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Dual-earner migration. Earnings gains, employment and self-selection

Birgitta Rabe

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Abstract This paper examines how spouses in dual-earner couples weigh each partner's expected wage growth in the decision to migrate. Previous research suggests that husbands' job prospects dominate the migration choice irrespective of their relative earnings potential. Based on British panel data, this paper employs an endogenous switching model and estimates wage differentials of migrating vs. staying for husbands and wives corrected for double selectivity of migration and employment. Dual-earner couples attach a positive weight to each partner's expected wage gains when deciding to migrate. Moreover, migrant wives' employment decreases temporarily, and there are significant selection effects in migration and employment amongst non-migrants.

Keywords Family migration · Dual-earner couples · Double selection

JEL Classification J61 · D19 · C35

1 Introduction

This paper examines the factors influencing whether dual-earner couples migrate, as well as the employment consequences of migration. In particular, it investigates the effects of expected wage gains of a husband and a wife on the decision to migrate. Whether the effects are asymmetric has important

Responsible editor: Klaus F. Zimmermann

B. Rabe (✉)
Institute for Social and Economic Research, University of Essex, Colchester,
Essex, C04 3SQ, UK
e-mail: brabe@essex.ac.uk

implications for discriminating between the unitary and collective theory of family migration. Given the rise in the proportion of dual-earner couples (Costa and Kahn 2000), family migration choices also have a significant role in shaping the career prospects of men and women.

The paper makes several contributions. It is one of the first to explicitly examine the impact of each spouse's expected wage differential between origin and destination location on family migration decision making. The main finding is that spouses attach a positive weight to each partner's expected wage growth. Moreover, the paper gives insight into what happens to the employment of husbands and wives when families move. Whilst wives experience a temporary 8.5% reduction in labour force participation after migration, husbands' employment remains unaltered. Finally, the paper accounts for selectivity both in the migration decision and in the wives' employment participation by employing a double-selection framework (Heckman 1979; Tunali 1986). Only few previous papers have studied the double selection into migration and employment (Vijverberg 1995; McNabb and Vijverberg 1998).

The human capital model of family migration assumes that spouses seek to maximise joint family income when making the decision to migrate and that they are indifferent as to who contributes to this income and in which proportion (Mincer 1978; Sandell 1977). Whenever maximisation of family income makes spouses stay (move) although they could individually receive higher earnings by moving (staying), these spouses are tied stayers (movers). Greater market earnings power and more continuous labour force participation potentially yield higher migration returns to husbands than to wives. Wives are therefore likely to be tied movers who experience reductions in wages and working hours following the move, thus reinforcing the initial differences in career prospects between the spouses (e.g. Morrison and Lichter 1988; Jacobsen and Levin 1997; Lee and Roseman 1999; Boyle et al. 2001; Blackburn 2006; Taylor 2007). However, after an initial drop, women do recover their pre-move positions after 1–3 years (Spitze 1984; Maxwell 1988; Lichter 1983; LeClere and McLaughlin 1997).

Many empirical studies focus on the decrease in women's *annual earnings* after migration. These drops result to a large part from a fall in working hours and labour market participation (e.g. LeClere and McLaughlin 1997; Blackburn 2006). The effect of migration on *hourly wage rates*, which could be considered the more accurate predictor of lifetime earnings change given that drops in women's working hours post-migration are typically temporary, is less well researched, and results are more ambiguous. Hourly wage rates are therefore the focus of this paper.

Working wives—in particular if they contribute a large share to family income and have a stable labour force attachment—deter family mobility, making husbands likely to be tied stayers (e.g. Long 1974; Sandell 1977; Mincer 1978; Jürges 1998; Nivalainen 2004). However, several studies show that personal and job characteristics of the wife that should be indicative of high earnings potential, like high occupational status, earnings, or job attachment, exert little or no influence on family migration (e.g. Duncan and Perrucci 1976;

Lichter 1982; Shihadeh 1991; Jürges 1998; Nivalainen 2004; however, Bird and Bird 1985). They infer that the husbands' earnings gains are weighted more heavily than the wives' earnings gains. Jacobsen and Levin (2000) explicitly test the coefficients on a measure of the spouses' potential earnings gain, obtained by estimating regional wage equations. They find that migration is positively related to potential household earnings change regardless of who contributes to it. On the other hand, using spouses' pre-migration income as a measure of earning potential, Cooke (2003) finds that post-migration income is correlated with the husband's earning potential but not with the wife's, thus giving evidence of asymmetrical decision making in favour of the husband. This literature often concludes that a gender-role model performs better in predicting migration than human capital theory does (e.g. Bielby and Bielby 1992; Jürges 2006).

Another interpretation of this literature is that it challenges the unitary family model which underlies the theory of family migration. If modelled in the collective framework of marriage which analyses interactions of spouses with separate sets of preferences, a non-cooperative bargaining model suggests that each spouse's individual utility maximisation may result in location and employment decisions which are not efficient at the household level (Lundberg and Pollak 2003). The main argument is that location decisions of dual-earner couples may affect future bargaining power, for example via the assumption that individual earnings determine distribution within marriage. In the absence of binding commitments to prevent exploitation of future bargaining advantage, inefficient outcomes are plausible and provide an alternative explanation of asymmetrical decision making.

Against this background, this paper investigates how the prospective earnings gains of husbands and wives are weighted when making the migration decision. Unlike many previous papers, the focus is on matched partnerships rather than groups of husbands and wives that are not necessarily associated to each other. This has the advantage that I am able to assess migration outcomes at the household level. Couples are defined to include legally married or cohabiting adults of opposite sex, with or without children. These will be referred to as 'husbands' and 'wives', or 'families'.

2 Econometric methods

In line with the standard human capital formulation, a family's decision to migrate is modelled as a function of, for each spouse, the difference between origin and destination earnings and migration costs. For simplicity, I aggregate all potential destinations into one so that migration is treated as a binary choice. A couple will decide to migrate if the discounted net gain of moving, M^*, is positive. This can be written as:

$$M^* \equiv \Delta Y^{\mathrm{H}} + \Delta Y^{\mathrm{W}} - C > 0, \tag{1}$$

where ΔY^{H} and ΔY^{W} are the present values of the expected lifetime earnings differentials of migrating vs. not migrating for husbands and wives, respectively. C is the present value of the couples' net mobility costs which include monetary and non-monetary costs and benefits of moving like gathering information about alternative labour markets, leaving networks of family and friends etc.

In the empirical specification of this model, I take the expected hourly wage differential of migrating vs. staying at time $t+1$ (i.e. after a possible move between time t and $t+1$) as a predictor of lifetime earnings change. However, counterfactual predicted wages for migrants and non-migrants and migration costs and benefits are not directly observable. Instead of the actual expected gain from migration between time t and time $t+1$, we observe, for each couple i, a binary random variable $M_{i,t+1}$ which is defined as

$$M_{i,t+1} = \begin{cases} 1 \text{ if } M^* \geq 0 \\ 0 \text{ otherwise} \end{cases}.$$

Assuming that migration costs are determined by a vector of exogenous household and both spouse's individual characteristics as well as house price growth in the origin locality, Z, a structural probit model of family migration can be described such that:

$$M_{i,t+1} = \gamma_1 \left(\mathrm{wH}^{\mathrm{mig}}_{i,t+1} - \mathrm{wH}^{\mathrm{stay}}_{i,t+1} \right) + \gamma_2 \left(\mathrm{wW}^{\mathrm{mig}}_{i,t+1} - \mathrm{wW}^{\mathrm{stay}}_{i,t+1} \right) + \gamma_3^{'} Z_{i,t} + v_{i,t+1}, \tag{2}$$

where the first two terms capture the predicted hourly wage differential of migrating vs. staying (mig, stay) for husbands and wives (H, W), respectively. The error term, $v_{i,t+1}$, is normally distributed with 0 mean and unit variance. In what follows I drop the couple-subscript i for ease of exposition.

The predicted hourly wage differential is obtained by estimating log wage equations for migrants and non-migrants, respectively, separately for husbands and wives. These are used to impute wages for the counterfactual situation, i.e. the change in earnings a migrant (stayer) would have received had he or she stayed (migrated). We model wages in $t+1$ as functions of characteristics at time t which is the information set available to families at the time they make their migration decision. The log hourly wage equations for migrating and non-migrating husbands and wives, respectively, which complete the model are:

$$\ln \left(\mathrm{wH}^{\mathrm{mig}}_{t+1} \right) = \beta_1^{'} X H_t + \varepsilon_{1,t}, \tag{3}$$

$$\ln \left(\mathrm{wH}^{\mathrm{stay}}_{t+1} \right) = \beta_2^{'} X H_t + \varepsilon_{2,t}, \tag{4}$$

$$\ln\left(\mathrm{wW}_{t+1}^{\mathrm{mig}}\right) = \beta_3' XW_t + \varepsilon_{3,t}, \tag{5}$$

$$\ln\left(\mathrm{wW}_{t+1}^{\mathrm{stay}}\right) = \beta_4' XW_t + \varepsilon_{4,t}. \tag{6}$$

The wage equations could consistently be estimated by ordinary least squares (OLS) under the assumption that $E(\varepsilon_t) = 0$ if wage data for migrants and non-migrants was randomly selected. However, Eqs. 3–6 may be subject to selectivity in migration as migrants may differ from stayers in observed and unobserved characteristics which also affect wages. Equations 5 and 6 may additionally be subject to selectivity in female employment participation choice as post-migration wages are only observed for wives who participate in employment and they may be a non-random sample of the population.

The equations which model these selection processes are

$$M_{t+1} = \delta_1' X1_t + u_{1,t} \qquad \text{family migration choice} \tag{7}$$

$$\mathrm{PW}_{t+1} = \delta_2' X2_t + \mu_2 M_{t+1} + u_{2,t} \qquad \text{wife's employment} \tag{8}$$

Equation 7 is a linear approximation to the selection process in the latent variable. PW_{t+1} is an indicator function for the wife's employment participation, Xb $(b = 1, 2)$ are vectors of explanatory variables assumed to determine mobility and female employment, respectively, δ_b' are vectors of unknown coefficients, and μ_2 is a scalar unknown coefficient. By including a migration status indicator variable (M_{t+1}) into the participation equation, I allow participation to vary according to the migration choice made. This binary variable captures a level effect of migration on female employment.[1]

By assumption, a family chooses to migrate if the utility of moving exceeds that of staying. At the same time, the spouses make participation choices for wives that depend on both spouses' human capital and job characteristics and which may be interdependent. I discuss the empirical specification of the models in the next section. The household will choose participation of the wife in the labour market if the household's utility from participation exceeds that of non-participation. The utilities of the selection equations are not directly observable; we observe only a dichotomous variable indicating whether or not a couple migrates and whether or not the wife is employed at time $t + 1$.

[1]Several authors have shown that labour force participation choices may differ between women who migrate and women who do not, for example because female migrants might temporarily withdraw from the labour force in order to accommodate increased household needs in the first years following a move.

A two-step estimation approach in the spirit of Heckman (1979) is adopted to deal with the selection problems. This procedure begins by estimating the selection equations and constructing sample-selection correction terms based on these estimates. Then, the wage Eqs. 3–6 can consistently be estimated by OLS, including the correction terms as additional regressors. The wives' wage equations for migrants and non-migrants are corrected for selectivity in migration and the wives' employment participation. The husbands' wage equations are corrected for non-random selection into migration.

If the selection processes specified in Eqs. 7 and 8 are independent, i.e. the correlation of the error terms, $\mathrm{Cov}[u_{1,t}, u_{2,t}] = \rho_{12}$ is equal to 0, the correction terms can be derived from separate probit models for migration and participation choices as in the single selection case. The correction terms for selection into migration then are the inverse Mills ratios, namely:

$$\lambda_M = \frac{\phi\left(\delta_1 X1_t\right)}{\Phi\left(\delta_1 X1_t\right)} \text{ if } M_{t+1} = 1 \text{ and } \lambda_M = \frac{-\phi\left(\delta_1 X1_t\right)}{1 - \Phi\left(\delta_1 X1_t\right)} \text{ if } M_{t+1} = 0 \tag{9}$$

where ϕ is the standard normal density function and Φ is the corresponding standard normal distribution function. The correction terms for wives' selection into employment are derived analogously.

As the migration and participation decisions are—by assumption—made jointly, the selection processes may not be independent, i.e. ρ_{12} may not be equal to 0 even after controlling for observed heterogeneity. In this case, a double-selection framework can be applied (Tunali 1986; Fishe et al. 1981; Ham 1982) which assumes a trivariate normal distribution of the error terms of the outcome equations and the two selection equations. The selection processes are then estimated using a bivariate probit, and augmented selection correction terms are derived.

I adopt an evidence-based procedure as follows: First, I estimate the selection Eqs. 7 and 8 jointly in a bivariate probit model. The resulting model is a recursive, simultaneous equation model because the dependent variable of Eq. 7 appears as independent variable in Eq. 8. Identification of the equation system is assured by employing a set of exclusion restrictions. In particular, each selection equation includes one exogenous variable assumed to be relevant only for this equation which is excluded from the other selection and the wage equations. I describe the variables used in the next section. In all estimates, I adjust the standard errors for having repeated observations on some couples.

These estimates yield a value for ρ_{12} and can be seen as a test for independence of the selection processes. Based on these results, I am able to separate the migration equation from the employment equation because I do not reject the assumption $\rho_{12} = 0$ at a 1% level of significance. This also means that the migration dummy is exogenous in the participation equation.

Thus, I continue to estimate single migration and female employment probits, and I derive inverse Mills ratios to account for selection into migration and employment. These then enter into the log wage equations and allow consistent estimation.

The estimated coefficients on the migrants' and non-migrants' log hourly wage equations are used to predict each spouses' expected wage when migrating and when staying in the original location, separately for husbands and wives. The coefficients of the migrants' wage equations can be interpreted as a weighted average of prices obtainable for individual and job-related characteristics in potential destinations. The weights represent the locations actually chosen by migrants. Conversely, the coefficients on the non-migrants' equations reflect the prices obtainable at an average origin, weighted by the origin locations of stayers. Expected wages are derived from predicted $\widehat{\ln w}$ using $E(\hat{w}) = \exp(\widehat{\ln w} + \hat{\sigma}_\varepsilon^2/2)$ and assuming a log-normal distribution of the log wages. Differencing predicted wages in origin and destination yields a wage differential of migrating vs. staying for each individual. The final step of the procedure is to estimate the structural migration probit (Eq. 2) using these differentials. The coefficients on the wage differentials reveal how the potential gains and losses of migration are weighted between the spouses.

3 Data

The analysis uses the first 16 waves of the British Household Panel Survey (BHPS), spanning 1991 to 2006. The BHPS is a nationally representative sample of about 5,500 households recruited in 1991, containing approximately 10,000 adults who are interviewed each successive year. Data are collected on a broad range of socioeconomic characteristics at both the individual and the household level.

From the BHPS, I extract an estimation subsample. Following common practice, I restrict the analysis to couples, married or cohabiting, who remain intact and living together at the same address over a 2-year period. I choose couples where both spouses were in employment at time *t*, i.e. prior to a possible move and are aged between 18 and 55 inclusive. The focus on dual earners is necessary to answer the central question of this paper about the weighting of the respective wage differentials for both partners. The age band concentrates the analysis on a group most likely to migrate for work-related reasons. The resulting sample is an unbalanced panel which includes all couples, for whom information is available at two consecutive interviews, allowing the same couple to enter the sample several times. After removing observations with missing data for any of the variables used in the analysis, same-sex couples and employees reporting zero working time in the previous week, the sample comprises 11,569 observations with 2,185 unique couples.

Migration is defined in this paper as a change in a family's address in the period between two interviews which also involved crossing the boundaries of one of Britain's 278 BHPS Local Authority Districts (Böheim and Taylor 2007).[2] Any local move within the boundaries of a Local Authority is thus considered to be residential mobility rather than migration. This definition identifies 285 migration events in the dataset. A look at distances moved shows that amongst those couples classified as migrants, the average distance moved was 75 km, and amongst those classified as residential movers, it was 3 km.[3]

Whilst the BHPS attempts to follow all movers who remain in private households in Britain, attrition rates are higher amongst individuals who move house than amongst those who remain in the same residence (Buck 2000). However, in most cases, it is possible to identify the destination area and thus the migrant status of individuals who do not remain in the sample. I have analysed non-response amongst dual-earner couples whose pre-attrition characteristics were identical to the restrictions imposed on my estimating subsample. Attrition is very low in this group (below 2% both amongst non-migrants and migrants). Therefore, I do not expect it to influence the results.

The selection equations are specified as follows: The migration selection equation (Eq. 7) includes all human capital and job-related variables of both spouses that are relevant for the wage equations, specified below. These are included to capture the economic opportunities that the spouses face in the labour market. In addition, I include household and region-of-origin characteristics which act as proxies for the direct and indirect costs and opportunities of moving. The size of the household is an indicator of the direct costs of moving and of the network attached to any family. I distinguish between the number of children under age 5 and over age 5 in the household. Families with pre-school children are often found to migrate in search for better environments for their children whilst the presence of school children usually deters relocation because of the difficulties involved in changing schools. Because legally married spouses may attach a higher cost to partnership dissolution

[2]In the BHPS, Local Authority Districts are aggregated if their population falls below 120,000. Therefore, 278 separate areas can be identified instead of the 354 different Local Authority Districts.

[3]Boundary-based definitions of migration are most commonly used in the migration literature. Alternative definitions are based on distance moved, on self-reported motivations for moving, and/or on information about changing jobs. Each of these definitions is not without problems and potentially risks misclassification of migration and residential mobility. This paper uses the boundary-based definition because (1) this makes the results compatible with previous research using this definition; (2) recent research has suggested that distance moved is an inadequate criterion to distinguish migration and residential mobility, as a significant proportion of short-distance moves have employment explanations, and both long and short distance moves are at least partially motivated by housing adjustment reasons (Clark and Davies Whithers 2007); and (3) a definition based on geographical boundaries allows using region-of-origin characteristics to explain migration, under the assumption that distinct geographies exhibit distinct economic situations.

and would therefore be more likely to migrate together than those merely cohabiting, I include a marital status variable in the migration equation. Non-labour household income (in the month before the interview, equivalised for household size) is assumed to measure a household's ability to take risks. Binary variables indicating outright home ownership vs. mortgaged home ownership vs. rental accommodation approximate the costs of relocation.

Three region-of-origin characteristics are included in the migration model. (1) The regional unemployment rate captures the migration incentives arising from employment opportunities. (2) A binary variable indicates whether a family lived in the South East of England or London. These regions in Britain act as 'escalator regions' that attract potentially upwardly mobile young people and promote them at higher rates than elsewhere in the country (Fielding 1992). There is evidence that a significant proportion of those who achieve high status and pay then 'step off' the escalator by migrating away later in the life cycle. We would therefore expect a higher migration propensity amongst dual-earner couples living in these regions. (3) Relative regional house price growth is included as an instrument to identify the model. More details on this are given below. All of the variables are measured at time t, i.e. the time when the migration decision is assumed to be made.

The wives' employment participation is defined as being in paid employment at time $t+1$, i.e. after possible migration. The equation includes the same variables as the migration equation (measured at time t), i.e. household and region-of-origin characteristics as well as human capital and job-related variables of both spouses to capture the fact that a woman's participation may depend on her own as well as her husband's job prospects. The household characteristics capture well-known effects on female employment. Being married generally decreases the labour force attachment of women. Likewise, the existence of children is expected to reduce a woman's involvement in market work, especially if the children are young. Outright home ownership and increasing amounts of non-labour household income should reduce the dependence of the family on earned wages and thus participation in the labour market.

The dependent variable in the wage offer equations is the log of usual real hourly gross earnings at time $t+1$ in January 2000 prices. Hourly wages were derived from usual monthly wages using hours worked and assuming that paid overtime hours were associated with a 50% wage premium. Wages are modelled as a function of human capital and job-related characteristics at time t. In particular, age, age squared, highest educational degree (five binary variables), occupational status (four binary variables), working time, fixed-term job contract (yes/no) and job tenure (in years) are included in the wage equations. The wage equations also contain the selection correction terms as well as year-of-interview indicator variables. The spouse's human capital and job characteristics and the household characteristics are excluded from the wage equations on theoretical grounds as they do not determine the wage offer an individual will receive. Variables such as spouse's characteristics and housing tenure may be empirically associated with wages, for example because of assortative mating or because past wages influence housing tenure choice, but changing spouse or house does not affect wages.[4]

Identification of the equation system is assured by a set of exclusion restrictions, i.e. exogenous variables included in each selection equation which are not included in or relevant for the other selection or the wage equations. In particular, the migration equation includes the relative change in local house prices[5] in the origin location from time $t-1$ to t, and this is excluded from the other equations. The wives' employment participation equation is identified using a binary variable indicating whether her mother was an employee when she was aged 14. I justify the choice of these instruments in the two paragraphs below.

Relative house price change Research has shown that relative house price appreciation plays an important role in determining migration (Kiel 1994; Chan 2001; Murphy et al. 2006). Falling house prices constrain migration and residential mobility by reducing the equity available to households to repay their mortgages and provide a down payment on a new home (Henley 1998; Chan 2001). Rising house prices, on the other hand, increase the available equity, and households may choose to use it to finance higher consumption of housing or other goods, leading to more house moves (Kiel 1994). Moreover, there is evidence of loss aversion amongst households that experience falling house prices (or conversely, wanting to sell a house which has gained value in the past) which is not an economic constraint but nonetheless contributes to lower (higher) mobility rates (Kiel 1994; Chan 2001). Migration propensity is therefore expected to increase (decrease) with year-to-year house price increases (decreases). Whilst levels of house prices may be related to wages through compensating differentials, I assume that economic factors changing relative house prices from one year to the other—such as exogenous variations in, for example, interest rates or construction costs—will not immediately reflect in wage levels because of the lags inherent in the wage determination process. Regarding the employment participation of the wife, relative changes in house prices have no impact on the debt incurred when a house was

[4]There are also practical concerns about the use of these variables in a switching regression regime. Some variables may be endogenous to migration, for example by future migrants selecting into private rented accommodation in anticipation of a move. It is not appropriate to assume the 'premium' associated with private renting for migrants to be available to non-migrants renting houses. Moreover, some characteristics will change as a result of migration. For example, couples moving away from London and the South East should not be attributed the wage premium associated with working in these regions post-migration. Any regional effects on wages will be captured in the coefficients of the wage equations which can be interpreted as the average 'price' attached to human capital in potential destinations. Job characteristics such as occupational status, being on a fixed term job and working hours may also change as a result of migration but there are likely to be 'scarring effects' on future wages.

[5]House price data are from Halifax Housing Research on average annual house prices at UK post-town level from 1990–2005. These data were aggregated to BHPS Local Authority District level.

originally bought and are therefore assumed not to influence wives' employment choices directly.

Mother's employment status For the wives' employment participation equation, I make use of information on the employment status of each woman's mother. The literature on the transmission of employment status between parents and adult children shows a high degree of intergenerational persistence—in particular between mothers and daughters. Arguably, a mother serves as a role model in terms of female labour market participation for her daughter (e.g. Thornton et al. 1983; Moen et al. 1997). I therefore assume that women whose mothers worked during their formative years are also more likely to work and to remain in employment themselves. It seems reasonable to assume that there are no direct effects of the employment status of a woman's mother on the couple's migration decision or on the woman's wages after controlling for education, age and tenure.

4 Empirical results

Table 1 presents descriptive evidence on migration, wages and labour market participation over the period 1991–2006 for the analysis sample. About 11% of the couples in the sample migrate some time over the 15-year period, which are 2.5% of the couple-year observations. These migration rates are well below those found in the BHPS for a sample of married and single men (15% and 3.9% over a 12-year period according to Böheim and Taylor 2007), confirming reduced migration amongst dual-earner families. Migration is concentrated amongst couples with pre-migration wages well above the average: Hourly wages of migrating husbands were 9%, and those of migrating wives were 21% higher than those of their non-migrant counterparts prior to migration. The table also shows that wage increases over a 1-year period are greater for migrants than non-migrants.

Table 1 Migration, wages and labour market participation, BHPS 1991–2006

	Non-migrants		Migrants	
	Husbands	Wives	Husbands	Wives
Mean hourly wage t (£)	9.7	7.0	10.6	8.5
Mean hourly wage $t + 1$ (£)	10.5	7.6	12.9	10.0
Mean wage increase t to $t + 1$ (%)	7.7	8.6	21.1	17.3
Mean weekly working hours t	39	29	39	31
Change in working hours t to $t + 1$ (%)	0.8	2.3	2.3	4.9
Participation rate $t + 1$ (%)	95.6	91.8	93.3	80.4
Observations	11,284		285 (2.5%)	
Couples	1,938		247 (11.3%)	

Gross monthly wages in January 2000 prices. All values for time t refer to employed individuals only. Migration is defined as a move across BHPS Local Authority District boundaries

Hours normally worked per week are slightly higher amongst migrant wives before they move, and they increase post-migration for both employed women and men who migrate. However, participation in the labour market decreases more amongst migrants than non-migrants. Whilst this difference is moderate amongst men (2 percentage points), the participation rate of migrating wives is 11.4 percentage points lower than that of non-migrating wives. In summary, these descriptive results indicate that couples migrate to get better paid jobs of husbands *and* wives but that migrating wives may stop working following a move.

The first step in the estimation procedure is to jointly estimate the two selection Eqs. 7 and 8 in order to explore the error term correlation, using bivariate probit. The Wald test for the hypothesis that $\rho_{12} = 0$ (bottom of Table 2) shows that there is no statistically significant correlation of the unobservables of the migration equation with the participation equation. As a result, I cannot reject the hypothesis that the migration dummy is exogenous in the participation equations. This allows me to estimate separate, univariate migration and participation probits and to derive the selection correction terms from the results.

Table 2 shows the results. As this is the first stage of the estimation procedure, we are not interested in interpreting all the coefficients separately. The top panel of the table therefore summarises most of the estimates, showing Wald tests for the hypothesis that the coefficients on variables grouped by topic are jointly equal to 0. In particular, this is shown for household characteristics

Table 2 Migration and participation selection models, BHPS 1991–2006

Variable groups	Migration probit		Employment participation $t+1$ (wives)	
	χ^2	*p* value	χ^2	*p* value
Household characteristics (8 variables)	92.97	0.0000	70.65	0.0000
Husband's human capital and job characteristics (12 variables)	38.59	0.0001	20.58	0.0569
Wife's human capital and job characteristics (12 variables)	26.11	0.0103	124.53	0.0000
Year indicators (14 variables)	11.52	0.6444	18.83	0.0172
Migrant			−0.427[a]	(4.80)**,[b]
Relative change in house prices	0.762[a]	(2.43)*,[b]		
Mother employee			0.092[a]	(2.45)*,[b]
Constant	−2.783[a]	(4.34)**,[b]	−0.436[a]	(1.07)[b]
H_0: $\rho_{12} = 0$			1.67	0.1966
Log likelihood	−1,178.31		−3,158.06	
Observations	11,569		11,569	

All regressors measured at time *t*. Household characteristics include number of children, housing tenure, non-labour household income and region-of-origin characteristics. Human capital and job characteristics include age, education, occupational status, working hours, fixed-term contract and job tenure. See text for more details

$^{*}p = 0.05$; $^{**}p = 0.01$

[a]Coefficient

[b]Absolute value of *z* statistics adjusted for clustering at the couple level

(including region-of-origin characteristics), both spouses' human capital and job characteristics and year indicators as described in more detail above. The tests show that, contrary to the results in some previous papers, both the husbands' and the wives' human capital and job characteristics play a role in the joint migration decision. This could indicate that dual earners behave differently from the general group of married couples that have been the focus of much previous research (see Jürges 2006 for another example of distinguishing between couple types). The husband's human capital and job characteristics have no significant effect on the wife's participation decision, however.

The middle panel of Table 2 displays estimates for some variables of particular interest. Firstly, the coefficients on the variables used as exclusion restrictions to identify the equation system are statistically significant at the 5% level. They show that, as expected, migration probability increases with relative house price growth in origin and that a wife's employment at time $t+1$ is more likely if her mother was employed in the wife's formative years. Secondly, the coefficient on the binary variable indicating the migrant status in the employment participation equation shows that wives who migrate have lower employment rates at the interview following migration than those who do not. Evaluated at the means of the other variables, a migrating wife has a 7.9 percentage point (or 8.5%) lower probability of employment than a non-migrating wife after controlling for her household, human capital and job-related characteristics. This reduction is lower than that found in studies predominantly based on US data but similar to the estimates provided by Blackburn (2006) for the UK. Probit estimates based on data for those wives also interviewed in the following year ($t+2$) reveal that migration no longer has a negative impact on their employment probability (not shown). Thus, the decrease in wives' employment probability is temporary and, in line with the findings in other papers, recovers after about 1 year.

The estimates are used to derive the selection correction terms for unobserved individual heterogeneity described by Eq. 9. These are used as regressors in the log wage equations in order to derive consistent estimates. Table 3 displays the results. The coefficients are fairly consistent across the four groups and follow standard expectations. There is a non-linear relationship between log wages and age. Having higher educational degrees (particularly for migrants) and higher occupational status (particularly for non-migrants) are associated with higher wages. After controlling for age effects, tenure is only statistically significant for non-migrant wives. There is a wage penalty associated with being in a fixed term contract. The estimates of the migrants' wage equations are based on relatively small samples and thus have lower levels of significance. I test the hypothesis that the coefficients on the migrants wage equations are equal to the coefficients on the stayers wage equations, separately for husbands and wives. The results of the test are displayed in Table 3 and reject this hypothesis. I also test whether the exclusion restriction(s) are (jointly) equal to 0 when entered into the wage equations. This is not rejected for the wives' wage equations. For the migrant (non-migrant) husbands' wage

Table 3 Selectivity-corrected wage equations, BHPS 1991–2006

	Non-migrants		Migrants	
	Husbands	Wives	Husbands	Wives
Constant	0.367 (2.74)***	−0.102 (0.80)	−1.025 (1.27)	−0.096 (0.12)
Age	0.059 (8.81)***	0.060 (8.68)***	0.144 (3.02)***	0.089 (2.63)***
Age squared	−0.001 (8.09)***	−0.001 (8.14)***	−0.002 (2.75)***	−0.001 (2.46)**
Education 1	0.420 (12.28)***	0.481 (14.31)***	0.489 (3.19)***	0.638 (4.72)***
Education 2	0.207 (8.65)***	0.229 (10.73)***	0.392 (2.68)***	0.301 (2.66)***
Education 3	0.168 (5.86)***	0.165 (6.08)***	0.236 (1.40)	0.248 (1.96)*
Education 4	0.140 (5.56)***	0.109 (5.53)***	0.214 (1.46)	0.269 (1.72)*
Tenure (years)	−0.000 (0.12)	0.009 (6.11)***	−0.000 (0.00)	0.008 (0.68)
Fixed term contract	−0.167 (5.00)***	−0.053 (1.80)*	−0.119 (0.69)	−0.012 (0.08)
Working hours	−0.005 (4.27)***	0.010 (10.24)***	0.003 (0.65)	0.009 (1.74)*
Professional/manager/technician	0.529 (20.51)***	0.482 (21.55)***	0.265 (1.96)*	0.263 (1.91)*
Skilled non-manual	0.265 (10.51)***	0.204 (11.48)***	0.159 (0.94)	0.144 (1.31)
Skilled manual	0.097 (4.91)***	0.027 (1.04)	0.009 (0.07)	−0.037 (0.20)
Year indicators	Yes	Yes	Yes	Yes
λ_M	0.427 (2.26)**	−0.519 (2.60)***	−0.157 (1.34)	−0.167 (1.12)
λ_P		0.196 (4.26)***		−0.163 (0.43)
H_0: $\beta_1 XH_t = \beta_2 XH_t$ (Eqs. 3 and 4)	65.1(28)[a] 0.0001[b]			
H_0: $\beta_3 XW_t = \beta_4 XW_t$ (Eqs. 5 and 6)		43.7 (29)[a] 0.0391[b]		
H_0: dhp = 0	3.0 (2021)[a] 0.0812[b]		4.1 (230)[a] 0.0436[b]	
H_0: dhp, mother employee = 0		1.2 (1952)[a] 0.3105[b]		0.3 (203)[a] 0.7114[b]
Observations	10,782	10,356	266	229
R^2	0.512	0.561	0.372	0.433

Absolute value of t statistics (in parentheses) adjusted for clustering at individual level. Dependent variable is log of hourly gross wage in January 2000 prices. Independent variables measured at time t. The highest educational degree is 1 = first degree or higher; 2 = teaching, nursing or other higher qualification; 3 = GCE A levels; 4 = GCE O levels or equivalent; or 5 = commercial, CSE qualification, apprenticeship, no qualification or other. Reference category for occupational status is 'partly and unskilled occupations'

$^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

[a] Test statistic (df)

[b] p value

equations, this is rejected at the 5% (10%) level of significance, which raises concern about the validity of the instrument for migrant husbands. In absence of a better instrument, I present results for migration effects estimated without any selection corrections for comparison below.

The estimates reveal statistically significant selection bias for non-migrants. The sign on the coefficient on λ_M indicates that non-migrant husbands are positively selected into the group of stayers: They possess unobserved characteristics which are associated with higher wages than they would receive in case of migration. Conversely, the negative coefficient implies a negative selection of wives into the stayer group. Moreover, non-migrant wives who choose to work possess comparative advantage at it, as the positive coefficient on λ_{P_W} indicates. The coefficients for migrants are not statistically significant, giving no evidence of selection bias for them.

The wage estimates are used to derive the counterfactual wages for each husband and wife, i.e. the wage a non-migrant would have received when migrating and vice versa. The coefficients on the selection-correction terms are set to 0 because I cannot assume the relative advantage (disadvantage) of a husband or a wife in the observed state to be equally useful (disadvantageous) in the counterfactual situation. Thus, I measure wage differentials due to observed factors only. Deriving expected wages from the log wage equations and differencing between migrant and stayer wage yield a wage differential for each individual. These are also derived for individuals not employed in $t+1$ who will, by assumption, evaluate lifetime earnings changes in their decision to migrate which are approximated by the immediate expected returns. Hence, any migration-related withdrawal from the labour market, often associated for women with accommodating family needs post-migration, is interpreted as being temporary—indeed, no effect of migration on employment participation choice remains in $t+2$.

Table 4 describes the distribution of predicted wage gains of migrating vs. staying by forming groups based on whether or not the husband, wife and the couple as a whole gain by moving. Note that we can only report predicted wage differentials, thus ignoring the error variation in wages that can be large given that the models explain roughly half the variance in log wages. Non-wage

Table 4 Husbands' and wives' predicted wage differentials and mobility

	I : $\Delta wH + \Delta wW > 0$		II : $\Delta wH + \Delta wW \leq 0$	
	Migrants	Non-migrants	Migrants	Non-migrants
$\Delta wH > 0$, $\Delta wW > 0$	247 (5.70, 2.34)	9,476 (5.59, 2.17)	n/a	n/a
$\Delta wH > 0$, $\Delta wW \leq 0$	33 (7.27, −0.65)	1,612 (6.86, −0.84)	0	56 (1.14, −1.80)
$\Delta wH \leq 0$, $\Delta wW > 0$	4 (−1.17, 2.83)	84 (−0.70, 2.32)	0	23 (−1.83, 0.96)
$\Delta wH \leq 0$, $\Delta wW \leq 0$	n/a	n/a	1 (−0.04, −2.56)	33 (−1.01, −1.10)

ΔwH and ΔwW are the estimated hourly wage differentials of migrating vs. not migrating of husbands and wives, respectively, in January 2000 prices. The table displays the number of couples in each category. In parentheses are the average wage differentials for husbands (left) and wives (right) costs and benefits to migration are also not included. Column I gives counts of migrants and non-migrants who could as a couple achieve predicted wage gains by migrating for different combinations amongst the spouses. Column II counts couples who would fare worse in terms of joint income by migrating. Next to the counts are, in parentheses, average estimated hourly wage differentials in each category, first for husbands and then for wives. Looking first at migrants, column I shows that in 247 migrating couples (87% of migrants), both spouses are predicted to gain considerably by migrating: Husbands gain an average of £5.70/h in year 2000 prices; wives gain an average of £2.34. Migration thus seems to be a rational choice for these families. Thirty-three (four) couples migrate with a predicted positive family return to migration but minor losses for the wife (husband); one couple migrates although wage losses are predicted for both spouses. According to the predicted component of the wage differential, the table suggests that 12% of wives and 1% of husbands could be tied movers.

Turning now to non-migrants, the first row in column I shows that 9,476 couple observations (84% of observations) do not migrate although a wage gain is predicted for each spouse individually and for the couple as a whole by doing so. Compared to the migrants in this category, however, their predicted expected gains are slightly lower, amounting to £5.59 for husbands and £2.17 for wives per hour worked. As the figures do not include the unknown mobility costs, possible non-monetary benefits, or the error variation, it is possible that these couples would in total not fare better by migrating. Likewise, it may well be that the 1,696 observations (15%) of couples seen not to be moving in spite of a predicted family wage gain would not benefit after taking mobility costs into consideration. However, it is possible that some husbands in the group are tied stayers who would have fared better individually by moving net of migration costs. Likewise, the 84 (1%) observations listed in the row below could include wives who are tied stayers. Non-migrants in column II have nothing to gain as a family from migration according to the predicted component of wages.

In summary, the comparison between migrants' and non-migrants' predicted wage gains is consistent with expectations. Although we cannot observe the earnings gain threshold after which migration becomes profitable individually or as a family, the estimates indicate that couples who expect higher wage gains migrate.

The last step in the estimation procedure is to estimate the structural migration probit, Eq. 2, containing the predicted wage differentials of migrating vs. staying of husbands and wives. The structural migration equation contains both spouses' human capital and job characteristics via the predicted wage differentials, as well as the household and region-of-origin characteristics and age. Table 5 displays the probit estimates with selection corrections in column 1, the corresponding marginal effects in column 2 and probit estimates without selection corrections are given for comparison in column 3. Marginal effects are given at sample means of the other variables and in the case of binary variables compare predicted migration probabilities when the variable is set

Table 5 Structural migration probit, BHPS 1991–2006

	1	2	3
Wage differential wife (£)	0.0481***	0.0021***	0.0737***
Wage differential husband (£)	0.0271***	0.0012***	0.0118
Age husband	−0.0269***	−0.0012***	−0.0255***
Age (husband–wife)	0.0138*	0.0006*	0.0149**
Married	−0.0383	−0.0017	−0.0337
Number of children <5	−0.0790	−0.0034	−0.0602
Number of children ≥5	−0.2173***	−0.0094***	−0.2023***
Non-labour household income (£)	0.0367**	0.0016**	0.0385**
Home owner outright	−0.3939***	−0.0120***	−0.3900***
Home owner mortgage	−0.4507***	−0.0094***	−0.4331***
London/South East	0.2248***	0.0109***	0.2269***
Unemployment in origin (rate)	−0.0128	−0.0006	−0.0122
Relative change in house prices	0.7548**	0.0326**	0.7550**
Constant	−1.1122***		−1.0554***
Log likelihood	−1,225.83		−1,227.46
Observed probability		0.025	
Predicted probability		0.018	
Observations		11,569	

All variables except wage differentials measured at time *t*. Bootstrapping (1,000 replications, sampling couples) was used to derive confidence intervals. Statistical significance of the effects was inferred if the bias-corrected confidence interval failed to include 0

1 probit estimates with selection corrections, *2* marginal effects of selection corrected estimates at sample means of other variables, *3* probit estimates without selection corrections for comparison

$^{*}p = 0.10$; $^{**}p = 0.05$; $^{***}p = 0.01$

to 0 and 1, respectively. The standard errors have to be adjusted for the fact that predicted wages rather than observed wages enter the structural migration probit. I use bootstrapping, with 1,000 replications, to derive confidence intervals in order to infer significance levels for the two-stage procedure.[6] If the bias-corrected confidence interval did not include 0, the effect was taken to be significant at the level indicated by the size of the confidence interval.

One of the main results of this paper is the coefficient on the spouses' wage differentials of migrating vs. staying. The estimates reported in column 1 show that these coefficients are positive and statistically significant for both spouses. According to the estimates, couples attach a slightly higher weight to the wives' predicted wage differentials than to the husbands' in the family migration decision. However, given that these results are likely sensitive to model specification and sample selection, I would be reluctant to interpret the differences in the coefficients. In answer to the main question driving this paper, it appears that spouses in dual-earner couples attach a positive weight to both the husband's and wife's predicted wage gain in the migration

[6]Bootstrapping is a nonparametric approach for evaluating the distribution of a statistic based on random resampling with replacement. All stages of the estimation procedure are estimated using the bootstrap sample. Confidence intervals are derived, and the sample standard deviation is calculated from the sampling distribution (Guan 2003).

decision. Thus, I cannot confirm earlier findings that it is the husband's job alone that motivates dual-earner migration. I discuss the implications of these findings in the conclusion. The probit estimates based on wage equations without selection corrections are given in column 3 for comparison. There is also a positive migration effect for both spouses, although the coefficient on the husband's wage differential is not statistically significant and the weights are more asymmetric between the spouses. Reassuringly, the overall results are in line with the selection corrected version.

The further results displayed in Table 5 confirm most of the standard expectations about migration choices. Migration propensity decreases with the age of the husband and increases with the age difference between husband and wife, i.e. the younger the wife compared to her husband.[7] Older individuals are expected to be less mobile than younger ones either because they reap the benefits of migration for a shorter period or because they are more attached to their current location. The presence of school-age children and house ownership inhibit migration, whilst the presence of young children in the household does not seem to influence migration probabilities. Couples are more likely to migrate if they live in London or the South East and if they have a higher non-labour household income. Interestingly, the local unemployment rate is not an important push factor for migration. This may be because we are looking at couples employed at time *t*. Marital status does not affect migration either. Finally, as expected, there is a positive relationship between migration and relative house-price growth.

5 Conclusions

This paper investigates the effects of expected wage gains of a husband and a wife on the decision to migrate. Previous papers suggesting that spouses' migration decisions are husband-centred have often relied on estimates from migration equations where the wife's personal and/or job characteristics in origin are taken to proxy her expected wage gains through migration. Unlike several of these papers, I find the characteristics of the wife's human capital and job characteristics to significantly influence the family migration decision in the unstructured probit selection equation (Table 2). One explanation for this could be that this paper focuses on dual-earner couples, whereas many previous papers have focused on married couples. Recent research has highlighted the importance of distinguishing between couple types (Jürges 2006).

In addition, I explicitly derive the coefficients on each spouse's expected wage differential of migrating vs. staying, obtained in a switching regression

[7] I enter the husband's age and the age difference between husband and wife to avoid collinearity between the variables. Because women are on average younger than their partners, a positive coefficient on the age difference is in line with expectations.

model and corrected for the double selection into migration and employment. This shows that a positive weight is attached to both spouse's predicted hourly wage gains, and they are highly relevant in a structural form of the migration equation. These estimates have to be interpreted with more caution than the first-stage estimates as they rely not only on the data and sampling criteria but also on the credibility of the exclusion restrictions and the assumptions imposed on the model. However, the results are in line with the first-stage estimates and indicate that decision making in dual-earner couples does not seem to be highly asymmetric in favour of the husband's job prospects.

Women suffer a reduction in their employment in the first year after migration of about 8.5% after other factors have been accounted for, whereas husbands' employment is unaltered by migration. However, the reduction in female employment is temporary, with no migration effect remaining in the following year. Given the temporal nature of the employment effect, changes in the hourly wage rate seem to be a more accurate predictor of lifetime earnings gain than annual earning differentials which reflect changes in both the wage rate and the working time. Annual earnings in the year following migration were the outcome of interest for many previous papers, and much of the earnings loss found in these papers can be accounted for by the (temporal) decrease in women's employment.

Predicted wage differentials of migrating vs. staying indicate that in most cases, both spouses in a migrating couple expected a positive wage return. There are 12% of migrating wives and 1% of migrating husband who individually experience a wage loss (with a family gain to migration) and who could possibly be tied movers. However, we have to caution that a sizeable error variation as well as non-wage costs and benefits to migration are not included in these predictions, so this is a very rough indication only. Under the same caveat, most non-migrants appear to have had the chance of positive wage returns to migration, but in 14% of non-migrant couples, the wife would have had a wage loss individually and in 1% of the cases the husband. Although we cannot observe the actual costs and benefits to migration, this does seem to indicate that there are tied stayers amongst husbands. Thus, whilst dual earners may experience disadvantages in pursuing their careers because of restrictions to mobility, the negative effects of migration for wives are apparently mainly confined to temporary reductions in labour market participation.

What can be learned from this paper in terms of family decision making? Regrettably, the results do not allow us to discriminate between the traditional unitary model and a bargaining model of the family. Although the results seem to indicate that both the husband's and the wife's wage returns count in the spousal decision, the uncertainties are too large to establish the extent to which decision making is symmetric. Symmetry between husband and wife could equally support the unitary model which assumes equal weights on the partners' wage gains as it could a bargaining model of the family in which both partners have equal bargaining power. In fact, the assumption of equal bargaining power does not seem unlikely in dual-earner couples that according to this analysis have similar educational and occupational backgrounds. A natural research agenda would be to further test this issue in differing frameworks, for example by explicitly modelling several destinations available to a couple rather than aggregating these options into one destination.

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