labour shortages. This indicates more specifically that female-dominated occupations are undervalued relative to their actual productive contribution.

Even though, at first sight, differences in occupational worth seem to account for the wage penalty associated with working in female-dominated occupations, our analyses show that the returns to occupational worth are significantly lower in female-dominated occupations – i.e. the wage penalty for being employed in a female-dominated occupation is especially large for men and women who are employed in occupations that require high levels of education, skill, and responsibility. Again, this strongly indicates the impact of gender on the Dutch wage structure.

The different returns to occupational worth for male- and female-dominated occupations are probably due to the practice of job evaluation systems in the Netherlands. At several points in time, the objectivity of these job evaluation systems has been questioned (De Bruijn, 1996; Van Doorne-Huiskes, Van Beek, De Ruijter, Schippers, and Veldman,

2001). First, typically female skills, like social or communicative aptitudes, are often absent from job evaluation systems. If they are included, they have a relatively lower weight in the overall evaluation of jobs than male skills (like supervisory or technical competencies). Additionally, several Dutch organizations use different job evaluation systems to value either male jobs in management or subordinate female jobs, which results in a sharp contrast between the evaluation of male and female jobs within the same organization. Moreover, male and female jobs that are evaluated using the same system are often divided into different groups of jobs, where comparisons between jobs in different groups is not allowed.

Our study indicates the importance of looking across the boundaries of specific evaluation systems, and across the boundaries of groups of jobs within the same job evaluation system. Unless this is done, female-dominated occupations will continue to be undervalued relative to male-dominated occupations.

Notes

1. The context effect refers to the purely contextual effect of sex composition on wages: all individuals earn lower wages if they work in female-dominated occupations. The composition refers to the influence of individual-level characteristics on wages (for example, because individual women earn lower wages than individual men, and because more women than men are employed in female-dominated occupations, wages are also lower in these occupations).
2. Please note that Kanter's hypothesis entails that negative consequences of being a minority member arise if this minority is small enough.
3. The reader should note that our definition of female-dominated, mixed-sex, and male-dominated occupations depends entirely on the numerical composition of these occupations. This distinguishes our definition from sex-typing of occupations based on occupational content. For instance, one might say that female occupations are those requiring social and nurturing skills. However, these definitions are gendered themselves, i.e. based on stereotypes about men's and women's appropriate 'roles'. Besides, gender is analytically distinct from sex. While gender is an interpretation of the social roles associated with the sexes, sex is a biological constant. For example,

female-dominated occupations do not necessarily require typically female skills. Nonetheless, the gendered valuation of labour might be important in explaining why wages are generally lower in occupations that are numerically dominated by women.

4. It was a condition of Statistics Netherlands to exclude occupations with too few incumbents from the analyses. Specifically, they required that we exclude occupations with less than 300 incumbents. We did perform analyses including measures of gender composition for all five-digit occupations as a check for whether the selection of occupations with more than 300 incumbents was representative, and the results were very similar (even though levels of significance were, as one can might with a superior number of occupations, higher).
5. Even though using age as a single proxy would result in an overestimation of the experience of women, given that a relatively large number of women either work part-time or interrupt their careers.
6. Additional models were estimated including other measures of occupational sex composition, e.g. a continuous measure and a categorical variable, that indicate that our results are robust: there is a significant wage penalty for being employed in a female-dominated occupation that is found using varying measures of occupational sex composition (for example, continuous and categorical measures of sex composition as well as dummies that use more or less stringent definitions of which occupations are male- or female-dominated).

Acknowledgements

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Appendix A

Occupational Worth Measures and Computation of Reliabilities

Because of the well-known difficulties associated with asking occupational incumbents to rate their own occupations in terms of requisite skills, level of responsibility, and effort, we use ratings based on the evaluations of 147 expert judges (job evaluators, vocational advisors, and social scientists). These experts were asked to judge 500 occupations, which were randomly selected from the population of 1,211 five-digit occupations that make up the standard occupational classification in the Netherlands. For each of the 500 occupations, a card was created that contained the occupational title and a short task description (also taken from the Dutch standard occupational classification). Twenty of these cards were given to each expert, who was asked to complete a short, written questionnaire which addressed the eleven component items that were used to construct the three measures of occupational worth. These are listed below:

Dimension #1: Levels/Amount of Education and Skills required
1. Level of education
2. On-the-job training
3. Cognitive skills
4. Social skills
5. Physical skills

Dimension #2: Responsibility
1. Number of subordinates supervised
2. How often worker plans the activities of others
3. Severity of financial consequences for poor job performance
4. Severity of organizational consequences for poor job performance

Dimension #3: Effort
1. Amount of physical energy devoted to work
2. Amount of mental energy devoted to work

The 147 experts judged 500 occupations along these dimensions. Because every expert judged 20 occupations, there were 2,940 possible judgements. Thirty-four cards were left blank, though, bringing the total number of ratings to 2,906 (indicating that 99 per cent of the cards were rated). To determine how consistent the judgements of the different experts are, the following random-effect model was estimated for all eleven different aspects of occupational worth:

$$Y_{ij} = a_i + b_j + e_{ij}$$

Where: Y_{ij} = judgement of occupation i by judge j; a_i = random effect of occupation I; b_j = random effect of judge j; e_{ij} = the sum of the residual and the occupation × judge interaction.

This model relates the scores on the different aspects of occupational worth (Y) to the variance in scores between both occupations and judges (these are expressed by the random effects of occupation and judge). Since each expert judged 20 occupations, there is dependence between the variances. This is expressed by the interaction between occupation and judge. The interaction represents variability in the ordering of occupations between the judges. It follows that the reliability can be computed from:

$$\text{var}(a_i):$$
$$\alpha_{ij} = \text{var}(a_i) + \{\text{var}(e_{ij})/n_i\}$$

Where: n_i = the average number of judges of occupation I.

This formula relates the variance in scores between occupations to the variance in scores of occupations between judges. The smaller the variance in scores between judges is relative to the variance in scores between occupations, the degree of agreement between the experts on the rating of occupations and the higher the resulting reliability estimate. This value can range between 0 (lowest reliability) and 1 (highest reliability). The results (which are reported in detail by De Ruijter, 2001) indicate that all the reliabilities for the eleven component items fall between 0.70 and 0.90, suggesting that they are highly reliable measures. The full set of results is available from the authors upon request.

Appendix B

The 25 Industrial Sectors from the Classification of Statistics Netherlands

1. Agriculture and fishing
2. Mineral extraction
3. Remainder industry
4. Food industry
5. Graphical industry
6. Oil and chemicals
7. Metals and electromechanics
8. Energy and water companies
9. Construction
10. Car industry and repairs
11. Wholesale trade
12. Retail trade
13. Hotel and catering
14. Public transportation and road transport
15. Remainder transport and communication
16. Financial institutions
17. Remainder business services
18. Temporary employment agencies
19. Cleaning companies
20. Public administration
21. Education
22. Remainder healthcare and welfare industry
23. Hospitals
24. Nursing homes and homes for the elderly
25. Culture and other services (reference category)

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