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by

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ABSTRACT

Data for Germany, Britain and the United States are used to investigate the hypothesis that women, especially married women, are less responsive than men to expected occupational wage differentials.

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1. Introduction

It is widely held that occupational segregation accounts for much of the gender gap in remuneration. This finding results from numerous studies which examine the role played by occupational selection in determining remuneration (see, for instance, Dolton *et al*., 1989). In this note, I approach the question of the gender-specific determination of occupation from a different angle: the responsiveness of different demographic groups to expected inter-occupational wage differentials is assessed. In so doing, I develop a model of the simultaneous determination of labor market participation and occupation.

Previous studies of female labor market participation have touched on some, but not all, of the issues discussed here. In particular, the literature on part time work exemplified by Blank (1989, 1990) and by Nakamura and Nakamura (1983) considers female labor market decision-making in a limited dependent variable framework bearing a family resemblance to that adopted in the sequel. Here, though, greater emphasis is placed on the occupational regime into which each worker is placed. In the latter respect, the paper bears some resemblance to the work of Schmidt and Strauss (1975) and of Brown *et al*. (1999). Perhaps the most obvious antecedent of the present work, however, is provided by Dolton and Makepeace (1993) who examine the supply to the labor market of female teachers.

2. Method and data

The approach pursued is to construct a bivariate probit model of participation and occupational regimes. Three stages may be identified. In the first, I consider two latent variables,

$$P^*_i = \boldsymbol{X}_i\varphi + \varepsilon_{1i} \tag{1}$$

and

$$S^*_i = \boldsymbol{Y}_i\xi + \varepsilon_{2i} \tag{2}$$

These underpin individuals' observed behavior as regards labor market participation (P_i=1 iff P^*_i>0, otherwise P_i=0) and occupation (S_i=1 iff S^*_i>0, otherwise S_i=0), where P and S are both binary and represent employment and skilled occupation respectively. Explanatory variables are denoted by the vectors $\boldsymbol{X}_i$ and $\boldsymbol{Y}_i$ and the ε denote residuals. The set of variables included in $\boldsymbol{Y}_i$ include *inter alia* all measurable determinants of occupation-specific earnings, so the model may usefully be thought of as a reduced form. Since S_i is observed iff P_i=1, this is a censored (bivariate) probit model of the type discussed by Meng and Schmidt (1985).

The second stage involves the estimation of occupation-specific earnings equations which, following Heckman (1979) and Lee (1983), correct for sample selection bias. This is done by deriving, from the reduced form bivariate probit, a pair of sample selection terms, $\lambda^p{}_i$ and $\lambda^o{}_i$, respectively representing the otherwise unobserved impact of participation and occupational choice on the *i*th individual's earnings. Ahn (1992) shows that these selection terms may be defined as

$$\lambda^p{}_i = \phi(\boldsymbol{X}_i\varphi)\ \Phi[(\boldsymbol{Y}_i\xi - \rho\boldsymbol{X}_i\varphi)/(1-\rho^2)^{½}]\,/\,F(\boldsymbol{X}_i\varphi,\ \boldsymbol{Y}_i\xi,\ \rho) \tag{3}$$

$$\lambda^o{}_i = \phi(\boldsymbol{Y}_i\xi)\ \Phi[(\boldsymbol{X}_i\varphi - \rho\boldsymbol{Y}_i\xi)/(1-\rho^2)^{1/2}]\ /\ F(\boldsymbol{X}_i\varphi,\ \boldsymbol{Y}_i\xi,\ \rho) \tag{4}$$

where ϕ is the density of the standard normal, Φ is the standard normal distribution function, F is the bivariate standard normal distribution and ρ is corr($\varepsilon_1,\varepsilon_2$). Hence, in occupation $j = u,s$, the gender-specific earnings equations to be estimated are given by

$$\ln w_{ji} = \alpha_j + \boldsymbol{Z}^+{}_i\boldsymbol{\beta}^+{}_j + \gamma_j\lambda^p{}_i + \delta_j\lambda^o{}_i + \varepsilon_{3ji} \tag{5}$$

where $\boldsymbol{Z}^+{}_i$ is a vector of the ith individual's characteristics. The standard errors attached to the estimated coefficients of these earnings functions must be adjusted using the method of Ham (1982).

The third stage of the modelling procedure is to estimate the system given by (1) and the followng equation (2').

$$S^*{}_i = \boldsymbol{Y}^+{}_i\xi^+ + \kappa(\widehat{\ln w_{si} - \ln w_{ui}}) + \varepsilon'_{2i} \tag{2'}$$

The λ terms are set to zero in using (5) to calculate the expected relative wage which appears in (2'). The vector $\boldsymbol{Y}^+{}_i$ contains all variables in $\boldsymbol{Y}_i$ with the exception of some or all of the variables which comprise $\boldsymbol{Z}^+{}_i$.

Put simply then, a structural form of the bivariate probit is used to analyse participation and occupation, where occupation is hypothesised to be responsive to variations in the expected relative wage. Of especial interest is a test of the sign and significance of κ and of the associated marginal effects, and how the latter vary across demographic groups.

3. Results

The data used in the analysis reported below refer to the Federal Republic of Germany, Great Britain, and the United States of America over the period 1988-91. They come from the International Social Survey Program (ISSP), and so have been collected on as consitent a basis as possible. Additional data, on local unemployment rates, have been grafted on to the ISSP data set from three sources: the *US Statistical Yearbook*, the *Statistiches Jahrbüch*, and *Regional Trends*.

The choice of countries is intended to reflect a variety of labor market types – from the relatively free market of the US to the more regulated market of Germany, with Britain coming somewhere in the middle. The choice of period captures a time frame during which Britain was moving rapidly into recession, while macroeconomic conditions in the other two countries were somewhat more stable.[1]

The analysis is conducted separately for men, single women and married women in the 21-55 age group, and coefficients are estimated separately for each of the three countries. The

[1] As ever, the choice of both countries and period was dictated also, to an extent, by data availability.

specification of the preferred model described here, however, is identical across countries and demographic groups.

The selectivity-corrected earnings functions take a simple Mincerian form; the dependent variable is the log hourly wage, with years of schooling, potential experience, experience squared, a part-time dummy, and year dummies as regressors.[2] The reduced form bivariate probits also include all of these as explanatory variables in the occupation equation, plus a set of region dummies. In the participation equation, the explanatory variables are potential experience, household size, the local unemployment rate, and year dummies. For reasons of space, the reduced form probits and the earnings equations are not reported here.[3]

Two features of the earnings equations are worth reporting, however. First, the coefficient on part-time work is positive (often significantly so) for all demographic groups, occupations and countries with one exception (skilled married women in the USA). This is a rather surprising result, in that is suggests that part-time workers are not underpaid relative to their full-time counterparts, though it is consistent with the finding of Blank (1990) that the rate of return to education for part-time workers is relatively high. It seems that, when the different propensities of part-time and full-time workers to enter different occupations is accounted for, the apparent penalty associated with membership of the former group vanishes. Secondly, the local unemployment rate does not appear as a regressor in the wage equations because it was found to be nowhere significant. Once allowance has been made for sample selection bias, the robustness of the wage curve comes into question.

Tables 1 through 3 give the results of the structural model in each country and for each of the demographic groups. A number of consistent patterns emerge. The coefficient on household size is positive in the participation equation for men in all countries, but is negative in the equations for both single and married women. With the exception of males and married females in the US (where the relevant coefficients are insignificant), the log of local unemployment has a negative coefficient in the participation equation. In the occupational choice equations, the sign on the expected relative wage coefficient is always positive for men (significantly so in Germany and Britain), and always negative (sometimes, surprisingly, significantly so) for married women.

The coefficients evaluated in a bivariate probit are not easily interpreted, however, and it is often more useful to examine the marginal effects. These may be calculated using the method of Christofides *et al*. (1997), and are reported in Table 4 for the coefficient on the expected relative wage variable. It is easily seen that, in each country, men respond to expected wage differentials across occupations so that, *ceteris paribus*, they are more likely to enter a given occupation when the wage differential is relatively large in favor of that occupation.

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[2] For Germany, no data on years of schooling are given in the ISSP for 1989, so these had to be estimated using information about highest level of schooling completed.

[3] The interested reader may, however, refer to them at http://www.lancs.ac.uk/people/ecagj/wagediff.html, where further information on the definition of variables is also available.

4. Conclusions

The results reported above suggest that males are more responsive than females to changes in the expected relative wage across occupations. The pattern is remarkably consitent across countries in Europe and North America. While there exists a variety of explanations for this observation, it is consitent with the widespread presence of gender based occupational segregation – women may simply not be able to respond to occupational wage differentials because their access to certain occupations remains limited.

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Table 1
Structural bivariate probit estimates of the participation and occupational choice equations: Federal Republic of Germany

	males		single females		married females	
	occupation	participation	occupation	participation	occupation	participation
constant	-3.738	0.695	0.565	0.792	0.990	0.761
	(8.85)	(4.23)	(0.35)	(3.21)	(1.39)	(3.78)
expected relative wage	4.888		1.098		-4.651	
	(10.89)		(2.56)		(3.66)	
experience	0.009	0.038	-0.088	0.001	-0.020	-0.010
	(1.75)	(14.66)	(7.36)	(0.30)	(1.27)	(2.82)
household size		0.087		-0.052		-0.284
		(3.59)		(1.14)		(9.13)
log of the local unemployment rate		-0.028		-0.035		-0.003
		(2.02)		(1.67)		(0.22)
ρ	-0.995		-0.005		0.820	
	(126.947)		(0.00)		(2.77)	
log likelihood	-1129.088		-564.533		-964.313	

Note: t statistics appear in parentheses. The occupational choice equation also includes regional dummies; the participation choice equation also includes year dummies.

Table 2
Structural bivariate probit estimates of the participation and occupational choice equations: Great Britain

	males		single females		married females	
	occupation	participation	occupation	participation	occupation	participation
constant	-0.377	1.759	2.579	1.153	1.510	0.962
	(3.40)	(6.38)	(1.31)	(3.01)	(2.40)	(4.41)
expected relative wage	5.716		-0.977		-0.903	
	(13.37)		(0.94)		(2.60)	
experience	-0.023	-0.007	-0.073	-0.014	-0.061	-0.009
	(5.51)	(1.50)	(2.47)	(2.07)	(6.49)	(2.40)
household size		0.055		-0.045		-0.113
		(1.67)		(0.81)		(3.37)
log of the local unemployment rate		-0.069		-0.042		-0.010
		(3.08)		(1.35)		(0.63)
ρ	0.956		-0.008		-0.011	
	(1.10)		(0.00)		(0.01)	
log likelihood	-981.926		-343.418		-1151.235	

Note: See note to Table 1.

Table 3
Structural bivariate probit estimates of the participation and occupational choice equations: USA

	males		single females		married females	
	occupation	participation	occupation	participation	occupation	participation
constant	0.877	0.730	1.316	0.927	0.637	0.721
	(0.49)	(2.54)	(1.89)	(2.96)	(0.62)	(2.33)
expected relative wage	0.012		-0.930		-0.582	
	(0.13)		(3.26)		(1.63)	
experience	-0.098	0.013	-0.045	-0.006	-0.059	-0.014
	(3.52)	(3.56)	(5.27)	(1.26)	(3.02)	(3.02)
household size		0.014		-0.068		-0.040
		(0.49)		(2.11)		(1.26)
log of the local unemployment rate		0.020		-0.013		0.009
		(0.43)		(0.25)		(0.19)
ρ	0.003		-0.003		-0.005	
	(0.00)		(0.00)		(0.00)	
log likelihood	-999.704		-712.970		-911.569	

Note: See note to Table 1.

Table 4
Marginal effects of the expected wage variable

	Germany	Great Britain	USA
males	1.128	0.26×10^{5}	0.001
single females	0.089	-0.188	-0.39×10^{-13}
married females	-0.25×10^{-8}	-0.066	-0.17×10^{-13}