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# The feminization of occupations and change in wages: a panel analysis of Britain, Germany and Switzerland

Emily Murphy and Daniel Oesch

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# **The feminization of occupations and change in wages: a panel analysis of Britain, Germany and Switzerland**

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## **Abstract**

In the last four decades, women have made major inroads into occupations previously dominated by men. This paper examines whether occupational feminization is accompanied by a decline in wages: Do workers suffer a wage penalty if they remain in, or move into, feminizing occupations? We analyze this question over the 1990s and 2000s in Britain, Germany and Switzerland, using longitudinal panel data to estimate individual fixed effects for men and women. Moving from an entirely male to an entirely female occupation entails a loss in individual earnings of twelve percent in Britain, six percent in Switzerland and three percent in Germany. The impact of occupational feminization on wages is not linear, but sets apart occupations holding less than 50 percent of women from those with more than 60 percent of women. Only moving into the latter incurs a wage penalty. Contrary to the prevailing idea in economics, differences in productivity – human capital, job-specific skill requirements and time investment – do not fully explain the wage gap between male and female occupations. Moreover, the wage penalty associated with working in a female occupation is much larger where employer discretion is greater – the private sector – than where wage setting is guided by formal rules – the public sector. These findings suggest that wage disparities across male and female occupations are due to gender devaluation.

**Keywords:** occupations, gender, wages, discrimination, sex-segregation

**JEL classification:** J16, J21 J23 J24 J31

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## **Introduction**

Over the last four decades, women's labor market participation has increased continuously in the Western World. The growing number of employed women has thus led to a series of occupations becoming more 'female'. Professions in health care, law and human resources are examples of higher-level occupations in which women have greatly increased their employment share. Postal clerks and bakers represent lower-level occupations that have feminized.

The question raised in this paper is whether occupational feminization is accompanied by a decline in wages. At the aggregate level, the concern is whether increasingly female jobs such as physicians, teachers, or social workers lose ground in the occupational earnings hierarchy. At the individual level, the issue at stake is whether workers who remain in, or move into, feminizing occupations suffer a wage penalty.

In the literature, several views have challenged each other over this question. One view is based on neoclassical economics and stresses differential investment into skill acquisition and paid work between male- and female-dominated occupations (e.g. Becker 1985; Tam 1997; Polavieja 2008, 2012). This argument expects employers to pay lower wages in female occupations on a rational basis; productivity in these occupations is lower, as workers accumulate less specialized human capital, and adjust their working time to fit with childcare and household arrangements.

A second view, often called "cultural devaluation", believes wages to not only be determined by productivity, but also by the perception of differences in status that men and women deserve (e.g. Sørensen 1994; England et al. 2007). The basic idea is that women's work is of lower value than men's work. As a result, occupations that feminize are assigned lower wages because women are considered to deserve lower earnings than men.

A third view highlights conflictual power relations and argues that men are better organized in trade unions and possess more bargaining power than women (Jacobs and Steinberg 1990; Arulampalam et al. 2007). The rationale for lower pay in female occupations would in this way have less to do with differential perceptions of worth, and rather be that male-dominated occupations are better positioned to garner higher wages.

The aim of our paper is to analyze these competing expectations of the impact of occupational feminization on wages. Our research tries to advance the literature in two ways. First, our focus is on three West European countries - Britain, Germany and Switzerland -

rather than on the United States. While the influence of occupational feminization on earnings has been repeatedly studied for the U.S., only a handful of quantitative studies exists for Europe (de Ruijter et al. 2003 for the Netherlands; Grönlund and Magnusson 2013 for Sweden; Perales 2013 for Britain; Polavieja 2008 for Spain). Our study's comparative design allows us to test whether occupational feminization affects wages similarly across countries – which is uncertain given that the institutional context in which women establish their careers in male-dominated occupations differs strongly across Europe (LeFeuvre 2010). Labour markets with a more dispersed wage distribution and less institutional interference such as the US and Britain may feature higher levels of wage devaluation of female occupations than Germany or Switzerland (Mandel and Semyonov 2006).

A second innovation is the study's longitudinal design. We use data stemming from three of the world's leading individual-level panel studies: the British Household Panel Survey (BHPS) 1991-2009, the German Socio-Economic Panel (SOEP) 1991-2010, and the Swiss Household Panel (SHP) 1999-2011. This design contrasts with the European studies quoted above (except Perales 2010) and several influential American studies (e.g. Sørensen 1994; Tam 1997; Tomaskovic-Devey and Scraggs 2002) that are all based on cross-sectional data. The few existing longitudinal studies for the United States use the National Longitudinal Survey and are thus limited to short time-spans and samples of young people (England et al. 1988; Gerhard and El Cheikh 1991; MacPherson and Hirsch 1995). Or alternatively, they are set at the aggregate level of occupations, and thus cannot control for individual-level differences between workers (Catanzarite 2003; England et al. 2007; Levanon et al. 2009). The crucial advantage that longitudinal studies have over cross-sectional analyses is that they enable the researcher to use fixed-effects estimators that control for time-constant unobserved heterogeneity between people. In our case, this allows us to cancel out different ingrained preferences, capabilities and motivations, which affect both a worker's decision to enter male- or female-dominated occupations and his or her earnings potential over the life course.

Our paper is structured as follows. Section II maps out the theoretical arguments as to why workers in female-dominated occupations should earn lower wages than in male-dominated ones and then sketches out our hypotheses. Section III presents our data and estimation method and discusses the advantage of using panel data. Section IV shows descriptive evidence and the results of fixed-effects models. The concluding section V sums up our findings.

### **Mechanisms linking occupational feminization to wages**

Empirical research has consistently found that occupations with a larger share of women pay lower wages. The more robust studies use individual-level panel data with fixed-effects and focus on the American labor market of the 1970s and 1980s. After controlling for differences in human capital, they find that moving from a completely male to a completely female occupation leads to a wage decrease for women of between 4 (Gerhard and El Cheikh 1991: 69), 8 (England et al. 1988: 554) and 9 percent (MacPherson and Hirsch 1995: 446). For men, the wage penalty for moving out of a completely male into a completely female occupation is somewhat higher and ranges between 9 (MacPherson and Hirsch 1995: 446), 10 (England et al. 1988: 554) and 19 percent (Gerhard and El Cheikh 1991: 69). American panel studies that use *occupation* instead of the individual as the unit of analysis find that earnings in female-dominated occupations are between 3 to 5 (England et al. 2007: 1250) and 6 to 10 percent (Levanon et al. 2009: 885) lower than in mixed-gender occupations, after controlling for skill differences. An American analysis of *changes* in an occupation's gender composition and wages between 1970 and 2007 finds male earnings to decline by 3 to 5 percent with increasing shares of female entrants, higher level occupations being most negatively affected by feminisation (Mandel 2013: 1200).

The central question is why female-dominated occupations should yield lower wages than male-dominated ones. While the debate has introduced several causal mechanisms, the core issue is simple and divides explanations into two camps. One camp considers wage disparities between male and female occupations to solely reflect differences in human capital and productivity. Gender pay gaps are thus seen as a spurious by-product of different endowments and preferences of occupational incumbents. In contrast, a second camp believes that wage disparities are rooted in perceptions of unequal worth, and therefore point to labor market discrimination against women. The idea is that gendered allocation in the labour market gives way to valuative discrimination, whereby employers tend to undervalue 'female' as opposed to 'male' work (Petersen and Saporta 2004). In addition, a less prominent but still relevant explanation highlights asymmetric power resources in the labor market and focuses on differences in collective organization and wage bargaining.<sup>1</sup>

### *Differential investment in job-specific skills*

The first camp draws heavily on Gary Becker's (1985: 36) New Home Economics and emphasizes the importance of household specialization among partners. The basic idea is that men specialize in paid work and invest more in job-specific skills. Whereas, women specialize in child care and choose mother-friendly occupations which demand less effort and less intensive training. Employers thus pay lower wages in female-dominated occupations because workers' marginal productivity in these occupations is lower than in male-dominated ones. This productivity differential stems from two mechanisms. One mechanism is unequal investment into human capital. Since women, on average, take on more responsibility for child rearing and housework than men, they will be more likely to interrupt their employment careers and work part-time than men. This more tenuous attachment to paid work is expected to decrease the incentive for both women to invest in their own - and employers to invest in their female employees' - job-specific human capital (Polavieja 2008: 202; see also Polavieja 2012). Men should thus receive more *on-the-job training*. The resulting sex differences in job-specific skills and time spent in vocational training are held to be the crucial factor explaining lower wages in female rather than male occupations (Tam 1997: 1656).

Tam (1997) is correct in asserting that male occupations will be more intensive in terms of job-specific vocational training. Vocational education was originally devised to train craftsmen and is thus still more relevant to male-dominated than female-dominated occupations. And although women have surpassed men in graduation rates from upper secondary *general* educational programs, they are still less likely than men to obtain an upper secondary *vocational* education (OECD 2012: 53).<sup>2</sup> For this reason, one underestimates the skill requirements of female occupations by only controlling for job-specific skills, but not general skills.<sup>3</sup>

Several implications of this hypothesis can be tested empirically. To begin with, the wage gap between male- and female-dominated occupations should disappear once differences in jobholders' tenure and on-the-job training are taken into account. Moreover, on-the-job training is closely linked to the way a country organizes vocational education – and here our study's comparative setting may prove useful.

Vocational training is highly standardized and embedded in the national educational system in Germany and Switzerland, but acquired to a larger extent through informal on-the-job training in Britain – as in the United States (Charles et al. 2001: 376). Job-related training



should thus be captured, to some degree, in workers' initial formal educational attainment in Germany and Switzerland's apprenticeship system, but not in the more informal British (and American) system of on-the-job training. Accordingly, job-specific skills should be more consequential for the explanation of sex-differences in occupational wages in Britain (and the U.S.) than Germany and Switzerland.

#### *Gender specialization in the household*

A second mechanism stressed by New Home Economics originates in women's greater investment into domestic work. The idea is that "child care and other housework are tiring and limit access to jobs requiring travel or odd hours" (Becker 1985: 35). Married women and mothers are expected to avoid occupations that make high demands in terms of constant availability, non-standard hours, overtime work, or business travel. By selecting themselves into less onerous occupations with lower financial rewards, women exchange lower wages for more 'family-friendly' working conditions (Polavieja 2008: 200). Female-dominated occupations may be less attractive in terms of wages, but compensate for their lower pay by offering otherwise more desirable features than male-dominated occupations.

We can again spell out the argument's implications for the empirical analysis. The idea of compensating differentials should apply to women with children, but not to childless women. The moment at which gender specialization should negatively affect women's careers is birth of the first child (Becker 1985). If household specialization is the key mechanism, it is difficult to see why women without children should be more likely than men to waive earnings in order to get a less demanding, but more comfortable and family-friendly job. More generally, controls for individual differences in time spent on housework and childcare (investment into the household) and time on overtime work (investment into the job) should explain away the wage gap between male- and female-dominated occupations.

On the country level, women with children may be more willing (or harder pressed) to forego earnings for family-friendly working conditions if the alternative – the typical full-time job held by men – means very long working hours. In this respect, Switzerland seems to be least family-friendly with 84 per cent of men working 40 hours or more, following by Germany with 64 per cent and Britain with 62 per cent. As a consequence, women are more likely to work less than 30 hours per week in Switzerland (46%) than in Britain (39%) or Germany (38%) (OECD family database, data for 2012/3). We find the same rank-order in the

index of family policy developed by Mandel and Semyonov (2006 1923) where Switzerland is at the very bottom of the distribution, Germany in the lowest fourth and Britain in the lowest third of 22 affluent Western countries. Accordingly, we expect women's investment into domestic work to be more consequential for the gender wage gap in Switzerland than in either Britain or Germany.

### *Gendered valuation of occupations*

Counter to the mechanisms discussed above, sociological theories refute the notion that wages are solely determined by workers' marginal productivity. For Lalive and Stutzer (2010: 936), the importance of the bargaining process for wage setting strongly suggests that non-economic factors also affect people's earnings. According to the "cultural devaluation" perspective, one such factor is a gender norm which privileges men over women on the labor market and thus considers male work to be more valuable than female work (England et al. 2007: 1238). One mechanism behind gendered valuation is that many female jobs are in care activities which have been externalized from the family to the labor market more recently and still carry the stigma of being close to private household tasks (Bradley 1989, England et al. 1994).

Lalive and Stutzer (2010: 937) review an extensive literature in social psychology, which shows that both women and men consider it appropriate for earnings to be lower for women than men (e.g. Jasso and Webster 1997). Likewise, experimental research consistently finds that women tend to pay themselves lower earnings and to ask for less in wage bargaining than do men (e.g. S  ve-S  derbergh 2007). A British study finds that women are just as likely to be promoted as men – yet the wage rewards associated with promotion are lower for women than men (Booth et al. 2003: 314). Similarly, a Swedish analysis of matched employee-firm data reports male employees to participate to a greater extent in firm profits than female employees (Nekby 2003).

The gendered valuation of occupations and skills makes it difficult to interpret the effect of having children on wages. Men may earn higher wages once they have children not because they become workaholics and devote more time to their job. Rather, having children may bestow higher social status on men as the breadwinner of a family and thereby increase their moral bargaining power in wage negotiations.

It is notoriously difficult to set up an empirical test of the cultural devaluation hypothesis. Traditionally, the existence of cultural devaluation – or active discrimination – has been inferred indirectly from the size of an occupation's sex-composition coefficient, after controlling for differences in workplace characteristics and human capital. We also have to rely on this procedure.

On the country level, we expect the extent of coordination in wage-setting to be crucial. To the extent that coordination over wages includes more stakeholders and thus creates a system of checks and balances, wages in occupations may be more closely linked to objectively measurable dimensions of worker productivity – and hence reduce employers' scope for "valuative discrimination" of female jobs (Petersen and Saporta 2004, Mandel and Semyonov 2006). In this respect, Britain's liberal market economy gives more leeway to employers and single firms, facilitating unilateral management control over wages in most workplaces, than Germany's more coordinated market economy with collective agreements at the industry level and powerful works councils at the firm level – an institutional set-up also prevalent, albeit more weakly, in Switzerland (Soskice 2005). Accordingly, the hypothesis of gendered valuation would lead us to expect a greater impact of women's share in an occupation on wages in Britain than in Switzerland and, above all, Germany.

#### *Gender differences in power resources*

Gendered valuation may be one explanation for lower wages in female occupations, power resources another. The latter hypothesis expects social norms to interact with power resources, and salient in wage bargaining. Eileen Appelbaum argues that: "wages depend largely on the respective bargaining power of business and labor, and on ... normative factors" (in Jacobs and Sternberg 1990: 460). Similarly, Arulampalam et al. (2007: 183) believe women wield less bargaining power because of a "social custom whereby a man's career takes precedence". More generally, subordinate groups such as women and minority men are seen as having less political power and thus less leverage to bargain over wages (Catanzarite 2003: 17).

One evident mechanism through which power resources affect wages is trade union representation. Union contracts can lead to wage levels above those which skills in covered occupations would dictate – a pay premium for power. Through their history as organizers of craft and industrial workers, trade unions have traditionally been stronger in male than female

occupations. Consequently, the median voter in unions used to be a male worker, and the design of union wage policies and priorities tended to favor male over female occupations (Jacobs and Steinberg 1990: 460, Arulampalam et al. 2007: 183).

Again, as with social norms, the effect of differential bargaining power is difficult to capture empirically. One approximation is union membership: union members should benefit from collective bargaining and receive, all else equal, higher wages than non-members. Where unions are dominated by men, and union priorities set accordingly, union membership should be more beneficial for pay in male than female occupations. However, over the last two decades, male union dominance has waned in some countries as jobs in public services have replaced manufacturing as the primary union stronghold. Women's union density rates have consequently surpassed those of men not only in Scandinavia, but also in Britain starting from 2002. In contrast, Germany's union movement still remains squarely in male hands, with men's union density rate being twice that of women's in the early 2000s (Visser 2011). While data on union density by gender is less systematic in Switzerland, survey evidence suggests male density rates to be 1.6 times those of women's (reference not disclosed). Accordingly, belonging to a union should be more instrumental for men than women in Germany and Switzerland, but not necessarily in Britain. As such, we expect union membership to be more pertinent in explaining any wage gap between male and female occupations in Germany and Switzerland than in Britain.

### *Overview of the hypotheses*

In sum, our study examines four hypotheses of the effect of occupational feminization on wages (see table 1). Hypothesis 1 highlights sex-differences in accumulated job-specific skills. It predicts no effect of occupational feminization on earnings once all the standard human capital variables and measures for tenure and on-the-job training have been taken into account. On-the-job training should be particularly consequential for the earnings gap between male and female occupations in Britain, but less so in Germany and Switzerland where these skills are, to a larger extent, acquired in formal education.

Hypothesis 2 emphasizes gender-differences in housework and expects women to accept lower wages in return for less exacting working conditions. The wage effect of occupational feminization should disappear once we control for women's greater investment into childcare and housework, and men's greater investment into paid work through overtime. This effect

should be the stronger, the more conservative a country's family policy is – and hence more marked in Switzerland than in Germany and Britain.

Hypothesis 3 focuses on gendered valuation and argues that employers consider female jobs inherently less valuable than male jobs. It expects the wage gap between female and male occupations to persist even though differences in human capital, childcare and housework are accounted for. This wage gap should be larger in liberal market economies such as Britain with more unilateral employer control over wages than in coordinated market economies such as Germany or Switzerland, where a closer nexus between the educational and wage system makes the occupational wage structure less sensitive to normative pressures.

Hypothesis 4 highlights the role of power and union membership, and expects men to exhibit greater leverage in wage bargaining. Union membership should be a strong mediating factor of the wage gap between women's and men's occupations in Germany and Switzerland where the union movements are male-dominated, but less so in Britain where unions have been feminizing over the last two decades.

Table 1 around here

## **Data, measures and method**

### *Data*

Our empirical analysis is based on longitudinal data from the British Household Panel (BHPS), the German Socio-Economic Panel (SOEP), and the Swiss Household Panel (SHP). These nationally representative surveys collect information on a wide range of respondents' socio-demographic characteristics and labour force participation. We draw on unbalanced panels that comprise 18 waves of data from the BHPS (1991-2009) (Taylor et al. 2010), 20 waves (1991-2010) from the SOEP (Wagner et al. 2007), and 13 waves (1999-2011) from the SHP, including booster samples<sup>4</sup> (Voorpostel et al. 2010).

We restrict our estimations to employees (ages 24 to legal retirement age)<sup>5</sup>, working 15 hours or more per week<sup>6</sup>. The self-employed, those in the armed forces, full-time education or government schemes are excluded as the wage setting process of these workers is markedly different. Observations with missing values on relevant covariates are dropped from our analysis. In terms of observations, this leaves us for the British sample with 4700 women and 4808 men, for the German sample with 7235 women and 8812 men, and for the Swiss sample

with 2228 women and 2566 men. On average, men appear in a total of 12 years, women in 11, of the British panel; men in 11 years and women 10 years in the German sample; men in 8 years and women in 7 years in the Swiss sample. Each person contributes a minimum of two years. Tables A.1 to A.3 in the appendix provide summary statistics for the samples.

### *Individual and Occupational Measures*

The first decision to be made is how to aggregate over 300 occupations in our three samples. Many of these occupations are empty in some waves and too small in other waves to permit robust wage estimations. Therefore, we group occupations according to the ‘micro-class’ concept introduced by Grusky and Weeden (2001).<sup>7</sup> This classification combines occupational categories on the basis of their social closure, which is brought about through wage-bargaining processes (unionisation), access to training, and returns to education. It provides us with a coherent, cross-nationally comparable measure of 81 occupations (Grusky and Weeden, 2001). One drawback of this classification is the loss of detail in terms of jobs actually performed by men and women – and previous research indicates that the wage effect of occupational feminization is the greater the finer the job decomposition (Tomaskovic-Devey and Skaggs 2002: 105).

Our dependent variable is the natural logarithm of individuals’ gross monthly wages, expressed in real terms: constant 2005 pounds sterling (for Britain), 2005 euros (for Germany), 2005 Swiss francs (for Switzerland)<sup>8</sup>. To ensure that potential outliers arising from measurement error do not bias our wage equations, we drop one percent of observations at the bottom of the wage distribution.

Our key independent variable is the share of women in a given occupation. This share ranges from 0 to 100 and is calculated *for each year* on the basis of the Labour Force Survey for Britain (UK-LFS, spring quarter 1991-2008)<sup>9</sup>, the Socio-Economic Panel for Germany (SOEP 1990-2010) and the Swiss Labour Force Survey (SLFS 1998-2011). In order to eliminate spurious variation due to small samples, we average the weighted proportions across two waves for Germany and Switzerland. This allows us to calculate the share of women for a given occupation in 1991 by taking the mean proportion of women in 1990 and 1991, and so on.

By taking an annual measure we address a shortcoming of the few panel studies in the feminization literature. The feminization of occupations implies that the share of women are

growing, and vary over time. However, in previous longitudinal studies, an occupation's share of women has been measured at one single point in time and therefore kept artificially stable over the observation period (e.g. England 1988 – but not MacPherson and Hirsch 1995). This means that fixed effects analyses are limited to the fraction of workers who change jobs. In not constraining the share of women in an occupation to be the same across years, and observing change over a longer time period, we broaden our scope. This allows us to test the effect of both remaining in a feminizing occupation, and moving from male to female occupations, on a worker's monthly wages.

Note that there is considerable variance in the share of women in an occupation over the period of time that we observe. Examples of occupations that have been feminizing between the first and last time points are jurists in Britain (1991-2008: +16 percentage points), accountants in Germany (1991-2010: +32 pp) or statistical and social scientists in Switzerland (1999-2011: +19%). Therefore, while individuals in our sample experience greater change in the share of women in their occupation when they change jobs altogether, remaining in a feminizing occupations also contributes substantial variance. We control for changing jobs by introducing a dummy for the change in occupation into our wage equations.

The usual determinants in wage equations make up our independent variables: number of hours normally worked per week (delimited to 50 hours), current job and firm tenure, part-time status, temporary contract<sup>10</sup>, past unemployment experience, and detailed regional controls<sup>11</sup>. A series of 1-digit industry (NACE)<sup>12</sup>, public sector and firm size dummies should control for workplace characteristics and pick up industry-specific skills (Tomaskovic-Devey and Scraggs 2002; Tam 1997).

Good measures for accumulated individual skill and human capital are central to the study of occupational feminization and wages. For all three countries, we construct the same three educational levels (low, intermediary, high) based on the International Standard Classification of Education (ISCED). Work experience in the German models is a measure of total years spent in fulltime work, with the exception of those who only reported part-time work experience. Unfortunately, we are forced to approximate work experience using age in the British models. While this is problematic given the differences in spells of inactivity between men and women, previous studies using the BHPS suggest that – once other variables such as tenure are properly controlled for – age serves as a reasonable proxy for work experience (see e.g. Bryan and Sevilla-Sanz 2011).

In order to address expectations related to occupational differences in general skill requirements, we construct an aggregate measure of an occupation's educational level by averaging the share of people with low (score of 0), intermediate (score of 0.5) and high education (score of 1). We measure job skill specialization for Britain and Switzerland by matching in from the Labour Force Surveys an occupation's share of incumbents who have received any form of training or work related courses in the reference year. This occupational measure is supplemented by an individual indicator for training received in the reference year of the panel. For Switzerland, as a further test of training-occupation match and to control for unobserved skill specialization that might result from tenure, we include a binary indicator (no 0; yes 1) in answer to 'do your qualifications correspond to your job'. The German models contain three precise binary indicators of self-reported job training requirements, coded one if a job requires (i) on-the-job training, (ii) special courses, or (iii) further training, such as technical college.

Differential investment into work and the household is captured with variables for unpaid overtime hours per week, marital/cohabiting status, hours spent on housework per week, and the number of dependent children in the household. Hours of housework are capped at 50 hours per week, while unpaid overtime in the main job is originally capped at 23 hours in the German data, and imposed as 28 hours per week for Britain.<sup>13</sup>

Most pertinent to theories of power resources is union coverage at the firm level. The British models test for whether a person's workplace has an established union. For the Swiss SHP, we only have information on individual membership in a work association or a trade union. The same question on union membership was asked in the German SOEP, but only in five waves (1993, 1998, 2001, 2003, 2007).<sup>14</sup>

Occupational feminization is likely to take place in occupations for which there is growing labor demand – and change in labour demand is largely exogenous, driven by technology (Oesch 2013). But since it may also affect the evolution of our key parameters – occupational feminization and wages –, we need to control for it. We do so by introducing a measure of the annual share of total employment in a given occupation (based on the Labour Force Surveys for Britain and Switzerland, and SOEP for Germany). Over the time under study, the annual employment share decreases for occupations such as metal fitters and office clerks, but increases for occupations such as health semi-professionals and managers.



### *Model specification*

When analyzing the effect of occupational feminization on wages, we need to address the issue of unobserved heterogeneity. Notably the theories of New Home Economics imply that unmeasured abilities and preferences may explain the negative association between the share of women in an occupation and wages. The idea is that women and men select themselves into certain occupations, which carry different wage returns, on the basis of personal attributes that are not easily observed in survey data. Occupations that are more ‘female’ could predominantly attract less productive women, who sort into less demanding jobs because they prioritize family care over paid work, and thus accept the condition of earning a lower wage (MacPherson and Hirsch 1995). Fixed effects panel models eliminate time-invariant, unmeasured characteristics such as individual preferences, capabilities and motivations, since parameters are estimated on the basis of within-person changes only (Halaby 2004). In other words, these models only take into account the variance that stems from changes in individuals’ lives over time, but not from differences between individuals.

Regressions are estimated separately for men and women and we adopt a step-wise approach. The independent variables relevant for each hypothesis are added to our baseline model, and are then removed, to examine net effects. Previous findings suggest that wage effects are stronger at distinct values of the share of women in an occupation. We test for such nonlinearity in a second set of analyses by decomposing our indicator into percentage bands.

### **Findings on the wage effect of occupational feminization**

We begin our analysis with descriptive statistics. Figures 1a to 1c show how an occupation’s monthly wages vary depending on the share of women in the occupation. Unlike our subsequent multivariate analysis, this computation is set at the aggregate level of occupations and focuses on occupational median wages. Three results are noteworthy.

First, we observe systematically higher median wages for men than women, regardless of the share of women who work in an occupation. The male-female wage gap is largest in occupations holding between 50 to 60 percent of women in Britain, 70 to 80 percent of women in Switzerland and 90 to 100 percent of women in Germany.

Second, the median wage is highest in occupations which employ between 10 to 20 percent of women in Germany, 20 to 30 percent of women in Switzerland and 40 to 50 percent of women in Britain. Wages then gradually decline as women’s share in an occupation increases.

*Female* median wages in occupations with a share of 80 to 90 percent women are substantially lower than *female* median wages in occupations with a share of 30 to 40 percent women – a 38 percent differential in Britain, 21 percent in Germany, and 13 percent in Switzerland. This suggests that wage disparities between male- and female-dominated occupations are higher in Britain than in Germany and, above all, Switzerland.

Third, although not as low as those at the female end of the occupational distribution, median wages are also very low in occupations employing more than 90 percent of men. We deal here with mostly low-skilled occupations in production and craft such as heavy machine operatives, mechanics or plumbers – and technological change has depressed firm's demand for these jobs over the last few decades. The lower wage levels in these heavily male-dominated occupations suggests that the relationship between the share of women in an occupation and earnings is not linear – a finding to which we will come back below.

[Figure 1 \(1a to 1c\) around here](#)

We move on from descriptive statistics to estimate wage equations for British women and men, German women and men, and Swiss women and men. These analyses are set at the individual level and the dependent variable is logged monthly earnings. In a first OLS baseline model M0(OLS), we simply introduce the key independent variable “female share in an occupation” (henceforth FEM), alongside controls for time (in years), normal hours worked per week and labor demand (share of employment in a given occupation). In a second baseline model M0(FE), we introduce individual fixed effects alongside the same three control variables. We then keep fixed effects and add, in two subsequent models, controls for workplace characteristics (M1) and standard human capital (M2). The following models M3 to M5 then provide tests for three of our hypotheses: M3 introduces several measures for job-specific skills; M4 includes several variables for household and work investment; M5 integrates union membership. Finally, M6 provides the results of a full model. For clarity, table 2 only shows the coefficients for our key variable FEM (for the complete models, see tables A.4 to A.6 in the appendix).

What are our main findings? The two baseline models M0 show that using fixed-effects model makes a large difference. For women, the wage penalty of staying in, or moving to, a feminizing occupation is roughly divided by half if we move from OLS to fixed effects and

only look at within-person changes over time. Women who choose to work in female-dominated occupations thus seem to be different from women who work in more male-dominated occupations – their earnings potential seems to be lower. For men, the opposite applies: the wage penalty of FEM only emerges (in Germany and Switzerland) or becomes larger (in Britain) if we use fixed effects and thus hold time-invariant individual characteristics constant.

Both baseline models suggest that moving from a male to a female occupation – or staying within an occupation that feminizes – entails a sizeable wage loss. Adding controls for the workplace (M1) and general human capital (M2) makes no difference: the wage penalty associated with FEM amounts to about 15 per cent for British women, British men and Swiss women,<sup>15</sup> and to about 5 per cent for German women, German men and Swiss men.

The hypothesis that job-specific skills go some way towards explaining why wages are lower in female than male occupations is supported by our third model. Once we introduce controls for job-specific skills (M3), the wage loss associated with moving from a fully male to a fully female occupation remains basically unchanged for British women and men, but becomes substantially smaller for German women and men, and, above all, Swiss women and men. The effect of FEM becomes close to zero for Swiss men and shrinks from 14 to 7 percent for Swiss women. Differential acquisition in job-specific skills in male and female occupations thus clearly matters. However, the wage penalty associated with FEM does not disappear altogether: the coefficients remain negative in Germany and Switzerland.

However, contrary to our country hypothesis, controlling for job-specific skills does nothing to reduce the massive wage gap between male and female occupations in Britain, but leads to a smaller effect of FEM in Germany and Switzerland. This suggests that in the two German-speaking countries, the acquisition of vocational skills is finished at the end of formal vocational education, but continues (to a larger extent than in Britain) over the life course.

The model controlling for differential investment into housework shows that unpaid overtime work is systematically associated, for both men and women, with higher wages, whereas hours devoted to housework lead to lower pay. Gender differences emerge with respect to two other characteristics of household upkeep: being married and having dependent children. While marriage increases wages equally for men and women in Britain, its beneficial effect on wages is limited to men in Germany and Switzerland, whereas women

seem to lose out from it. Even more marked is the gender difference with respect to children. Even though we control for hours of housework, we still find that having children is associated with lower pay for women in all three countries. Having two or more children in the household entails a massive decrease in women's wages by 5 (German women), 8 (Swiss women) and 9 per cent (British women). For men, having children has no negative effect – on the contrary, the coefficients are weakly positive in all three countries.

Table 2 around here

By and large, we thus obtain the wage effects of overtime, marriage and children predicted by New Home Economics. However, we do not know whether women's wage penalty, and men's wage bonus, associated with children is due to productivity or discrimination. More importantly, these measures of differential investment into work and the household fail to explain why moving into female occupations is associated with lower wages for men and women. When introducing these measures into the wage equation alongside workplace and human capital controls, the coefficients for FEM remain unchanged in Germany and Switzerland – and they only slightly decrease the (still substantial) wage penalty associated with FEM in Britain. Again, our country hypothesis is not supported. Differential investment into the household does no more explain away the wage loss associated with FEM in Switzerland, the country with the most conservative family policy, than in Britain or Germany.

Our model M5 incorporates union coverage or union membership respectively. While we observe a strongly positive effect of a workplace union on wages in Britain, the presence of a union does not account for the differences in wages between male and female occupations. In Germany and Switzerland, the wage bonus of union membership is small and statistically insignificant. In all three countries, the introduction of union coverage or membership into our wage equation has no impact whatsoever on our key independent variable FEM. Accordingly, we find no evidence for this hypothesis either on the individual or country level.

Finally, when estimating a full model M6 which integrates all our control variables, we basically obtain the same coefficients for FEM as in model M3 which includes the measures for job-specific skills (alongside workplace characteristics and general human capital). More importantly, we still observe a wage penalty associated with working in occupations that have

high shares of women – although we introduce about 25 measures for workplace characteristics, general and job-specific human capital as well as the household. This residual wage penalty is large for British women and men (12-13 percent), non-negligible for Swiss women (6 percent) and small for German women and men (2-3 percent). At this stage, the only hypothesis consistent with this result seems to be gendered valuation: the perception of both employers and employees that male work is more valuable than female work.

We further probe the plausibility of Gary Becker's differential investment hypothesis by looking at different subsamples. His argument that women specialize in housework and thus choose less demanding jobs should only apply to women with children – but not to childless women. More precisely, his theory points to the birth of a child as the time at which disadvantages in women's careers begin to escalate. If women do not have a child to take care of, they are unlikely to forego higher wages for more family-friendly working conditions. We thus re-estimate the full model 6 for women without children. Since women may make career choices based on planned fertility, their wages could already decrease a year or two before the first child is born – as they look for a family-friendly job before entering motherhood. For this reason, we limit the samples in table 5 first to women without children and then further to childless women who would also remain childless in two subsequent waves of our panels.

The results are shown in Table 2 and suggest that, contrary to the expectation of New Home Economics, occupational feminization not only affects the wages of women with children, but also those of childless women – although they do not spend time and energy on childcare. Regardless of whether women have children or not, the wage penalty associated with FEM is substantial. For childless women, the wage effect of moving from a completely male to a completely female occupation amounts to 9 percent in Britain, 7 to 9 percent in Switzerland and 4 percent in Germany.

#### Table 3 around here

In a next step, we need to tackle the question of whether the effect of FEM on wages is linear. We examine this issue by estimating a full model where our continuous variable FEM (the share of women in an occupation from 0 to 100%) is decomposed into six categories: less than 30% of women, 30-40%, 40-50%, 50-60%, 60-70%, and more than a 70% of women in an occupation.

Figure 2 presents the regression coefficients by showing the percentage change in an individual's wage associated with moving from a very male occupation (reference category of 0-30% men in occupation) to mixed-gender and increasingly female occupations. These figures clearly demonstrate that the impact of occupational feminization on wages is not linear, but mainly sets occupations holding less than 50 percent of women apart from occupations holding more than 60 percent of women. As long as women make up a minority within an occupation, it does not make much of a difference for wages whether there are 10 or 45 per cent of women in the three countries under study.

Despite introducing all our control variables for human capital, job-specific skills and household investment, the dampening wage effect of FEM apparent in the previous linear regressions is still visible in Britain, Germany and Switzerland (where, however, the sample size is small and standard errors large, leading to coefficients that are no longer statistically significant). The wage penalty associated with crossing the boundary of 60% FEM amounts to 5 percent for British women and to 2 per cent for German men and women. In Britain, the costs of occupational feminization are somewhat higher for men than women: moving from an occupation with less than 50 percent of women to an occupation holding between 60 and 70 percent of women comes with a wage decline of 7 percent for British men.

Figure 2 around here

While our results strongly suggest that occupational feminization is accompanied by a wage penalty, they leave us wondering why we observe a much stronger effect in Britain than in Germany or Switzerland. Our country hypothesis expected a larger scope for gendered valuation – employers' latitude to set wages according to gender perceptions – in countries with a more deregulated wage structure, such as Britain, than in countries with widespread wage coordination as in Germany or Switzerland. The argument is that it is wage coordination, formal rules – in other words, whether the general wage determination system is loosely or closely tied to qualifications – rather than specific gender policies that have the strongest impact on women's relative pay position (Rubery et al. 1997). Evidence for this hypothesis is that Germany and Switzerland had consistently lower levels of wage inequality over the 1990s and 2000s than Britain (OECD 2011: 87). We analyze this hypothesis by replacing monthly wages with individuals' wage percentile ranking within each country and

year. Using the percentile ranking allows us to get rid of differences in wage inequality across our three countries.

We re-estimate models M0 to M6 with normalized wage percentile ranking as the outcome variable (see table A.7 in the appendix). While we still find a sizeable wage penalty associated with the share of women in an occupation, the country differences do not become smaller. Based on this measure, FEM entails a relative wage loss for Swiss women that is almost as large as for British women and men. As opposed to this, German women, German men and Swiss men still stand out as being less affected by the share of women in an occupation. Accordingly, different levels of wage inequality do not explain why remaining in, or moving into, a feminizing occupation entails a much larger wage decrease in Britain than in Germany.

In a next step, we analyze whether wage coordination and formal rules decrease employer discretion in setting wages according to their perception of an occupation's worth by looking separately at the private and public sector. The idea is that wage setting in the public sector obeys adheres more to the logic of formal rules and standard procedures, whereas the private sector gives greater latitude to employers' personal appreciation. We thus estimate a full model M6 on two different subsamples (private/public) where the dependent variable is log monthly wages and the key independent variable is the share of women in an occupation, decomposed into the same six categories as in Figure 2 above.

The results are shown in Figure A.1 in the appendix and reveal that the wage penalty associated with working in a female occupation is systematically larger in the private than the public sector in all three countries. The difference is striking for Germany and Switzerland where there is a sizeable wage penalty associated with the share of women in an occupation in the *private* sector, but none in the public sector. On the contrary, coefficients even suggest that there is a small wage bonus associated with FEM in the public sector for men in Germany and women and men in Switzerland. In Britain, we find a negative effect for FEM in both sectors, but the wage penalty is twice as large in the private than the public sector. This evidence is consistent with the expectations both of gendered valuation and of the crucial role the general wage-setting system plays for women's relative pay position.

## Conclusion

This paper opened with the question of whether workers who remain in, or move into, feminizing occupations earn lower wages. A tentative answer from our panel-data analyses is that, in the absence of controls for differences in workplace characteristics and human capital, employment in a completely female occupation is associated with a substantially lower wage than employment in a completely male occupation. This wage penalty amounts to about 15 percent in Britain, Germany and Switzerland. Once we account for differences in firm characteristics, human capital and job-specific skills, the effect of occupational feminization on wages becomes more negligible for German women, German men and Swiss men, but remains substantial for Swiss women and, above all, British women and men. In Britain, moving from an entirely male to entirely female occupation entails – everything else being equal – a wage loss of over ten percent.

Wage disparities between male and female occupations, contrary to the prevailing idea in economics, do not disappear once we control for other differences in workers' productivity. Variation in job-specific skills, overtime work, childcare and housework does not explain why British workers earn lower wages in female, as opposed to male, occupations. Crucially, it is not only women with children, but also childless women and men who earn lower wages when working in female-dominated occupations. In addition, our analyses are based on fixed-effects estimators and thus only use variation within individuals over time. By controlling for time-constant unobserved characteristics, we can discard the hypothesis that our results are driven by the fact that different people (e. g. more productive and ambitious workers) choose to work in different occupations (e.g. male and not female occupations). The implication is that factors beyond productivity must be operating.

Our analysis provides only partial support for the job-specific skill hypothesis – and very little support for the differential investment hypothesis. Likewise, differences in union membership and union coverage do not explain the lower wages in female occupations. Although belonging to a union and working in a unionized firm are admittedly imperfect measures of workers' power resources in the labor market – and our evidence in this respect is thus tentative at best.

How can we interpret the failure of these different hypotheses to explain the wage impact of occupational feminization? Our reading of these findings is simple: wage disparities between male and female occupations are, to some extent, rooted in unequal gender norms



that accord higher value to male work effort, and thus imply labor market discrimination against women.

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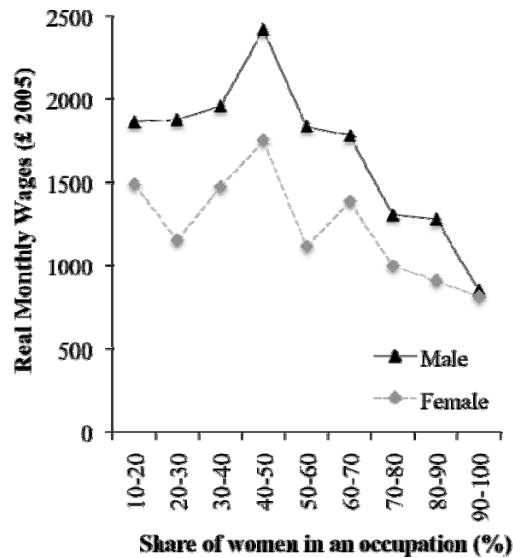
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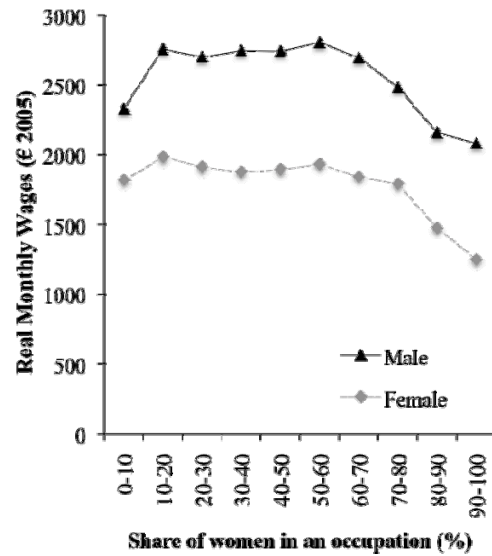
**Figure 1.** Share of women in an occupation and an occupation's median gross monthly wage

*Figure 1a: Britain, 1991-2009*



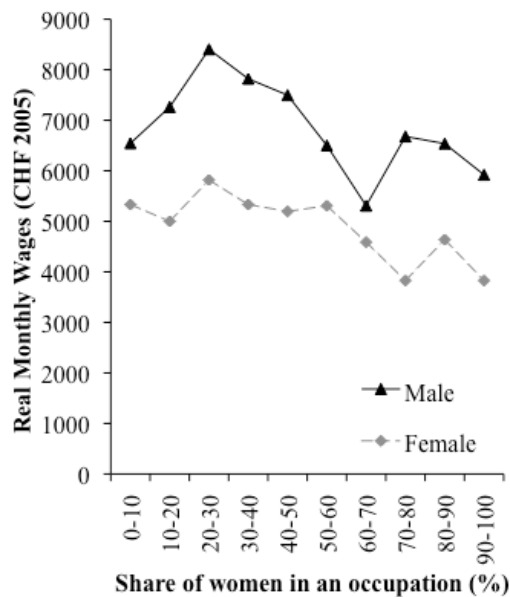
BHPS 1991-2009; N=1458 (pooled cross-section: 81 occupations \* 18 waves)

*Figure 1b: Germany, 1991-2010*



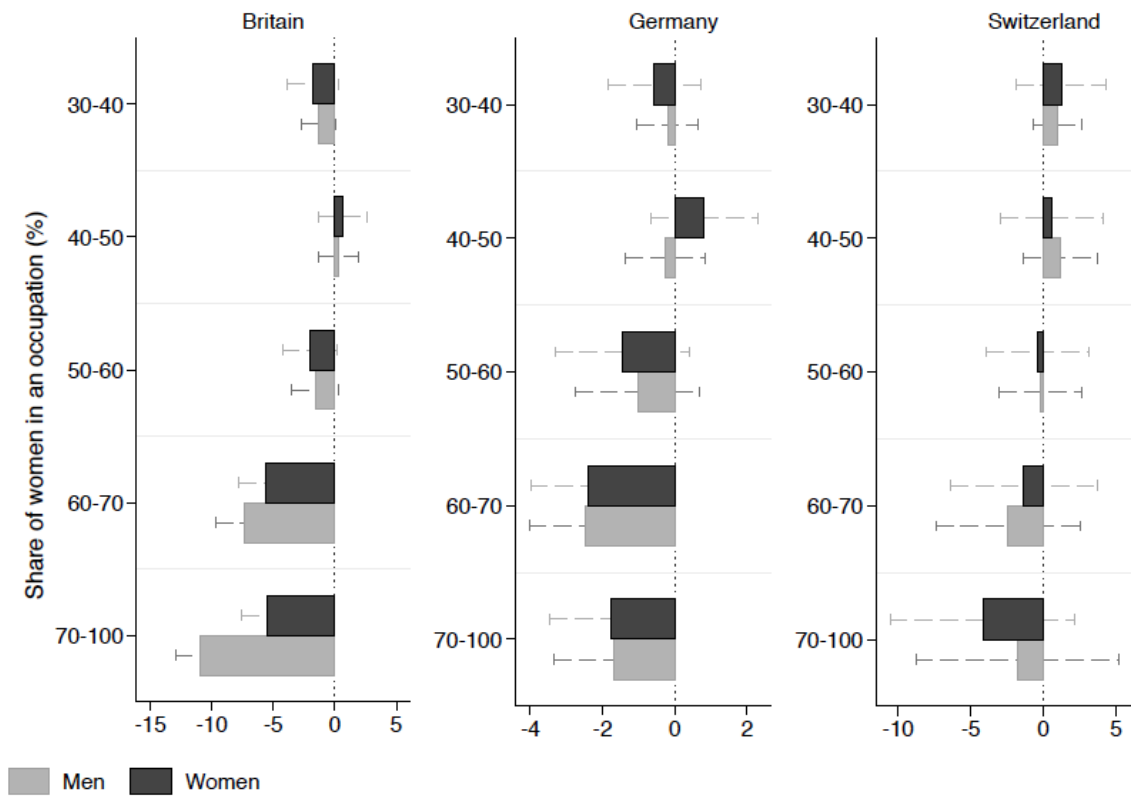
SOEP v27, 1991-2010; N=1600 (pooled cross-section: 80 occupations \* 20 waves)

*Figure 1c: Switzerland, 1999-2011*



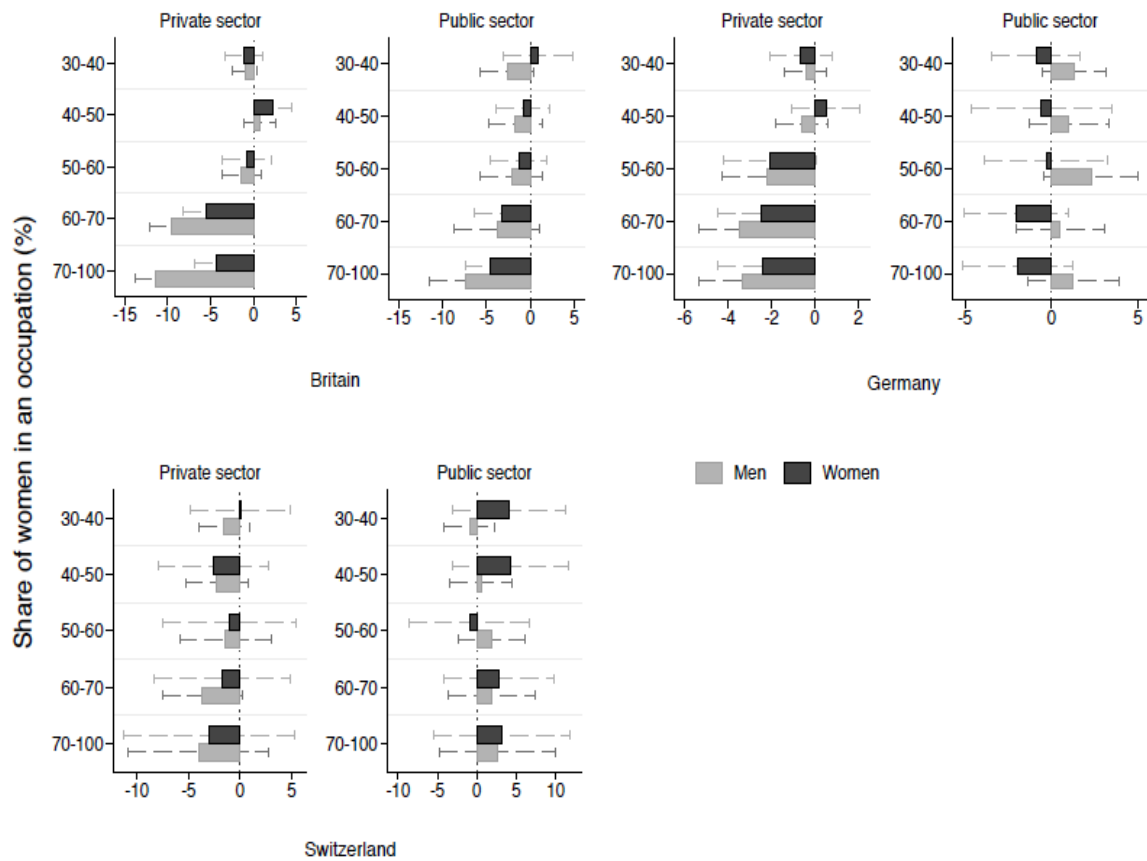
SHP 1999-2011; N=1079 (pooled cross-section: 83 occupations\* 13 waves)

**Figure 2.** wage evolution (in %) of a change from male (0-30% women) to feminizing occupations – Britain 1991-2009, Germany 1991-2010, Switzerland 1999-2011



## APPENDIX

**Figure A.1.** Wage evolution of a change from male (0-30% women) to feminizing occupations in the public and private sector – Britain 1991-2009, Germany 1991-2010, Switzerland 1999-2011



**Table 1:** Overview of the hypotheses

<i>Hypothesis</i>	<i>Focus</i>	<i>Mechanism</i>	<i>Country difference</i>	<i>Outcome – gender wage gap</i>
H1	Investment into job-specific skills	Disparity in job-specific skills explains the wage gap between male and female occupations	Controlling for on-the-job training should decrease wage gap more in GB than CH and DE	Productivity-related: no longer significant
H2	Investment into paid work and childcare	Women forgo wages for a job with more family-friendly working conditions	Controlling for gendered investment should decrease wage gap more in CH than DE and GB	Productivity-related: no longer significant
H3	Cultural devaluation	Gender norms ascribe higher value to male than female work	After controls, wage gap should be larger in liberal than coordinated countries: in GB than DE or CH	Discrimination persists: effect remains negative
H4	Power resources and union membership	Men have more bargaining power than women, notably through collective organization and bargaining	Controlling for unions should decrease wage gap more in DE than CH and, above all, GB	Discrimination persists: effect remains negative

**Table 2.** Determinants of log monthly wages in Britain, Germany and Switzerland

		M0 OLS base	M0 Fixed- Effects FE base	M1 FE Work controls	M2 FE Human capital	M3 FE Job specific skills	M4 FE DHI	M5 FE Unions <sup>a</sup>	M6 FE (M1-M4)
<b>Britain</b>	Women	<b>-0.31</b> (0.01)	<b>-0.15</b> (0.02)	<b>-0.16</b> (0.02)	<b>-0.15</b> (0.02)	<b>-0.13</b> (0.02)	<b>-0.14</b> (0.02)	<b>-0.16</b> (0.02)	<b>-0.12</b> (0.02)
	Men	<b>-0.07</b> (0.01)	<b>-0.13</b> (0.02)	<b>-0.17</b> (0.02)	<b>-0.14</b> (0.02)	<b>-0.14</b> (0.02)	<b>-0.12</b> (0.02)	<b>-0.14</b> (0.02)	<b>-0.13</b> (0.02)
<b>Germany</b>	Women	<b>-0.26</b> (0.01)	<b>-0.05</b> (0.01)	<b>-0.05</b> (0.01)	<b>-0.05</b> (0.01)	<b>-0.03</b> (0.01)	<b>-0.05</b> (0.01)	<b>-0.07</b> (0.02)	<b>-0.03</b> (0.01)
	Men	<b>0.14</b> (0.01)	<b>-0.05</b> (0.01)	<b>-0.04</b> (0.01)	<b>-0.03</b> (0.01)	<b>-0.02</b> (0.01)	<b>-0.03</b> (0.01)	<b>-0.06</b> (0.02)	<b>-0.02</b> (0.01)
<b>Switzerland</b>	Women	<b>-0.25</b> (0.02)	<b>-0.14</b> (0.05)	<b>-0.15</b> (0.05)	<b>-0.14</b> (0.05)	-0.07 (0.05)	-0.15 (0.05)	<b>-0.13</b> (0.05)	-0.06 (0.05)
	Men	0.02 (0.01)	-0.05 (0.03)	-0.05 (0.03)	-0.03 (0.03)	-0.01 (0.03)	-0.03 (0.03)	-0.02 (0.03)	-0.01 (0.03)

Source: BHPS; SHP; SOEP v27

Notes: **bold p** <0.05. Robust standard errors are shown in parentheses.

See tables A.4-A.6 in the appendix for the values of coefficients and number of observations.

Controls included in models:

- M0 to M6: normal weekly workhours, year, labor demand (share of employment in a given occupation)
- M1 to M6: occupational demand (%), region, industry, firm size and sector, occupational switch
- M2 to M6: work experience (age; age squared), unemployment spell, education level, temporary and part time status.
- M3 and M6: on the job training, job tenure, job's skill requirements (see table A.4 to A.6 for detailed overview)
- M4 and M6: married, number children in household, hours of housework and overtime work
- M5 only: union coverage in workplace or union membership

<sup>a</sup> As union membership has not been asked in every year, these models are estimated on a reduced set of years.



**Table 3.** Determinants of log (monthly) wages for women without children

	M6a FE women without children	M6b FE women without children at present and in the near future
<b>Britain</b>	<b>-0.09</b> (0.02)	<b>-0.09</b> (0.02)
<i>N individuals</i>	3 714	3 620
<b>Germany</b>	<b>-0.04</b> (0.02)	<b>-0.04</b> (0.02)
<i>N individuals</i>	5 596	5 546
<b>Switzerland</b>	-0.07 (0.05)	-0.09 (0.05)
<i>N individuals</i>	1 646	1 305

Source: BHPS; SHP; SOEP v27

Notes: **bold p** <0.05 Robust standard errors are shown in parentheses.

Model M6a exclude women with children (mothers); model M6b excludes women with children (mothers at present) and women who report a child in the household up to two years later (future mothers).

The same controls are included as in model M6 in (see Table 2 for details).

## APPENDIX

**Table A.1 British Sample Summary Statistics**

Variable	Female			Male		
	Mean	Min	Max	Mean	Min	Max
Natural Logarithm of (monthly) gross real wage [£2005]	6.99	5.59	11.21	7.49	5.59	11.26
Percentile rank of ln(monthly) gross real wage [£ 2005]	38.22	1	100	61.88	1	100
(LFS:Annual) Share of women in an occupation	0.64	0	0.99	0.3	0	0.98
<i>(LFS:Annual) Bands of women: 0-30 %</i>	0.12	0	1	0.61	0	1
30-40 %	0.04	0	1	0.08	0	1
40-50 %	0.09	0	1	0.1	0	1
50-60 %	0.06	0	1	0.05	0	1
60-70 %	0.12	0	1	0.04	0	1
70-100 %	0.57	0	1	0.13	0	1
(LFS Annual) Occupational demand (%)	4.62	0.03	14.28	2.88	0.01	14.28
(BHPS: Annual Mean) Education level of occupation	0.59	0	1	0.55	0	1
Age	41.3	24	64	41.3	24	64
<i>Government regions: 11 not shown</i>						
Normal working hours per week	31.99	15	50	39.09	15	50
Unemployment experience (in last 12 months)	50.03	0	1	0.04	0	1
Annual weeks of employment (current work	50.6	0	52	51.03	0	52
<i>Education: Lower level</i>	0.49	0	1	0.45	0	1
Intermediate secondary	0.35	0	1	0.37	0	1
Tertiary level	0.16	0	1	0.18	0	1
Part-time status	0.27	0	1	0.62	0	52
Temporary contract	0.04	0	1	0.27	0	1
Public sector	0.46	0	1	0.23	0	1
<i>Firm size: Less than 50 employees</i>	0.48	0	1	0.48	0	1
Less than 500	0.35	0	1	0.35	0	1
Greater than 500	0.18	0	1	0.18	0	1
<i>Industry: Agriculture</i>	0.01	0	1	0.02	0	1
Manufacturing	0.12	0	1	0.32	0	1
Construction	0.03	0	1	0.07	0	1
Transport	0.12	0	1	0.12	0	1
Trade	0.07	0	1	0.12	0	1
Financial/Banking	0.07	0	1	0.05	0	1
Services	0.58	0	1	0.02	0	1
Job tenure	4.63	0	42	5.55	0	50
Received job training (courses) in past 12 months	0.38	0	1	0.33	0	1
(LFS: Annual Mean) Occupation follows job training	0.16	0	0.98	0.14	0	1
Married /living as couple	0.64	0	1	0.67	0	1
No dependent children in household	0.64	0	1	0.62	0	1
One child in hh	0.18	0	1	0.16	0	1
Two or more children in hh	0.18	0	1	0.22	0	1
Hours of housework (per week)	13.13	0	50	4.95	0	50
Hours of overtime (per week)	3.07	0	28	5.31	0	28
Union coverage in workplace	0.58	0	1	0.47	0	1
<i>Occupational switch: microclass change</i>	0.24	0	1	0.27	0	1

**Table A.2 German Sample Summary Statistics**

Variable	Female			Male		
	Mean	Min	Max	Mean	Min	Max
Natural Logarithm of (monthly) gross real wage [€ 2005]	7.45	6.17	9.73	7.85	6.17	10.83
Percentile rank of ln(monthly) gross real wage [€ 2005]	37.05	1	100	60.84	1	100
(Annual) Share of women in an occupation	0.62	0	1	0.26	0	0.98
<i>(Annual) Bands of women in an occupation: 0-30 %</i>	0.11	0	1	0.63	0	1
30-40 %	0.06	0	1	0.09	0	1
40-50 %	0.1	0	1	0.08	0	1
50-60 %	0.04	0	1	0.02	0	1
60-70 %	0.31	0	1	0.11	0	1
70-100 %	0.37	0	1	0.06	0	1
(Annual) Occupational demand (%)	3.91	0.03	10.99	2.58	0.01	10.99
(Annual) Mean education level of occupation	0.43	0	1	0.37	0	1
Age	41.69	24	64	41.85	24	64
<i>State Regions: 16 not shown</i>						
<i>Industry: Agriculture</i>	0.01	0	1	0.03	0	1
Manufacturing	0.2	0	1	0.42	0	1
Construction	0.02	0	1	0.11	0	1
Trade	0.15	0	1	0.09	0	1
Transport	0.04	0	1	0.07	0	1
Financial/Insurance banking	0.05	0	1	0.04	0	1
Services	0.54	0	1	0.24	0	1
Work experience (fulltime unless only part-time experience)	13.98	0	47	19.39	0	49
Unemployment experience	0.27	0	1	39.61	15	60
Working hours per week	33.84	15	50	39.25	15	50
<i>Education: Lower level</i>	0.13	0	1	0.13	0	1
Intermediate secondary	0.64	0	1	0.67	0	1
Tertiary level	0.23	0	1	0.21	0	1
Public sector	0.37	0	1	0.2	0	1
<i>Firm size: Less than 200 employees</i>	0.53	0	1	0.47	0	1
Less than 2000	0.26	0	1	0.26	0	1
Greater than 2000	0.21	0	1	0.27	0	1
Job tenure	10.38	0	45	11.91	0	50
<i>Job requirements: no training or short introduction to job</i>						
Job requires on-the-job training or courses	0.15	0	1	0.11	0	1
Job requires vocational training	0.11	0	1	0.15	0	1
Job requires further college (technical/university) training	0.57	0	1	0.54	0	1
Married	0.17	0	1	0.2	0	1
No dependent children in household	0.66	0	1	0.73	0	1
One child in hh	0.62	0	1	0.53	0	1
Two or more children in hh	0.22	0	1	0.22	0	1
Hours of housework (per week)	0.15	0	1	0.25	0	1
Hours of overtime per week	9.81	0	50	3.31	0	50
Trade Union member	1.68	0	23	2.79	0	23
Occupational switch: microclass change	0.23	0	1	0.31	0	1
	0.23	0	1	0.28	0	1

**Table A.3 Swiss Sample Summary Statistics**

Variable	Female			Male		
	Mean	Min	Max	Mean	Min	Max
Natural Logarithm of (monthly) gross real wage [CHF 2005]	8.45	6.93	10.68	8.95	6.94	11.78
Percentile rank of ln(monthly) gross real wage [CHF 2005]	33.71	1	100	64.24	1	100
(SLFS: Annual) Share of women in an occupation	0.61	0.01	0.98	0.32	0	0.93
(SLFS: Annual) Bands of women in an occupation: 0-30 %	0.14	0	1	0.61	0	1
30-40 %	0.1	0	1	0.12	0	1
40-50 %	0.16	0	1	0.1	0	1
50-60 %	0.43	0	1	0.14	0	1
60-70 %	0.06	0	1	0.01	0	1
70-100 %	0.1	0	1	0.01	0	1
(SLFS: Annual) Occupational demand (%)	4.34	0.06	10.39	2.94	0.02	10.39
(SLFS: Annual) Mean education level of occupation	0.61	0.22	1	0.65	0.21	1
Observed in panel (waves)	6.83	2	13	7.49	2	13
Age	43.57	24	63	44.46	24	64
<i>Cantonal Regions: 7 not shown</i>						
Work experience	21.66	0	49	25.93	0	52
Working hours per week	32.05	15	50	40.68	15	50
Part-time status	0.64	0	1	0.12	0	1
Temporary contract	0.04	0	1	0.04	0	1
Public sector	0.47	0	1	0.33	0	1
Education: Lower level	0.18	0	1	0.09	0	1
Intermediate secondary	0.58	0	1	0.54	0	1
Tertiary level	0.24	0	1	0.37	0	1
Firm size: Less than 200 employees	0.46	0	1	0.36	0	1
Less than 500	0.35	0	1	0.37	0	1
Greater than 500	0.19	0	1	0.28	0	1
Industry: Agriculture,	0.01	0	1	0.03	0	1
Manufacturing	0.09	0	1	0.23	0	1
Construction	0.01	0	1	0.06	0	1
Trade	0.13	0	1	0.1	0	1
Transport	0.04	0	1	0.09	0	1
Financial/Insurance banking	0.07	0	1	0.09	0	1
Services	0.65	0	1	0.39	0	1
Received job training (courses) in past 12 months	0.48	0	1	0.45	0	1
(SLFS: Annual) Occupation follows job training (mean)	0.27	0	0.58	0.27	0	0.76
Corresponding job qualifications	0.8	0	1	0.82	0	1
Married	0.53	0	1	0.7	0	1
No dependent children in household	0.66	0	1	0.54	0	1
One child in hh	0.15	0	1	0.16	0	1
Two or more children in hh	0.19	0	1	0.3	0	1
Hours of housework (per week)	12.04	0	50	5.68	0	50
Trade Union member	0.25	0	1	0.29	0	1
Occupational switch: microclass change	0.07	0	1	0.07	0	1

**Table A.4** Determinants of log (monthly) wages in Britain: 1991-2009 fixed-effects estimates

	M0 FE FE Base	M2 FE Human Capital	M3 FE Job Specific Skills	M4 FE Differential Household Investment	M5 FE Unions
<b>WOMEN</b>					
Share of women in occupation	<b>-0.15 (0.02)</b>	<b>-0.15 (0.02)</b>	<b>-0.13 (0.02)</b>	<b>-0.14 (0.02)</b>	<b>-0.16 (0.02)</b>
Mean education of occupation			<b>0.19 (0.03)</b>		
Follows job training (occupation mean)			<b>0.15 (0.06)</b>		
Received job training (last 12 months)			<b>0.01 (0.00)</b>		
Job tenure			<b>0.00 (0.00)</b>		
Job tenure squared/100			<b>-0.01 (0.00)</b>		
Married/Living as couple				<b>0.02 (0.01)</b>	
1 child in household				<b>-0.04 (0.01)</b>	
2 or more children in hh				<b>-0.09 (0.01)</b>	
Hours of housework (per week)				<b>-0.00 (0.00)</b>	
Hours of overtime (per week)				<b>0.01 (0.00)</b>	
Union coverage in workplace					<b>0.06 (0.01)</b>
Human capital and workplace controls introduced	No	Yes	Yes	Yes	Yes
R2 within	0.46	0.50	0.51	0.52	0.50
N			34 163		
n			4 700		
<b>MEN</b>					
Share of women in occupation	<b>-0.13 (0.02)</b>	<b>-0.14 (0.02)</b>	<b>-0.13 (0.02)</b>	<b>-0.12 (0.02)</b>	<b>-0.14 (0.02)</b>
Mean education of occupation			<b>0.09 (0.02)</b>		
Follows job training (occupation mean)			0.11 (0.06)		
Received job training (last 12 months)			0.00 (0.00)		
Job tenure			<b>0.00 (0.00)</b>		
Job tenure squared/100			<b>-0.01 (0.00)</b>		
Married/Living as couple				<b>0.03 (0.01)</b>	
1 child in household				<b>0.02 (0.01)</b>	
2 or more children in hh				<b>0.03 (0.01)</b>	
Hours of housework (per week)				<b>-0.00 (0.00)</b>	
Hours of overtime (per week)				<b>0.01 (0.00)</b>	
Union coverage in workplace					<b>0.04 (0.01)</b>
Human capital and workplace controls introduced	No	Yes	Yes	Yes	Yes
R2 within	0.21	0.31	0.32	0.34	0.31
N			37 167		
n			4 808		

Source: QLFS (:2); BHPS 1991-2008/9

Notes: **bold p** <0.05. Human capital and workplace controls included in models M2-M5 are occupational demand (%), region, industry, firm size and sector, occupational switch, annual weeks employed, age; age squared, unemployment spell, education level, temporary and part time status. All models control for normal weekly workhours, and year. Robust standard errors are shown in parentheses.

**Table A.5** Determinants of log (monthly) wages in Germany: 1991-2010 fixed-effects estimates

	M0 FE FE Base	M2 FE Human Capital	M3 FE Job Specific Skills	M4 FE Differential Household Investment	M5 FE Unions <sup>a</sup>
<b>WOMEN</b>					
Share of women in occupation	<b>-0.05 (0.01)</b>	<b>-0.05 (0.01)</b>	<b>-0.03 (0.01)</b>	<b>-0.05 (0.01)</b>	<b>-0.07 (0.02)</b>
Mean education of occupation			<b>0.08 (0.02)</b>		
Job requires on-the-job training or courses			0.01 (0.01)		
Job requires vocational training			<b>0.03 (0.01)</b>		
Job requires further college (technical/university) training			<b>0.02 (0.01)</b>		
Job tenure			<b>0.01 (0.00)</b>		
Job tenure squared / 100			<b>-0.01 (0.00)</b>		
Married				-0.01 (0.01)	
1 child in household				<b>-0.02 (0.01)</b>	
2 or more children in hh				<b>-0.05 (0.01)</b>	
Hours of housework (per week)				<b>-0.00 (0.00)</b>	
Overtime hours per week				<b>0.01 (0.00)</b>	
Union member					0.01 (0.01)
Human capital and sector controls introduced	No	Yes	Yes	Yes	Yes
R2 within	0.28	0.31	0.32	0.32	0.35
N			50 464		13 093
n			7 235		6 197
<b>MEN</b>					
Share of women in occupation	<b>-0.05 (0.01)</b>	<b>-0.03 (0.01)</b>	<b>-0.02 (0.01)</b>	<b>-0.03 (0.01)</b>	<b>-0.06 (0.02)</b>
Mean education of occupation			<b>0.03 (0.01)</b>		
Job requires on-the-job training or courses			<b>0.02 (0.01)</b>		
Job requires vocational training			<b>0.02 (0.01)</b>		
Job requires further college (technical/university) training			<b>0.06 (0.01)</b>		
Job tenure			0.00 (0.00)		
Job tenure squared / 100			-0.00 (0.00)		
Married				<b>0.03 (0.01)</b>	
1 child in household				0.00 (0.00)	
2 or more children in hh				<b>0.01 (0.01)</b>	
Hours of housework (per week)				<b>-0.00 (0.00)</b>	
Overtime hours per week				<b>0.01 (0.00)</b>	
Union member					-0.00 (0.01)
Human capital and sector controls introduced	No	Yes	Yes	Yes	Yes
R2 within	0.14	0.20	0.20	0.21	0.26
N			65 351		17 112
n			8 812		7 742

Source: SOEP v27, 1991-2010

Notes: **bold p** < 0.05. <sup>a</sup> 1993, 1998, 2001, 2003, 2007. Human capital and workplace controls included in models M2-M5 are occupational demand (%), region, industry, firm size, sector, occupational switch, work experience, work experience squared, unemployment spell, education level, temporary and part time status. All models control for normal weekly workhours, and year. Robust standard errors are shown in parentheses.

**Table A.6** Determinants of log (monthly) wages in Switzerland: 1999-2011 fixed-effects estimates

	M0 FE FE Base	M2 FE Human Capital	M3 FE Job Specific Skills	M4 FE Differential Household Investment	M5 FE Unions <sup>a</sup>
<b>WOMEN</b>					
Share of women in occupation	<b>-0.14 (0.05)</b>	<b>-0.14 (0.05)</b>	-0.07 (0.05)	<b>-0.13 (0.05)</b>	<b>-0.13 (0.05)</b>
Mean education of occupation			<b>0.19 (0.08)</b>		
Follows job training (occupation mean)			0.09 (0.07)		
Received job training (last 12 months)			<b>0.01 (0.01)</b>		
Corresponding job qualifications			<b>0.03 (0.01)</b>		
Married				<b>-0.06 (0.02)</b>	
1 child in household				<b>-0.05 (0.01)</b>	
2 or more children in hh				<b>-0.08 (0.01)</b>	
Hours of housework (per week)				<b>-0.00 (0.00)</b>	
Trade union member					<b>0.02 (0.01)</b>
Human capital and workplace controls introduced	No	Yes	Yes	Yes	Yes
R2 within	0.23	0.26	0.27	0.28	0.25
<i>N</i>			10 148		9 130
<i>n</i>			2 147		2 149
<b>MEN</b>					
Share of women in occupation	-0.05 (0.03)	-0.03 (0.03)	-0.01 (0.03)	-0.03 (0.03)	-0.02 (0.03)
Mean education of occupation			<b>0.10 (0.05)</b>		
Follows job training (occupation mean)			0.04 (0.04)		
Received job training (last 12 months)			0.01 (0.00)		
Corresponding job qualifications			<b>0.02 (0.01)</b>		
Married				<b>0.04 (0.01)</b>	
1 child in household				0.01 (0.01)	
2 or more children in hh				<b>0.02 (0.01)</b>	
Hours of housework (per week)				-0.00 (0.00)	
Trade union member					0.01 (0.01)
Human capital and workplace controls introduced	No	Yes	Yes	Yes	Yes
R2 within	0.06	0.13	0.14	0.14	0.15
<i>N</i>			12 361		11 120
<i>n</i>			2 427		2 427

Source: SLFS; SHP 1999-2011

Notes: **bold p** < 0.05. <sup>a</sup> excludes 2010 Human capital and workplace controls included in models M2-M5 are occupational demand (%), region, industry, firm size, sector, occupational switch, work experience, work experience squared, unemployment spell, education level, temporary and part time status. All models control for normal weekly workhours, and year. Robust standard errors are shown in parentheses.

**Table A.7** Determinants of wage percentile rankings in Britain, Germany and Switzerland

		M0 OLS base	M0 Fixed- Effects FE base	M1 FE Workplac e controls	M2 FE Human capital	M3 FE Job specific skills	M4 FE Differenti al househol d investme nt	M5 FE Unions <sup>a</sup>	M6 FE (M1-M4)
Britain	Women	<b>-17.1</b> (0.63)	<b>-7.97</b> (0.85)	<b>-7.80</b> (0.88)	<b>-7.48</b> (0.85)	<b>-5.61</b> (0.96)	<b>-6.91</b> (0.83)	<b>-7.58</b> (0.84)	<b>-5.05</b> (0.94)
	Men	<b>-5.61</b> (0.51)	<b>-7.97</b> (0.86)	<b>-9.46</b> (0.94)	<b>-7.67</b> (0.94)	<b>-7.99</b> (0.88)	<b>-6.99</b> (0.81)	<b>-7.68</b> (0.85)	<b>-7.37</b> (0.83)
Germany	Women	<b>-14.9</b> (0.49)	<b>-2.52</b> (0.78)	<b>-2.31</b> (0.77)	<b>-2.05</b> (0.75)	-1.11 (0.76)	<b>-1.95</b> (0.74)	<b>-3.91</b> (1.33)	-1.10 (0.75)
	Men	<b>8.69</b> (0.41)	<b>-2.70</b> (0.65)	<b>-2.55</b> (0.72)	<b>-1.65</b> (0.69)	-1.32 (0.68)	<b>-1.61</b> (0.68)	<b>-2.82</b> (0.02)	-1.29 (0.68)
Switzerland	Women	<b>-15.3</b> (1.00)	<b>-6.90</b> (2.34)	<b>-7.08</b> (2.24)	<b>-6.60</b> (2.37)	<b>-4.36</b> (2.45)	<b>-6.30</b> (2.42)	<b>-6.38</b> (2.44)	-3.82 (2.48)
	Men	<b>2.34</b> (0.93)	-3.02 (1.81)	-2.56 (1.86)	-1.64 (1.73)	-0.09 (1.80)	-1.85 (1.72)	-1.30 (1.73)	-1.28 (1.78)

Source: BHPS; SHP; SOEP v27

Notes: **bold p** <0.05. Robust standard errors are shown in parentheses.

Controls included in models:

- M0 to M6: normal weekly workhours, year, labor demand (share of employment in a given occupation)
- M1 to M6: occupational demand (%), region, industry, firm size and sector, occupational switch. Controls included in models
- M2 to M6: work experience (age; age squared), unemployment spell, education level, temporary and part time status.
- M3 and M6: on the job training, job tenure, job's skill requirements (see table A.2 to A.4 for detailed overview)
- M4 and M6: married, number children in household, hours of housework and overtime work
- M5 only: union coverage in workplace or union membership

<sup>a</sup> As union membership has not been asked in every year, these models are estimated on a reduced set of years.



## Endnotes

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- 1 Another argument that we will not further pursue in this paper relates to the crowding of women in a few occupations. The idea is that employer discrimination – or women’s own preferences – leads women to look for employment in a few female occupations, resulting in excess supply and driving down wages (Bergmann 1974, Grönlund and Magnusson 2013).
- 2 For upper secondary *general* education, the graduation rates in the OECD were 56 percent for women, but only 44 percent for men in 2010. In contrast, graduation rates from *vocational* programmes were 32 percent for women and 37 percent for men. There are no gender-specific data for Britain, but the gender gap in vocational degrees in Germany is large: in 2010, 52 percent of men but only 42 percent of women chose the vocational educational track (OECD 2012: 53).
- 3 This point is well demonstrated by England et al. (2000) in their reply to Tam (1997).
- 4 We exclude the Northern Ireland sample in the BHPS, and the high earner sample (G) in SOEP.
- 5 While the legal retirement age is identical in the three countries for men, it varies for women. Accordingly, our sample consists of men aged between 24-64 in Britain, and women aged 24-59 in Britain, 24-64 for women and men in Germany, and men aged 24-64 and women aged 24-63 in Switzerland.
- 6 As a sensitivity check we estimated our regressions excluding those on a part-time contract. This does not substantially alter our results.
- 7 We benefit from the crosswalks generated by Lambert and Griffith (2011). These translate 3-digit 1990 Standard Occupational Coding (SOC90) indicators in the British data, and 4-digit 1988 International Standard Classification of Occupations (ISCO-88) in the Swiss and German data, with minor modifications, into the ‘micro-class’ scheme. More information can be found at: <http://www.geode.stir.ac.uk/>
- 8 Wages are deflated on the basis of Eurostat’s Consumer Price Index (CPI Eurostat index).
- 9 The years 1991 and 1992 refer to annual data, as the design of data-collection began to operate on a quarterly basis only in 1993.
- 10 Up until 1996 in the SOEP, the question of ‘contract duration’ was only asked of respondents who had changed jobs in the reference year. As a consequence, we assume constancy across 1991-1995 if no change is reported.
- 11 Neither an unemployment spell nor tenure indicator is available for Switzerland. A question on employer tenure was only asked in the first four waves of the SHP, and as a consequence indicators for tenure are absent in the Swiss models. In our checks for the effect of average occupational tenure (SLFS) in the job-specific skills models, estimates were largely unchanged.
- 12 For 2007 in the Swiss data, industrial sector is imputed from the previous year if no changes in employer or job are reported since the missing data reach over 10% on this particular item preventing us from dropping such a large portion of our sample.
- 13 The question of overtime hours is not asked in the SHP, as a check we modelled an imperfect proxy calculation for overtime hours on the basis of usual hours minus contractual weekly hours, in addition to an aggregate of the proportion of individuals in an occupation who report 50 hours or more usual weekly hours, but neither measures changed our substantive results and were thus excluded.
- 14 Accordingly, we are only able to estimate our regressions for union membership on a reduced German sample consisting of five non-consecutive waves. In Switzerland, we exclude the year 2010 from our union models as the question of union membership was not asked in this wave.
- 15 Since wages are in log terms, we would need to transform the larger coefficients of our independent variables to obtain precise results; a coefficient of -0.15 for British women thus gives us:  $1 - \exp(0.15) = 0.16$ ; this corresponds to a wage drop of 16%.