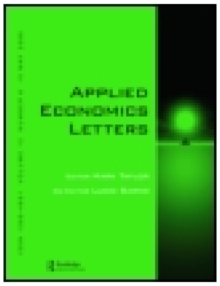

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Occupation and the labour market participation of women: why do some people trade down jobs when careers are interrupted?

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Occupation and the labour market participation of women: why do some people trade down jobs when careers are interrupted?

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A dynamic structural discrete choice model of labour market participation, schooling and occupational choice is applied to data for women drawn from the British Cohort Study. It is established that, for relatively highly educated workers, the return attached to childrearing is higher in the part-time non-managerial work regime than in the part-time managerial work regime. As a consequence, following childbirth, many female managers switch to occupations that underutilise their skills.

The full-time gender pay differential in the United Kingdom has responded to legislative interventions, and has substantially declined since the 1970s. The situation facing part-time workers is, however, less sanguine, with Francesconi and Gosling (2005) estimating that the earnings of part-time women are typically more than 30% lower than those of full-time men; this is twice the gap between full-time women and full-time men. Olsen and Walby (2004) provide similar evidence. Moreover, there is evidence to suggest that many women 'trade down' occupations following childbirth, often in order to secure employment that is part-time and, therefore, more sympathetic to their other commitments, this leading to the underutilization of a substantial stock of human capital (Darton and Hurrell, 2005; Johnes, 2006). This note investigates the reasons why trading down of occupations should happen. It represents the first step of an exercise designed to establish what policies could reduce the incidence of this 'hidden brain drain'.

The study concerns some 5155 women for which complete 14 year career histories are available in the British Cohort Study (BCS) for the period 1986 to 1999.[1] These data were kindly provided by the UK Data Archive. At the start of this period, respondents were aged 16, so the study follows them through to age 29. At the end of each year, each respondent's activity is classed into one of six mutually exclusive and collectively exhaustive categories: working full-time (30 hours per week or more) in a position with managerial responsibilities; working full-time in a nonmanagerial occupation; working part-time with managerial responsibilities; working part-time without managerial duties; full-time schooling; not working (and not in

[1] A somewhat more conventional multinomial logit analysis of *male* career choices, using this same dataset, is provided by Anyadike-Danes and McVicar (2005). These authors use optimal matching and cluster analysis to define a number of career path types, while the present analysis seeks to explain career paths in a dynamic context.

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full-time education). These categories are similar, albeit not identical, to those used in Johnes (2006).

The method used to analyse these data is the dynamic structural discrete choice model developed by Keane and Wolpin (1994, 1997). Rather than estimating the parameters of an empirical counterpart to a theoretical model, this method allows the parameters of the theoretical model itself to be evaluated using simulated maximum likelihood methods.[2] The model can be formalized by writing the instantaneous returns to each regime as follows.

$$R_{fm}(t) = \exp\{\alpha_0 + \alpha_1 x_s + \alpha_2 x_{fm} + \varepsilon_1\}$$

$$R_{fn}(t) = \exp\{\beta_0 + \beta_1 x_s + \beta_2 x_{fn} + \varepsilon_2\}$$

$$R_{pm}(t) = \exp\{\chi_0 + \chi_1 x_s + \chi_2 x_{fm} + \chi_3 x_{pm} + \varepsilon_3\} + \chi_4 c$$

$$R_{pn}(t) = \exp\{\delta_0 + \delta_1 x_s + \delta_2 x_{fn} + \delta_3 x_{pn} + \varepsilon_4\} + \delta_4 c$$

$$R_s(t) = \phi_0 + \varepsilon_5$$

$$R_h(t) = \gamma_0 + \gamma_1 c + \varepsilon_6$$

where R denotes returns, x denotes experience, c is a binary variable denoting the presence of a child (here assumed exogenous), and the ε terms are stochastic errors. The subscripts *fm*, *fn*, *pm*, *pn*, *s* and *h* refer, respectively to the six regimes: full-time managerial; full-time nonmanagerial; part-time managerial; part-time nonmanagerial; schooling and home. The errors are all assumed normal with zero mean; their SDs, denoted $\sigma_1, \ldots, \sigma_6$, are to be estimated as parameters of the model. In common with other studies of this type (Keane and Wolpin, 1997; Eckstein and Wolpin, 1999; Stinebrickner, 2001; Imai and Keane, 2004) we evaluate the parameters of this model separately for distinct 'types' of workers – in this case those educated to at least A level and others.[3] There are therefore, a total of 50 parameters to be simultaneously evaluated.

The intuition behind this type of model is extremely simple. In each period, individuals face a choice between the six regimes. They make the choice that, given their accumulation of schooling and experience up to that point, maximizes their expected future returns. Different people make different choices because in each period they receive different shocks drawn from (normal) random distributions; these shocks ensure that the returns attached to each regime differ, even across individuals with identical histories. The trick is then to evaluate (with some restrictions) the expected contribution that experience in each regime makes to expected returns from each regime – hence, for example, we need to evaluate the contribution that a year of schooling makes to the stream of expected future returns (or earnings) obtained by full-time managers, and so on.[4] Starting from assumed initial values of the parameters, a Monte–Carlo approach is used to evaluate the (log-)likelihood with which the observed pattern of regime selection across time occurs for each individual in the sample. An iterative procedure is then used to modify the parameter estimates in such a way as to maximize the likelihood.

In practice, the estimation of a model of this kind is complicated by the large state space involved. The evaluation of the return associated with, say, schooling in 1996 involves a comparison of all subsequent possible career paths (of which there are about 78 billion). Since the instantaneous return attached to any one regime is stochastic, the evaluation of returns in such a large state space is clearly a computationally formidable exercise. Keane and Wolpin (1994) have devised approximation methods that can be used to finesse this problem, and here we follow their lead. Since the dataset being used here is large, a 50–50 approximation specification is used (using the first of their approximation methods for large state spaces). In essence, Keane and Wolpin's method involves the use of Monte–Carlo methods to evaluate expected maximum returns for a subset of (in this case 50) points in the state space, and corresponding estimates for the remaining points in the state space are arrived at by interpolation.

In contrast with Keane and Wolpin (1997), we do not use data on earnings in the present exercise. Although the BCS data would allow this to be done, this approach is complicated by the fact that returns to part-time work, schooling and home production have nonpecuniary components. The model being estimated here is therefore, simply a dynamic analogue of a static multinomial logit model, and it is therefore, necessary to normalize by prescribing a value for some of the coefficients. For simplicity, we fix ϕ_0 at a value of zero.

A further complicating feature of the analysis results from the highly irregular surface of the likelihood function. Conventional algorithms aimed at maximizing the likelihood are not guaranteed

[2] Other recent papers that use this approach include Stinebrickner (2000, 2001), Imai and Keane (2004) and Lee (2005).
[3] The A (Advanced) level qualification in the United Kingdom is typically taken by upper secondary school pupils at age 18.
[4] In early runs of the model, a more sophisticated earnings determination mechanism than that implied by the above equations was estimated. Therein, the impact on earnings in each working regime of time spent in each other regime was evaluated by the addition of extra explanatory variables. Owing to collinearity between the explanatory variables, the performance of this model was poor, and so it is not reported here.

Table 1. Model results

Relatively highly-educated workers											
α_0	0.461	β_0	0.312	χ_0	−2.150	δ_0	1.086	ϕ_0	0	σ_1	0.968
α_1	0.585	β_1	2.212	χ_1	0.794	δ_1	−0.596			σ_2	1.646
α_2	1.321	β_2	−0.092	χ_2	3.120	δ_2	0.786	γ_0	0.975	σ_3	1.447
				χ_3	−0.012	δ_3	0.928	γ_1	0.418	σ_4	0.324
				χ_4	0.363	δ_4	1.025			σ_5	2.472
										σ_6	3.859
Less highly-educated workers											
α_0	0.835	β_0	0.733	χ_0	−1.093	δ_0	−1.546	ϕ_0	0	σ_1	0.874
α_1	1.882	β_1	1.634	χ_1	0.828	δ_1	−0.357			σ_2	1.052
α_2	0.313	β_2	−3.616	χ_2	0.207	δ_2	−0.110	γ_0	1.281	σ_3	1.626
				χ_3	2.760	δ_3	1.138	γ_1	1.727	σ_4	0.187
				χ_4	−0.220	δ_4	−0.569			σ_5	2.217
Log-likelihood	−151 213.09									σ_6	2.115

to succeed in such contexts, and so an heuristic method, simulated annealing, is used (Kirkpatrick *et al*., 1983; Eglese, 1990; Johnes, 2003). While the ability of heuristics to locate the global maximum is well documented, it is also recognized that they are computationally expensive. As a consequence of all these computational issues, the FORTRAN programme used to estimate the results reported below took several weeks to run on the Lancaster high performance cluster.

The results of the estimation are reported in Table 1. SEs have been computed using the outer product of the gradients method. In common with other exercises of this sort, these imply *t* statistics that are uniformly large; since none is lower than 100 in the present exercise, they are not reported in the table. Parameter estimates appear to be reasonable and in line with what one would expect from the received literature on human capital models. Note that there are some negative parameter estimates; these should be interpreted carefully since they are negative only in relation to the (implicitly assumed) zero coefficients on the corresponding variable in the schooling equation.

Of particular interest in the present context is a comparison of the coefficients χ_4 and δ_4, especially for the case of the worker type that has relatively high levels of education. That, for this type, the latter exceeds the former suggests that nonmanagerial occupations offer greater opportunities than do managerial occupations for mothers to earn (presumably nonpecuniary) returns from child-rearing. This provides an explanation for the observed incidence of new mothers in managerial occupations 'trading down' their occupation upon childbirth.

While computationally burdensome, the model estimated here remains very simple, and some obvious extensions suggest themselves. First, while childrearing has been assumed exogenous in the present article, this assumption needs to be relaxed in future work. Secondly, over a period of rapid social change, the possibility of time-varying coefficients could usefully be explored. Thirdly, structural models of this kind offer great possibilities for modelling responses to policy stimuli; the model could therefore, usefully be extended to incorporate a variety of policy variables. Taken together, these extensions represent an agenda for further research. Nevertheless, from the early work reported above, it is clear that a prerequisite for mitigating the 'hidden brain drain' is the introduction of policies to secure an increase in the return attached to childrearing amongst part-time managers.

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