# The Impact of Occupational Sex-Segregation on Wages: Evidence from Britain[1]

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## Abstract

*Research has consistently demonstrated a negative and significant relationship between occupational feminization and wages. Pay differences between male- and female-dominated occupations have traditionally been attributed to societal mechanisms that have historically undervalued the work mainly performed by women. More recently, empirical evidence from the US and Europe has supported human capital theories based on skill specialization. I examine whether lower wages in female-dominated occupations in Britain can be explained by differences in specialized human capital, allowing for other potentially mediating factors. Results from base models suggest a strong and negative relationship between occupational feminization and wages. The inclusion of unobservables and measures of specialized human capital reduces but fails to eliminate the observed wage penalties.*

## Introduction

The gender pay-gap is one of the most enduring features of the labour market. Although there has been extensive research on gender inequality in the work context since the early 1970s, scholars are far from achieving consensus about what mechanisms create and perpetuate it. In this article, panel data and panel data methods are used to examine the impact of the sex-composition of occupations on the wages of men and women and to test the importance of different theories in explaining these.[2]

There is far-reaching research documenting extensive and pervasive distributional inequality in respect to occupation within modern labour markets and also about the impact such segregation has on wages (Treiman and Hartmann, 1981; England et al, 1988; Sorensen, 1989; Groshen, 1991; Kilbourne et al, 1994; Macpherson and Hirsh, 1995; Tomaskovic-Devey, 1995; Cotter et al, 1997; Olsen and Walby, 2004; Magnusson, 2009). The wage effects of occupational sex-segregation are typically investigated by including the proportion of workers in an occupation who are women in a wage-equation. The sign and magnitude of the coefficient are interpreted as the impact of the gender-composition of an occupation on wages. Following this approach, there has been a general agreement in sociology and economics that working in an occupation in which a large proportion of workers are women incurs a wage penalty.

While the long-standing and well-established devaluation hypothesis maintains that work in female-dominated occupations is undervalued as a result of institutionalized bias against women (England, 1992; Kilbourne et al, 1994; England et al, 2007), recent research proposes that occupational sex-segregation does not directly affect wages, but that this association is caused by the lack of specialization of work in female-dominated occupations (Tam, 1997; Tomaskovic-Devey and Skaggs, 2002; Polavieja, 2007, 2008a, 2009).

This article has three aims. First, I provide a detailed examination of the relationship between occupational sex-segregation and wages in Britain using panel data. Second, I examine the role of specialized human capital in explaining the association between occupational feminization and wages, which has yet to be explored using British data. I use Tam (1997) to define specialized human capital, which refers to workers´ investments in human capital which are position-specific and which have little or no value outside a given work setting (e.g. an employee´s job, industry or occupation). Third, I use models that allow for individual-specific unobserved heterogeneity which potentially bias results from previous studies.

## The impact of occupational feminization on wages

Many studies examine the extent to which occupational sex-composition affects wages. Estimates from different studies are, however, only partially comparable as they vary across datasets, years, units of analysis (i.e. individuals or occupations), model specifications, estimation methods and measures of occupational sex-composition.

Commonly, the empirical literature illustrates the impact of occupational feminization on wages by reporting the expected difference in wages between two identical workers who are employed in a hypothetical fully male-dominated occupation and a hypothetical fully female-dominated occupation respectively. Previous studies spread evenly across time and focus primarily on the US. Most analyses use cross-sectional regression methods and census data, and the unit of analysis is more often individuals rather than occupations.

The common finding from US studies is that occupational feminization affects the wages of men and women negatively. Men working in fully female-dominated occupations have wages which are between 7% (England et al, 1988) and 26% (Cotter et al, 1997) lower relative to working in fully male-dominated occupations, while the effects range between 4% (Gerhart and El Cheikh, 1991) and 42% (US Bureau of the Census, 1987) for women. The classic exception is Filer (1989) who finds positive returns to occupational feminization in his fully specified model. However, his study has been heavily criticised for the use of a large number of explanatory variables (over 220), as collinearity may obscure the real effect of occupational feminization on wages.

## Theories of Occupational Sex-Segregation and the Gender Pay-Gap

There are a number of theories to explain occupational sex-segregation, its effect on wages and its contribution to the gender pay-gap. I discuss (and later test) the devaluation and human capital hypotheses.

*Cultural Explanations*

The unequal distribution of power between sexes in most spheres of social life is a reality that has for long been apparent to sociologists. Virtually all human societies can be considered to follow 'patriarchal' principles, where patriarchy is defined as *"a system of interrelated structures through which men exploit women"* with key sets of relations in market and non-market work, the state, male violence and sexuality (Walby, 1986, p.51-52).

Cultural explanations for occupational sex-segregation and the gender pay-gap propose that ideology and tradition mediate the social construction of the value of work (Magnusson, 2009). Given the male-centred order of society, sex-bias favouring men operates in the labour market and higher subjective value is attributed to skills, jobs or occupations in which men predominate, even when these exhibit objective worth comparable to that of those predominantly 'female' (England et al, 1994). The undervaluation of job tasks when these are performed by women has also been demonstrated in experimental research (classic examples being Bose and Rossi, 1983 and Major et al, 1984).

Building on this literature, the devaluation hypothesis offers a simple explanation for why male-dominated occupations receive higher wages than female-dominated occupations. Women's work is devalued by social structures, which translates into differential treatment in the wage-setting process. As Maume puts it, discrimination does not take place against individuals *"but against a category of jobs defined by the demographic traits of their incumbents"* (Maume, 1999, p.1436). Thus, unequal treatment is *"not so much of the gender of workers but of gendered jobs"* (Joshi and Paci, 1998).

*Human Capital Theories*

Human capital (HC) is the stock of knowledge and skills accumulated by an individual and acquired through education, training and experience. According to HC theories, gender differences in participation and wages are the result of gender-specific preferences regarding labour market investments and in the allocation of resources between the household and the workplace.

Becker's work effort/rational choice theory (1957, 1981, 1985, 1991) applies a utility-maximising standpoint to specialization in the household suggesting that if men expect to receive higher pay in the market than women, men will decide to work and women to stay at home. If women expect to spend less time in the labour market, they allocate fewer resources to their education, job-related training and duties at work than men and instead invest their efforts in family and household-related activities. Mincer and Polachek (1974) and Polachek, (1976, 1979, 1981) suggest that women are more likely than men to interrupt their work and careers due to family responsibilities. Intermittent employment leads to less labour market experience, forgone training and skill atrophy or depreciation. Both theories suggest that to maximise their lifetime earnings women may choose to work in positions and sectors of the economy in which work arrangements are more flexible, starting wages are highest, depreciation rates are lowest and wages are less dependent on experience, but which offer comparatively lower wages in the long run. Therefore, women become concentrated in a narrow range of occupations that offer such benefits and this explains the observed patterns of occupational sex-segregation and wage differences.

Tam (1997) introduced the concept of specialized human capital (SHC). Unlike general HC, investments in SHC are occupation-, industry- or firm-specific and have little or no value outside such settings. Highly specialized jobs are risky for both the employer (who bears additional training costs) and the employee (who forgoes the possibility to apply the obtained skills in other job contexts). To prevent highly specialized workers from leaving their jobs, firms may offer long-term contracts with upward sloping wage-tenure profiles (Polavieja, 2007). So at high levels of tenure employees in highly specialized jobs receive wages which

are comparatively higher than those offered by other jobs. Therefore, both workers and employers have incentives to maintain the employment relationship. The expectation of career breaks and the higher opportunity costs of training due to the unequal distribution of non-market work lead women to avoid jobs that require larger amounts of SHC. As a result, pay differences attributed to occupational sex-segregation may actually be due to differences in levels of specialization between occupations.

Consistent with this, Tam (1997), Tomaskovic-Devey and Skaggs (2002) and Polavieja (2007, 2008a, 2009) have shown that introducing SHC into a wage equation reduces the negative effects of occupational feminization on wages in the US, Spain and a pooled group of European countries. Estimates of the impact of occupational sex-segregation on wages range between 0.2% and 6%, and are never statistically significant. However, these analyses rely on cross-sectional data, often employ unreliable measures of occupational sex-segregation and SHC and have never focused on the British labour market.

The remainder of the chapter identifies the impact of occupational feminization on wages in Britain and explores the extent to which this is accounted for by the SHC hypothesis, also controlling for observable and unobservable confounding factors.

## Data and methods

*Datasets and Sample*

The analyses use data from three different nationally representative datasets (the British Household Panel Survey (BHPS), the Labour Force Survey (LFS) and the Skills Survey 2006) and are based on a sample of British resident employees of working age (men aged 18 to 64 and women aged 18 to 59). Those in full-time education are excluded because their choice of occupation is likely to be tied to their studies and unlikely to be final. Seventeen waves of the BHPS covering the period 1991-2007 are used. The resultant sample size is 8,326 individuals (3,968 men and 4,358 women) and 55,806 person-year observations (26,363 for men and 29,443 for women). The LFS is used to construct occupation-level variables that are then matched to individuals in the BHPS by their SOC90/SOC2000 occupational code and year. In particular, the proportion of females in each three-/four-digit occupation is calculated for each year using LFS data.[3] The main advantage of the LFS is its large sample size, which allows for more accurate measurement of occupational feminization than the BHPS. The Skills Survey (2006) is used to derive a measure of SHC at the three-digit occupational level using SOC2000.

*Model Specification*

The dependent variable in the analyses is the natural log of gross hourly wages, deflated to 2007 prices using Consumer Price Indices reported by the ONS. The resultant average wages are £12.33 for men, £9.53 for women and £10.85 for the whole sample. The key explanatory variable is the proportion of females in an individual's occupation. In addition, all models control for year, region of residence, age, marital status, highest educational qualification, establishment size, permanent job, private sector job, part-time work, hours of work, job tenure and industry.

*Model Estimation*

The models include a wide range of individual and job-related characteristics to help identify accurately the impact of occupational feminization on wages. Despite this there may also be unobserved (or unobservable) individual-specific characteristics which influence wages. Such individual unobserved heterogeneity, if not suitably allowed for, can bias the coefficients of interest. This is important, since individuals may possess different unmeasured productivity-related factors that affect their wages. Personal tastes, preferences or psychological traits may also shape individuals' decisions when choosing an occupation, industry or firm to work in. Also, firms in particular occupations may base their hiring decisions on factors such as perceived ability or commitment, which are difficult to capture in survey data. Panel data allows controlling for unobserved time-invariant individual-specific effects.

Within the context of this article the model to be estimated can be written as:

$$\log(WAGE_{it}) = FEM_{it}\beta + X_{it}'\delta' + Z_i'\theta' + v_{it} \qquad \textbf{(1)}$$

where i and t subscripts designate individual and time respectively; log(WAGE) represents logged hourly wages; FEM is an indicator of the proportion of females in each respondent's occupation; X' is a vector of observable time-varying individual-, job-, establishment- and occupation-level variables; Z' is a vector of observable time-invariant characteristics; and $\beta$, $\delta$', and $\theta$' are coefficients of interest. The error term $v_{it}$ can be decomposed in the following way:

$$v_{it} = \upsilon_i + \varepsilon_{it} \qquad \textbf{(2)}$$

where $\upsilon_i$ represents individual-specific time-constant unobservable effects; and $\varepsilon_{it}$ is a stochastic error term.

Estimating (1) using Ordinary Least Squares (OLS) ignores any time-invariant individual-specific characteristics ($\upsilon$) which, if correlated with the observables (FEM, Z & X), will produce biased results. Within-group fixed effects (FE) models are estimated by taking deviations from individual-specific means over time in both dependent and explanatory variables. This removes the effect of unobserved time-invariant characteristics ($\upsilon$) and allows for arbitrary correlation between observables and unobservables. However, the observed time-invariant covariates (Z) drop out of the equation too, and their effects on the dependent variable cannot be directly estimated. The model to be estimated becomes:

$$\log(WAGE)_{it} - \overline{\log(WAGE)}_i = (FEM_{it} - \overline{FEM}_i)\beta + (X_{it}' - \overline{X}'_i)\,\delta' + (\varepsilon_{it} - \bar{\varepsilon}_i) \qquad \textbf{(3)}$$

FE regression is employed as a complement to OLS regression to evaluate the extent to which the relationship between occupational feminization and wages is robust to controlling for unobserved individual heterogeneity. This is something that previous literature has not investigated.

## The Impact of Occupational Feminization on Wages

Model 1 in Tables 1 to 4 presents estimates for men and women from base models that include the control variables only.

Tables 1 and 2 provide estimates from OLS models. The $R^2$ statistic is .434 for men and .436 for women, indicating that observables explain around 44% of the total variance of wages. The coefficients on occupational feminization yield estimates of –0.171 and –0.321 for men and women respectively. These are statistically different from zero and indicate that working in a completely female-dominated occupation is associated with wages 17% and 32% lower than working in a completely male-dominated occupation. Since average wages in the sample are £12.33 for men and £9.53 for women, this is equivalent to £2.11 per hour for men and £3.06 per hour for women. Thus, occupational feminization is not only negatively associated with wages but its effects are also more harmful for women. The female dummy in a pooled model (not reported) indicates that women earn 13.4% lower wages than otherwise similar men. This suggests that on average women earn about £1.42 per hour less than men, everything else being equal.

Estimates from the base FE models (Tables 3 and 4) are consistent with those obtained from OLS, while the within $R^2$ falls to .299 and .218 for men and women respectively. However, once unobserved heterogeneity is allowed for, the wage penalties associated with female-dominated occupations are considerably lower. Moving from a fully male-dominated occupation to a fully female-dominated occupation is associated with wages 12.8% (£1.58) and 16.7% (£1.60) lower for men and women respectively. This suggests that unobserved characteristics of individuals (e.g. ability, motivation or taste) play an important role in allocating workers within the occupational feminization distribution. Workers with unmeasured characteristics positively associated with wages are more often men and tend to work in more male-dominated occupations.

## Introducing Potential Mediating Factors

The following section examines the extent to which variables measuring SHC, socialization and domestic labour supply, authority at the workplace and compensating differentials mediate the impact of occupational sex-segregation on wages. This is done using nested models in a model-building framework as in Tam (1997), Tomaskovic-Devey and Skaggs (2002) and Polavieja (2007, 2008a, 2009). Subsets of variables are added to the base model in a stepwise approach, which allows the impact of each set of covariates on the relationship between occupational feminization and wages to be assessed. I first describe the variables relevant to each of the theories.[4]

*SHC variables*

There are a number of ways to capture SHC using available data, and five different approaches are used here. The first is to include a variable indicating whether or not the individual received any on-the-job training in the year before the interview, which is collected annually in the BHPS (see also Polavieja, 2008b). However, this is a relatively weak measure of SHC, given that it is individual-specific and may depend on career position. The second

approach uses the proportion of workers in each occupation that undertook education or training connected with the present or future job in the last four weeks. This information is available in the LFS for 1992-1994 and 1997-2007. The modal time spent in such training is also included. A third alternative, following Polavieja (2005), is a condensed version of the Eriksson, Goldthorpe and Portocarero class schema (EGP) which is derived from BHPS data.[5] The fourth way aggregates SOC90 and SOC2000 into major skill groups, following Elias and McKnight (2001). Although, this reflects skill levels rather than skill specialization, distinguishing between the two is difficult. Four major skill levels can be identified.[6] The final measure of SHC comes from the Skills Survey 2006, in which employees were asked to quantify the importance of certain tasks and skills for their jobs on a scale from zero (not important at all) to four (essential). One question relates to their 'specialist knowledge or understanding'. The mean response to this question by occupation is matched to respondents in the BHPS.[7]

*Other controls*

The models specified in Tam (1997) lack a number of controls which are important in studies of gender inequality in the labour market, since these characteristics are differently distributed across sexes and may explain part of the effect of occupational sex-segregation on wages. I add a richer set of controls in the fully specified model for an even more parsimonious test of the hypotheses. In this way, model 3 controls for the effects of domestic labour supply and socialization by including the number of self-reported hours each respondent dedicates to housework per week, a variable identifying whether or not the respondent is responsible for caring for a sick or elderly person, a variable which identifies parents of children aged less than 11 who report doing most of the childcare and a composite index which captures attitudes towards the roles of men and women in society and the labour market (see also Swaffield, 2000). A set of variables constructed from the BHPS to measure an individual's managerial duties were also added. The different categories identify people who have managerial duties in a managerial occupation, managerial duties in a non-managerial occupation (e.g. a head nurse of a particular hospital section or a school headmaster), non-managerial duties in a managerial occupation (e.g. a senior officer without direct influence over others) and no managerial duties in a non-managerial occupation. Finally, a set of variables connected to the compensating differentials hypothesis is included. These are the average injury rate per 10,000 workers in the three-digit occupation obtained from the LFS, the number of unpaid overtime hours per week, the number of minutes spent travelling to work (one-way journey) and whether or not the respondent works shifts or unsociable hours.

## Results

This section presents results from models that add variables to the base OLS and FE equations to identify the extent to which they explain or mediate the relationship between occupational feminization and wages. Models 2a to 2e include different measures of SHC. A final model adds variables related to socialization, domestic-supply, workplace authority and compensating differentials theories. Models 1 to 2e, in which the additional variables are time-varying, are then re-estimated using FE. If the negative effect of occupational feminization on wages is explained or mediated by these various theories, then adding additional variables to the specifications will move the estimated coefficient on the

feminization indicator towards zero.

***OLS analysis***

Tables 1 and 2 summarise the results of OLS models for men and women. As a benchmark, the estimated coefficients on the occupational feminization term in the base models (model 1) are –0.171 for men, –0.321 for women and –0.253 for the whole sample (not reported). The estimated $R^2$ in the new models ranges between .43 and .57.

*Specialized human capital models*

Model 2a adds the first SHC control, whether or not the respondent received any on-the-job training in the past 12 months. Results show that, as predicted by SHC theories, training has a positive and significant effect, increasing wages by 4.3% for men and by 6.4% for women. However, including this variable does not reduce the negative and statistically significant effect of occupational feminization on wages, the coefficient on which remains almost unchanged from the base models.

Model 2b includes the proportion of workers in the three-digit occupation having received on-the-job training in the past 12 months and the modal length of such training. The proportion of trainees in an occupation has a large positive effect on wages for both sexes. A ten percentage-point increase in the proportion of workers is associated with 20% higher wages, the effect being larger for women than for men. Individuals in occupations in which the modal duration of training is less than a week have significantly higher wages than those in occupations with longer modal training periods.[8] Surprisingly, including these variables increases the penalty associated with working in female-dominated occupations. The estimated coefficients are now –0.233 and –0.366 for men and women respectively.

Model 2c includes the condensed version of the EGP classification. For both sexes the degree of specialization is statistically significant and positively associated with wages. Being in the highest specialization group is associated with a wage premium of 44% for women and 36.4% for men relative to being in the lowest specialization group. For men, including this specialization measure actually increases the importance of occupational feminization – the estimated coefficient becomes –0.245. For women, it becomes less negative (–0.137). Therefore, it seems that women are indeed sorted into different occupations in light of their SHC levels and that this explains part of the wage penalty associated with working in a female-dominated occupation. But why does the impact differ by sex? Two factors are important here: (a) how men and women are distributed across specialization groups and, (b) where specialization groups fall within the occupational distribution. The explanation may be that more specialized occupations are on average more integrated than other occupations for either sex. This can be seen as a mean reversal effect: for men, working in a highly-specialized occupation means moving to more feminized occupations than the average while the opposite holds true for women. If specialization is always correlated with higher wages, this may explain the diverging effects observed in these models.

Model 2d introduces variables denoting skill requirements of occupations. The results highlight the pecuniary advantages of working in more skilled occupations. Respondents working in occupations requiring higher levels of skill earn considerably more than respondents in those requiring the lowest skill levels. Women gain relatively more than men

from working in skilled occupations at any level of skill and this difference increases with skill levels – the estimated coefficients are larger for women than men, and the differences are largest at the highest skill levels. More importantly, the introduction of these SHC indicators reduces the negative effect of occupational feminization on wages more than any other set of controls. The coefficient is now –0.094 for men. For women, the coefficient falls to –0.044 and is only significant at the 10% level. Thus, a full switch from 0 to 1 in occupational feminization has a wage penalty of 9.4% for men and 4.4% for women.

Model 2e uses a measure of specialization derived from the Skills Survey 2006. As with other SHC controls, wages increase with average self-reported levels of specialization. In a 5-point scale, an increase in one level of specialization is associated with a wage premium of 29.8% for men and 34.5% for women at sample means. Including this variable also mediates the negative effect of feminization, although its impact is still negative and highly significant. The estimated coefficients are now –0.102 for men and –0.204 for women.

Therefore, these results suggest that some of the impact of occupational feminization on wages can be explained by SHC, and that the extent of this mediating effect varies with the measure of SHC used.

*Fully specified model*

In model 3 covariates on compensating differentials, socialization and workplace authority are included together with the SHC measure from model 2d.[9] The latter is preferred over other SHC measures, as it had the largest impact on the effect of occupational feminization on wages. The coefficients on SHC remain virtually unchanged in this specification. The key result is that, when including all controls, there is still a wage penalty associated with occupational feminization. The estimated coefficients become considerably less negative in all specifications from –0.171 to –0.126 for men and from –0.321 to –0.084 for women.

Therefore, the main finding from OLS models is that the negative impact of occupational feminization on wages cannot be completely explained by observable mediating factors. The wage penalty associated with moving from a completely male-dominated to a completely female-dominated occupation ranges from 9.4% to 23.3% for men and from 4.4% to 32.2%. The inclusion of controls related to SHC and other theories tends to reduce this penalty. SHC is found to have a positive and statistically significant impact on wages for both men and women.

Even when using the most conservative estimates to compare these results to those reported in previous literature, differences are apparent. Once SHC is accounted for, Polavieja (2007, 2008a, 2009) finds evidence that moving from a fully male to a fully female occupation reduces wages by between 1% to 3.1% in Europe and by 6% in Spain. Tomaskovic-Devey and Skaggs (2002) report a comparable figure of 6% in their US study. Tam (1997), using US data finds that moving from a completely male-dominated to a completely female-dominated occupation is associated with a wage penalty of 0.2% and 0.7% for men and women respectively when including SHC controls. None of the effects in these studies were statistically different from zero. These disparities in results may be the product of structural differences in the mechanisms which link workers to wages in Britain and other countries; of a downward bias in the estimates from previous studies due to the use of less elaborated

measures of occupational feminization and/or of differences in the operationalization of SHC.

***Fixed effects analysis***

Results from FE models are presented in Tables 3 and 4. In these models the within $R^2$ ranges between .134 and .311.

In the base model wages for men fell with occupational feminization with an estimated coefficient of –0.128. The addition of the SHC measures in models 2d and 2e reduces the impact of occupational feminization on wages, with estimated coefficients of –0.087 and –0.091 respectively. Compared to the OLS specifications, the wage returns to SHC diminish and even disappear, suggesting that unobservables are important in allocating workers to different training schemes and influencing their SHC accumulation. In other words, more motivated and able workers have both higher wages and higher levels of SHC.

As for men, SHC has a smaller effect on the wages of women in the FE specifications than in OLS. However, some differences by sex emerge. First, receiving on-the-job training in the past 12 months attracts a wage premium of 1.4% for women while it has no effect for men. The larger impact of SHC on wages for women than men also emerges in models 2c, 2d and 2e. Also, more of the SHC controls affect the negative impact of sex-composition on wages in FE models for women than men. For women, the estimated coefficients on occupational feminization in models 2c, 2d and 2e (–0.098, –0.066 and –0.102) are considerably less negative than in the base model (–0.167). Therefore, SHC reduces the negative effect of occupational feminization on the wages of women in the FE models, although this remains statistically significant.

Overall, findings from FE models are consistent with those from OLS specifications. The inclusion of SHC reduces the impact of occupational feminization on wages relative to the base model, but the coefficients on occupational feminization remain negative, large and statistically significant. Controlling for unobserved heterogeneity also reduces the effects of SHC on wages. This suggests that more able or motivated workers tend to have higher levels of SHC and also tend to work in better-paid male-dominated occupations.

## Discussion and Conclusion

The aim of this paper was to estimate the effect of occupational sex-segregation on wages in Britain and to evaluate the role of specialized human capital in explaining this. Previous work on the US, Spain and Europe has shown that the long-established negative association between occupational feminization and wages can largely be explained by SHC (Tam, 1997; Tomaskovic-Devey and Skaggs, 2002; Polavieja, 2007, 2008a, 2009). This casts doubts over the devaluation thesis, which interprets the negative association between feminization and wages as the result of a process of societal undervaluation of the work traditionally performed by women.

The base estimates indicate a strong negative relationship between occupational feminization and wages. Moving from a completely male-dominated to a completely female-dominated occupation is associated with wage penalties of 17% and a 32% for men and women respectively in base OLS models. The estimated penalties are lower in FE models (13% and

17% respectively), suggesting that unobservables play an important part in allocating workers to occupations in relation to their sex-composition.

Having established that a wage penalty exists for working in female-dominated occupations, analyses then examined the extent to which this is explained by SHC. The wage penalty associated with working in a female-dominated occupation remains in models that introduce relevant controls. Moving from a completely male-dominated occupation to a completely female-dominated occupation is associated with a significant wage penalty of 7% to 9% for men and women in the preferred FE specifications. Additionally, women receive wages that are 10% to 15% lower than otherwise similar men.

The impact of SHC varies across measures. For example, introducing training based measures of SHC did not reduce the wage penalty for working in female-dominated occupations. This may be because women in Britain now undertake training almost as often as men, although for a shorter duration (Greenhalgh and Mavrotas, 1994; Green and Zanchi, 1997; Jones et al, 2008). The measure of SHC that has the largest effect on the impact of occupational sex-composition on wages is a skill-based subdivision of the SOC. It is widely accepted that a sex-bias in skill conceptualization and evaluation affects occupational classifications (Grimshaw and Rubery, 2007; Steinberg, 1990; Phillips and Taylor, 1980). Therefore, to the extent that such biases are embedded into this measure, it is possible that the effect of occupational feminization on wages is downward-biased in this specification. Finally, although they undertake training as often as men, women report lower levels of specialist knowledge required for the job. This may suggest that the training received in female-dominated occupations concentrates on more transferable skills. There may also be sex-differences [IN?] perceiving or reporting specialist knowledge (Horrell et al, 1994; Correll, 2001).

Overall, these results provide support for the devaluation theory. The negative and statistically significant relationship between occupational feminization and wages remains in the presence of theoretically relevant controls and unobserved individual-specific effects. Thus, the hypothesis that deep-rooted societal mechanisms contribute to the devaluation of the work performed primarily by women cannot be rejected. However, there is also support for the SHC thesis. First, measures of SHC increase wages net of education, age, job tenure and other important drivers of pay. Second, the effect of occupational feminization on wages was reduced considerably when adding SHC to the models. In the light of these findings, which contrast with those for other countries, it is clear that the debate about the effect of occupational sex-segregation on wages in the British labour market is not closed.

## Notes

[1] This article is part of a chapter from the PhD thesis of the author. Due to space limitations the theory and analysis sections had to be considerably shortened. An extended, more detailed version of the chapter can be requested from the author at jfpera@essex.ac.uk.

[2] For simplicity, the terms 'occupational sex-segregation', 'occupational sex-composition' and 'occupational feminization' are used interchangeably to refer to the proportion of workers who are female in the individual's detailed occupation.

[3] Typically in the literature the three-digit (or equivalent) level of occupation is used as it

provides sufficiently detailed decomposition of occupational groups while maintaining cell sizes.

[4] I limit the number of control variables to avoid issues of collinearity (see Tam, 1997, 2000 and England et al, 2000 for a discussion) and to make results comparable with Tam (1997).

[5] Classes I (higher managerial and professional workers) and II (lower managerial and professional workers) of this scheme include highly specialized workers, while classes IIIa (routine clerical workers) and V (manual supervisors) employ workers with medium levels of SHC. Workers in routine service and sale jobs (class IIIb), skilled manual jobs (class VI), semi and unskilled manual jobs (class VIIa) and agriculture (class VIIb) have low SHC.

[6] The least skilled workers in skill level 1 must display *"competence associated with a good general education, usually acquired by a time a person completes his/her compulsory education"* and may also get involved in *"short periods of work-related training"* (Elias and McKnight, p.511-512). Occupations in skill level 2 require *"the knowledge provided via a good general education"* but *"typically have a longer period of work-related training or work experience"* (p.512). Occupations in the third level of skill *"require a body of knowledge associated with a period of post-compulsory education but not to degree level"* as well as *"a significant period of work experience"* (ibid). Finally, the highest level of skill (4) includes occupations for which *"a degree or equivalent period of relevant work experience"* is needed (ibid).

[7] However, these data are only available for the three-digit SOC2000 occupational classification (81 occupational groupings only). Since no direct conversion is possible between SOC90 and SOC2000, it can only be matched to waves 11 to 17 of the BHPS, and sample sizes are therefore smaller when including this variable (n=21,476).

[8] One explanation compatible with the SHC thesis is based on a 'career point' effect. If a career is defined as a hierarchical succession of occupations, it is possible that most SHC (in terms of training time) will be obtained at lower career levels. This idea introduces further theoretical and methodological challenges for the analysis of sex-segregation and SHC, since the benefits of on-the-job training may not only apply to the current occupation but to future positions on an occupational ladder. Also, not all occupations offer clearly defined career ladders. It is possible that 'nested' and 'independent' occupations may coexist within the occupational structure. Further work should pursue the question of whether this analytic strategy is compatible with a career-oriented view of occupations and acknowledge the different nature of occupations in relation to the availability of defined career ladders.

[9] The coefficients on socialization, domestic labour supply, workplace authority and compensating differential variables are in line with expectations and due to space constraints will not be commented upon here.

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## Tables

**Table 1**. Regression results for men (OLS).

| OLS - MEN | Model 1 | Model 2a | Model 2b | Model 2c | Model 2d | Model 2e | Model 3 |
|---|---|---|---|---|---|---|---|
| Occupational feminization | -0.171*** | -0.171*** | -0.233*** | -0.245*** | -0.094*** | -0.102*** | -0.126*** |
| Received on-the-job training in the past 12 months | | 0.043*** | | | | | |
| Proportion of trainees in the occupation | | | 1.705*** | | | | |
| Modal training "less than 1 week" | | | *Ref. cat.* | | | | |
| Modal training "more than a week but less than 1 year" | | | -0.042** | | | | |
| Modal training "more than a year but less than 3 years" | | | -0.153*** | | | | |
| Modal training "more than 3 years" | | | -0.095*** | | | | |
| Modal training "indefinite, continuously" | | | -0.080*** | | | | |
| Low occupational specialization | | | | *Ref. cat.* | | | |
| Medium occupational specialization | | | | 0.124*** | | | |
| High occupational specialization | | | | 0.364*** | | | |
| Level 1 of skill (lowest) | | | | | *Ref. cat.* | | *Ref. cat.* |
| Level 2 of skill | | | | | 0.130*** | | 0.125*** |
| Level 3 of skill | | | | | 0.261*** | | 0.221*** |
| Level 4 of skill (highest) | | | | | 0.466*** | | 0.332*** |
| Average self-reported "specialist knowledge" | | | | | | 0.298*** | |
| Attitudes towards women, family and employment | | | | | | | 0.003** |
| Hours dedicated to housework per week | | | | | | | -0.005*** |
| Caring for an ill or elderly person | | | | | | | -0.020* |
| Doing most of the childcare of an infant (aged 0 to 11) | | | | | | | -0.025 |
| No managerial duties | | | | | | | *Ref. cat.* |
| Managerial duties in managerial occupation | | | | | | | 0.183*** |
| Managerial duties in a non-managerial occ. | | | | | | | 0.198*** |
| No managerial duties in a managerial occupation | | | | | | | 0.033* |
| Ratio of accidents per 10000 workers in the occupation | | | | | | | 0.003+ |
| Works shifts or unsociable hours | | | | | | | 0.082*** |
| Number of unpaid overtime hours | | | | | | | 0.008*** |
| Minutes spent traveling to work | | | | | | | 0.001*** |
| **N (observations)** | 26362 | 26362 | 26362 | 26362 | 26362 | 9949 | 26362 |
| **N (individuals)** | 3983 | 3983 | 3983 | 3983 | 3983 | 2506 | 3983 |

| $R^2$ | 0.434 | 0.435 | 0.477 | 0.512 | 0.502 | 0.468 | 0.542 |
|---|---|---|---|---|---|---|---|

**Notes**: Dependent variable = Natural log of hourly wages; other non-reported controls: year, region, education, establishment size, job tenure and its square, permanent contract, age and its square, marital status, part time work, job hours and its square, private sector and industry. Significance levels: *** 0.01, ** 0.05, * 0.1, $^{+}$ 0.2.

**Table 2**. Regression results for women (OLS).

| OLS - WOMEN | Model 1 | Model 2a | Model 2b | Model 2c | Model 2d | Model 2e | Model 3 |
|---|---|---|---|---|---|---|---|
| Occupational feminization | -0.321*** | -0.322*** | -0.366*** | -0.137*** | -0.044* | -0.204*** | -0.084*** |
| Received on-the-job training in the past 12 months | | 0.064*** | | | | | |
| Proportion of trainees in the occupation | | | 1.975*** | | | | |
| Modal training "less than 1 week" | | | *Ref. cat.* | | | | |
| Modal training "more than a week but less than 1 year" | | | -0.112*** | | | | |
| Modal training "more than a year but less than 3 years" | | | -0.192*** | | | | |
| Modal training "more than 3 years" | | | -0.259*** | | | | |
| Modal training "indefinite, continuously" | | | -0.118*** | | | | |
| Low occupational specialization | | | | *Ref. cat.* | | | |
| Medium occupational specialization | | | | 0.164*** | | | |
| High occupational specialization | | | | 0.440*** | | | |
| Level 1 of skill (lowest) | | | | | *Ref. cat.* | | *Ref. cat.* |
| Level 2 of skill | | | | | 0.154*** | | 0.137*** |
| Level 3 of skill | | | | | 0.358*** | | 0.306*** |
| Level 4 of skill (highest) | | | | | 0.604*** | | 0.487*** |
| Average self-reported "specialist knowledge" | | | | | | 0.345*** | |
| Attitudes towards women, family and employment | | | | | | | -0.004*** |
| Hours dedicated to housework per week | | | | | | | -0.004*** |
| Caring for an ill or elderly person | | | | | | | -0.029*** |
| Doing most of the childcare of an infant (aged 0 to 11) | | | | | | | -0.005 |
| No managerial duties | | | | | | | *Ref. cat.* |
| Managerial duties in managerial occupation | | | | | | | 0.029+ |
| Managerial duties in a non-managerial occ. | | | | | | | 0.170*** |
| No managerial duties in a managerial occupation | | | | | | | -0.042** |
| Ratio of accidents per 10000 workers in the occupation | | | | | | | -0.008*** |
| Works shifts or unsociable hours | | | | | | | 0.033*** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Number of unpaid overtime hours | | | | | | | 0.012*** |
| Minutes spent traveling to work | | | | | | | 0.003*** |
| **N (observations)** | 29443 | 29443 | 29443 | 29443 | 29443 | 11526 | 29443 |
| **N (individuals)** | 4358 | 4358 | 4358 | 4358 | 4358 | 2868 | 4358 |
| **$R^2$** | 0.436 | 0.439 | 0.511 | 0.529 | 0.520 | 0.480 | 0.562 |

**Notes**: As for Table 1.

**Table 3**. Regression results for men (FE).

| **FIXED EFFECTS - MEN** | **Model 1** | **Model 2a** | **Model 2b** | **Model 2c** | **Model 2d** | **Model 2e** |
|---|---|---|---|---|---|---|
| Occupational feminization | -0.128*** | -0.128*** | -0.135*** | -0.124*** | -0.087*** | -0.091*** |
| Received on-the-job training in the past 12 months | | -0.002 | | | | |
| Proportion of trainees in the occupation | | | 0.396*** | | | |
| Modal training "less than 1 week" | | | *Ref. cat.* | | | |
| Modal training "more than a week but less than 1 year" | | | 0.012 | | | |
| Modal training "more than a year but less than 3 years" | | | -0.045*** | | | |
| Modal training "more than 3 years" | | | -0.046*** | | | |
| Modal training "indefinite, continuously" | | | 0.013 | | | |
| Low occupational specialization | | | | *Ref. cat.* | | |
| Medium occupational specialization | | | | 0.054*** | | |
| High occupational specialization | | | | 0.125*** | | |
| Level 1 of skill (lowest) | | | | | *Ref. cat.* | |
| Level 2 of skill | | | | | 0.060*** | |
| Level 3 of skill | | | | | 0.090*** | |
| Level 4 of skill (highest) | | | | | 0.150*** | |
| Average self-reported "specialist knowledge" | | | | | | 0.061*** |
| **N (observations)** | 26362 | 26362 | 26362 | 26362 | 26362 | 9949 |
| **N (individuals)** | 3968 | 3968 | 3968 | 3968 | 3968 | 2506 |
| **$R^2$ Within** | 0.299 | 0.299 | 0.303 | 0.311 | 0.308 | 0.163 |

**Notes**: As for Table 1.

**Table 4**. Regression results for women (FE).

| FIXED EFFECTS - WOMEN | Model 1 | Model 2a | Model 2b | Model 2c | Model 2d | Model 2e |
|---|---|---|---|---|---|---|
| Occupational feminization | -0.167*** | -0.167*** | -0.151*** | -0.098*** | -0.066*** | -0.102*** |
| Received on-the-job training in the past 12 months | | 0.014*** | | | | |
| Proportion of trainees in the occupation | | | 0.450*** | | | |
| Modal training "less than 1 week" | | | *Ref. cat.* | | | |
| Modal training "more than a week but less than 1 year" | | | -0.009 | | | |
| Modal training "more than a year but less than 3 years" | | | -0.105*** | | | |
| Modal training "more than 3 years" | | | -0.145*** | | | |
| Modal training "indefinite, continuously" | | | -0.012 | | | |
| Low occupational specialization | | | | *Ref. cat.* | | |
| Medium occupational specialization | | | | 0.087*** | | |
| High occupational specialization | | | | 0.174*** | | |
| Level 1 of skill (lowest) | | | | | *Ref. cat.* | |
| Level 2 of skill | | | | | 0.064*** | |
| Level 3 of skill | | | | | 0.135*** | |
| Level 4 of skill (highest) | | | | | 0.200*** | |
| Average self-reported "specialist knowledge" | | | | | | 0.092*** |
| **N (observations)** | 29443 | 29443 | 29443 | 29443 | 29443 | 11526 |
| **N (individuals)** | 4358 | 4358 | 4358 | 4358 | 4358 | 2868 |
| **$R^2$ Within** | 0.218 | 0.219 | 0.228 | 0.238 | 0.232 | 0.134 |

**Notes**: As for Table 1.