

Paper to be presented at the ERSA 41st European Congress in Zagreb, Croatia
29th August - 1st September 2001

LABOUR MARKET PERFORMANCE AND DETERMINANTS OF MIGRATION BY GENDER AND REGION OF ORIGIN *

Mika Haapanen
University of Jyväskylä
School of Business and Economics

30th June 2001

Mailing Address: University of Jyväskylä, School of Business and Economics,
PO Box 35, FIN-40351 Jyväskylä, Finland. Email: mphaapan@st.jyu.fi

Abstract

This paper examines the impact of labour market performance on interregional migration decisions in Finland. The focus is on the correlation between unobservable productivity factors in regions of origin and destination. Bivariate probit models are estimated separately by gender and region of origin. The results suggest that person-specific productivity has hardly any impact on the likelihood of migration, except for females living in peripheral regions: women with the poorest local prospects decide to migrate. It is concluded that peripheral regions are not necessarily losing their more productive workers.

Theme: Migration

JEL Classification: J61, J24, C35

Keywords: Migration, productivity, wages, bivariate probit, selectivity

* I would like to thank Hannu Tervo and Jaakko Pehkonen for helpful comments. This paper is part of my doctoral studies in the Finnish Postgraduate Programme in Economics (FPPE). Additional financial support from the Yrjö Jahnsson Foundation is also gratefully acknowledged.

1. Introduction

During recent decades migration in Finland has been characterised by a geographical shift of population towards areas of economic growth. This has resulted in a net loss of population in other (peripheral) regions and the concentration of economic activity in growth-centre regions (Pekkala 2000). How harmful this trend is depends on who migrate from peripheral regions to growth-centre regions. Therefore, we need to ask: are the peripheral regions losing their productive workers? Such comparisons concern both observed and unobserved productivity factors. In fact, origin productivity may differ substantially from destination productivity, for reasons of occupational specification and regional job separation (e.g. urban versus rural): people select themselves both occupationally and regionally.

Roy's (1951) model of selectivity is usually employed to study the role of unobservable productivity factors.¹ However, the Roy model does not allow a direct estimate of the correlation between the unobservable productivity factors in the region origin and region of destination. A viable alternative is Vijverberg's (1993) human capital model of migration, which demonstrates that more productive workers in the region of origin migrate only if origin and destination factors correlate positively. Vijverberg's findings on a developing country in sub-Saharan African, Côte d'Ivoire, suggest that more productive workers do migrate. Do these results hold in a highly advanced country, namely Finland? If so, this would mean that peripheral regions are losing their productive workers, which has obvious implications for the development of such regions.

To shed light on the above questions, we estimate bivariate probit models with selectivity. Our register-based data on the Finnish population permit us to estimate these models separately for both sexes and distinguish between people living in peripheral and growth-centre regions. The sensitivity of results is tested by allowing the errors of the bivariate probit models to be heteroskedastic.

¹ More elaborated versions of the Roy model include that by Heckman and Sedlacek (1985); see also Heckman and Honoré (1990). Another perspective is taken by Stark (1995) and Razin and Sadka (2000), who analyse international migration and skill of workers in their theoretical papers.

The remainder of this paper is organised as follows. Section 2 briefly reviews Vijverberg's human capital model of migration. Section 3 introduces our data and describes the empirical specifications of the model. Section 4 presents the results of estimation, and draws a comparison across gender and across regions of origin. Finally, Section 5 concludes the study.

2. Labour market performance and the decision to migrate

Vijverberg's (1993) human capital model focuses on the impact of labour market performance on migration by allowing statements about the effect of certain and uncertain components of the wage rate on the migration decision. The model assumes that there are two locations, $l = a$ and $l = b$, and that an individual resides currently ($t = 0$) at the present ($l = a$) location. At the end of the current time period, (s)he decides whether to move to an alternative ($l = b$) location.

As in the other human capital models (such as Sjaastad 1962; Schaeffer 1985), Vijverberg assumes that the individual maximises the expected life-cycle utility function:

$$ELCU(l) = U_0(a) + V_0(l), \quad (1)$$

where

$$V_0(l) = E_0 \left[\sum_{t=1}^T (1 + \rho)^{-t} U_t(l) \right], \quad (2)$$

and where $U_t(l)$ is the maximum utility obtained in period t at location l . The utility is a function of the wage rate at that moment and place, $W_t(l)$, and a set of exogenous assets, $X_t(l)$: $U_t(l) = U(W_t(l), X_t(l))$. The expectation E_0 is taken with respect to information available at $t = 0$ with the rate of time preference, ρ . While costs of migration are not explicitly mentioned in the model, they can be part of $X(l)$.

The decision to migrate is based on a comparison of the expected life-cycle utilities at the two locations (see also Polachek and Horvath 1977):

$$I^* = ELCU(b) - ELCU(a) = V_0(W(b), X(b)) - V_0(W(a), X(a)) \quad (3)$$

from which follows the dichotomous variable I :

$$I = 1 \text{ (migrate) if } I^* > 0, \text{ otherwise stay } (I = 0). \quad (4)$$

We can see from the above equations that amenities at the destination are appreciated ($\partial V_0 / \partial X(b) > 0$) and thus encourage migration. Similarly, a higher cost of living in the destination and increased cost of migration lower the maximum utility level ($\partial V_0 / \partial X(b) < 0$) and therefore deter migration. Note that X may be uncertain because information is incomplete, or future events are random.

To examine the nature of uncertainty in wages, Vijverberg decomposes the wage rate $W_t(l)$ into a certain component $\mu_t(l)$, which may be viewed as a market-determined average productivity (a wage norm), and into two uncertain components, $\eta_t(l)$ and $\varepsilon_t(l)$:

$$W_t(l) = \mu_t(l) + \eta_t(l) + \varepsilon_t(l). \quad (5)$$

$\mu_t(l)$ is determined by observable characteristics such as education and experience and depends on time t as a reflection of long-term trends in the labour market.² $\varepsilon_t(l)$ represents unpredictable random variations in productivity, caused for example by personal conditions such as sickness of self or other household members, and by random fluctuations in demand for the employer's output. $\varepsilon_t(l)$ obscures the value of $\eta_t(l)$, which is a person-specific productivity factor driven by talent and personality features. $\eta_t(l)$ may drift over time depending on local labour market conditions as the demand for such qualities shifts.

From the above equations we can derive how the person-specific component affects migration behaviour (see also Heckman and Sedlacek 1985, 1085; Vijverberg 1993, 157). A change in the prediction³ of $\eta_t(a)$, denoted by $\hat{\eta}_t(a)$, induces a change in the prediction of $\hat{\eta}_t(b)$, which together affect the utility gain from migration by the amount

$$\frac{\partial I^*}{\partial \hat{\eta}_t(a)} = \frac{\partial V_0(W(b), X(b))}{\partial \mu(b)} \frac{\partial \hat{\eta}_t(b)}{\partial \hat{\eta}_t(a)} - \frac{\partial V_0(W(a), X(a))}{\partial \mu(a)}. \quad (6)$$

² The wage norm can be viewed as the typical population-averaged wage of workers with a particular set of personal characteristics.

³ See Vijverberg (1993, 146) for a discussion on how an individual predicts the value of $\eta_t(l)$ for $l = \{a, b\}$.

Suppose, firstly, that we were to observe $\partial I^*/\partial \hat{\eta}(a) = 0$. What does this say about $\partial \hat{\eta}(b)/\partial \hat{\eta}(a)$ and thus about the correlation between origin and destination productivity? Equation (6) implies that marginal utility $\partial V_0(a)/\partial \mu(a)$ is approximately $[\partial V_0(b)/\partial \mu(b)][\partial \hat{\eta}(b)/\partial \hat{\eta}(a)]$. If we can assume that the marginal utilities $\partial V_0(a)/\partial \mu(a) \approx \partial V_0(b)/\partial \mu(b)$, then $\partial \hat{\eta}(b)/\partial \hat{\eta}(a) \approx 1$. That is, an increase in person-specific productivity in the region of origin improves opportunities elsewhere by approximately the same amount as those locally.

Secondly, suppose we were to find that $\partial I^*/\partial \hat{\eta}(a) < 0$. That is, a positive deviation from the norm significantly reduces the chances of migration. This would imply that the marginal utility $\partial V_0(a)/\partial \mu(a)$ is larger than $[\partial V_0(b)/\partial \mu(b)][\partial \hat{\eta}(b)/\partial \hat{\eta}(a)]$. If we can assume that the marginal utilities $\partial V_0(a)/\partial \mu(a) \approx \partial V_0(b)/\partial \mu(b)$, then $\partial \hat{\eta}(b)/\partial \hat{\eta}(a) < 1$, indicating that workers with the poorest local prospects will decide to migrate ('push' migration). Similarly, if we were to observe that $\partial I^*/\partial \hat{\eta}(a) > 0$, i.e. positive deviation from the norm enhances migration, this would imply a positive correlation between the person-specific components in wages in the origin and destination regions, indicating that more productive workers in the region of origin decide to migrate.⁴ Hence, information on how the deviation from the wage norm affects migration can be used to deduce what type of individuals move.

Finally, we consider the effect of the wage norm, $\mu_i(l)$, on migration behaviour. First, if a background variable raises a migrant's wages $\mu_i(b)$ more than it raises local wages $\mu_i(a)$, migration becomes more attractive. Thus, if education raises the productivity of labour in growth-centre regions more than in peripheral regions, migration is likely, especially among young workers. Hence, highly skilled and educated people may find it difficult to accept jobs in peripheral regions. Since the empirical analysis focuses on migration subsequent to labour force participation, we more likely find a negative than a positive association. Second, an *equal* increase in the wage norms in both locations, while preserving the spread of the distribution of wages, discourages migration: in the

⁴ Earlier studies have found positive selection of migrants and, sometimes, stayers: see e.g. Nakosteen and Zimmer (1980), Falaris (1987), Islam and Choudhury (1990), Vijverberg (1995), and Axelsson and Westerlund (1998). Positive selection is consistent with the migration model above: everything else being equal, an increase in $\hat{\eta}_i(b)$ makes migration more attractive.

presence of a diminishing marginal utility of income, the potential utility payoff declines; for a proof, see Vijverberg (1993). A third effect of $\mu_i(l)$ may relate to family ties and remittances (Mincer 1978).

The total wage, as the sum of the norm and the deviation, has an indeterminate impact on the individual's migration behaviour. Vijverberg's empirical findings lend support to these theoretical claims. We examine whether the results hold for Finland across gender and across regions.

3. Data and empirical model

The impact of labour market performance on the migration decision is tested with a one-percent random sample from the Finnish Longitudinal Census File. Statistics Finland has combined the population census with various employment registers maintained by the Ministry of Labour. The socioeconomic status of the sample individuals and their spouses is well documented: the data include information on personal and family status, past labour market record, and regional characteristics of over 60,000 persons.⁵ The empirical analysis of this study mainly utilises data from the years 1994–1995.

The sample used for the analysis was restricted to individuals aged between 15 and 65. In addition, self-employed and foreign-born individuals were excluded from the sample, as their wage and migration determination is likely to differ from that of the rest of the population. After these restrictions and omitting observations with missing information we are left with 26,553 observations, of whom 920 persons (3.46 percent) migrated in 1995.⁶ Table A1 in Appendix gives the descriptive statistics by migration and activity status for the variables used in the analysis.

We measure labour market performance with the annual wage income from labour. In our sample, 18,741 individuals (70.58 percent) had positive wages. Of these wage

⁵ The data do not allow us to use households as the unit of analysis, because we do not know what individuals belong to the same households. However, we do have wide range of household variables, which should adequately control for dependencies in migration decision making.

⁶ We used data from 84 subregions (NUTS4, "seutukunnat" in Finnish). Individuals from the subregion of Åland was excluded, as it has many distinctive characteristics (e.g. self-regulation, isolated geographical location and a Swedish-speaking majority).

earners, 3.08 percent migrated in 1995, which is less than the population average.⁷ Hence, if we were only to use observations of persons with a positive wage income, the sample would be self-selected: it would consist of persons who chose to hold a job for a wage in 1994. Estimating wage functions that do not control for the selectivity may result in biased parameter estimates. Therefore, we estimated selectivity-corrected log-wage regressions with maximum likelihood (see e.g. Heckman 1979; Heckman and Honoré 1990; Puhani 2000):

$$\ln W = \delta' X_w + \varepsilon_w, \quad (7)$$

where individual's activity choice (i.e. whether $\ln W > 0$) is modelled simultaneously:

$$J^* = \gamma' X_a + \varepsilon_a. \quad (8)$$

J^* is the index variable for activity choice: individual is engaged in wage employment in 1994, if $J^* \geq 0$, not engaged, if $J^* < 0$.

The explanatory variables in the log-wage equation are age, education, work experience⁸, work experience squared, and eight occupational dummies. Information on spouse and children were only used in the activity choice equation. The non-linear specification and the exclusion restrictions ensure that the model is identified.⁹ The maximum likelihood estimation results are not presented here, but are available from the author upon request.¹⁰ Likelihood ratio tests indicated that the estimated negative correlation between the disturbances of income equation and activity choice equation is significantly different from zero in all subsamples. Therefore, estimation by simple ordinary least squares could have resulted in biased estimates.

⁷ One could use a longer panel and observe more migrants. While the small proportion of migrants may work against finding strong statistical evidence, the fact that we examine labour market performance so soon before migration takes place may work in our favour: it is likely that the most recent information carries more weight in the worker's prediction of his future.

⁸ Work experience is defined as number of months of employment during 1987–93 divided by 10.

⁹ The model is identified by the exclusion restrictions so long as X_a contain at least one independent variable not in X_w (Maddala 1983).

¹⁰ The selectivity parameter was estimated to be negative in most of the samples. However, the precise interpretation of its sign, however, is problematic (Dolton and Makepeace 1987).

After the estimations, the wage norm (*wage-p*) and wage residual (*wage-r*) are calculated as¹¹

$$wage-p = \exp(\hat{\delta}'X_w + \hat{\sigma}^2 / 2) \quad (9)$$

$$wage-r = (\ln W - \hat{\delta}'X_w) / \hat{\sigma}, \quad (10)$$

where the residual is standardised to facilitate comparison of its effect across the subsamples and $\hat{\sigma}$ is estimated standard deviation of ε_w (^ denotes estimated values).

The parameters of interest are unlikely to be same for all members of the population. Therefore, the models were estimated separately for males and females living in the peripheral and the growth-centre regions. This enhances the homogeneity of the samples and increases reliability of the results within the sample groups. It also allows us to compare results between different groups of people. Approximate likelihood ratio tests (Ben-Akiva and Lerman 1985) for this labour market segmentation were employed and they lend support to the sample split.

The exploited classification of growth-centre regions and peripheral regions is formed using information on the net migration rates and population figures for the destination subregions in 1995 (Figure 1): a region is classified as a growth-centre region, if it has a positive net in-migration rate and its population is larger than 50,000 inhabitants.¹² The growth-centre regions are Helsinki, Porvoo, Salo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu, and are also characterised by high wage levels and low unemployment rates.¹³ The other 75 subregions are mostly peripheral and stagnating regions, although, in Finnish terms, they include some of the bigger towns (Lappeenranta, Rovaniemi).

¹¹ The result follows from the expected value properties of log-normal distributions (e.g. Mood *et. al.* 1974, 117).

¹² The regional division will not alter if the population is kept between 44,000 and 60,000.

¹³ See e.g. Statistics Finland's Kuntafakta (statistics on Finnish municipalities).

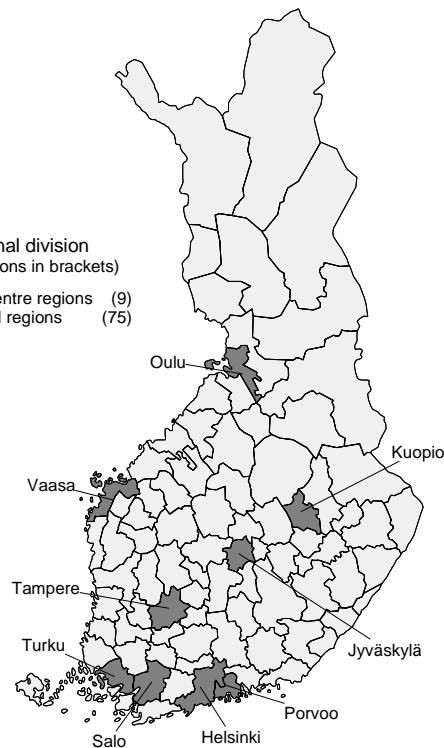


Figure 1. Regional division into growth-centre and peripheral regions

Table 1 presents the descriptive statistics of the resulting labour market performance variables. They are calculated only for those engaged in wage employment in 1994, because only for them we can calculate the deviation from the wage norm. A comparison between migrants and stayers indicates that migrants earned significantly lower wages than stayers in all subsamples. Note, for example, the very low wages of females in the peripheral regions. The results hold for predicted wages, except that the average wage norm exceeds the average wage by a substantial margin in every subsample. This is because $wage-p$ is calculated from $\hat{\delta}'X_w$ through a transformation, and because the selectivity-correction parameter (so called lambda) is estimated to be negative in all subsamples, being smallest (largest) in absolute value for females (males) living in the growth-centre regions.¹⁴ Deviations from the wage norm of the sending region, $wage-r$, show gender differences. Male (female) stayers have a larger (smaller)

¹⁴ We did not estimate the lambda directly in each sample, because we used the full-information maximum likelihood estimation method instead of Heckman's two-step method (limited-information maximum likelihood); see e.g. Heckman (1979) and Puhani (2000).

negative deviation from the norm than male (female) migrants. Deviations are on average larger for residents in the peripheral regions than for residents in the growth-centre regions.

Table 1. Descriptive statistics by gender and region of origin

Variable	Mean (std. dev.)			
	Peripheral region		Growth-centre region	
	Stayers	Migrants	Stayers	Migrants
Males	N = 4773		N = 4153	
	N = 192		N = 109	
<i>wage</i>	97.852 (71.04)	71.948 (68.313)	122.958 (98.878)	85.028 (72.195)
<i>wage-p</i>	135.826 (80.593)	85.219 (73.487)	158.01 (93.172)	99.778 (70.441)
<i>wage-r</i>	-0.143 (0.971)	-0.102 (1.238)	-0.098 (0.987)	-0.056 (1.091)
Females	N = 4601		N = 4637	
	N = 184		N = 92	
<i>wage</i>	71.319 (48.845)	38.511 (42.359)	87.675 (54.725)	62.739 (56.443)
<i>wage-p</i>	98.039 (52.557)	58.959 (53.903)	116.264 (54.021)	77.173 (50.593)
<i>wage-r</i>	-0.169 (0.971)	-0.403 (1.066)	-0.136 (0.971)	-0.359 (1.242)

Notes: Descriptive statistics are calculated only for individuals with positive wages in 1994. *Wage* is annual wage income from labour in 1994. *Wage-p* and *wage-r* are predicted wage and wage residual from the Heckman type of selection model, respectively. *Wage-r* is standardised in each of the four complete sex/region samples to mean 0 and variance 1. *Wage* and *wage-p* are in 1000 Finnish Marks.

Figure 2 below illustrates distributions of wage income, predicted wage income and the residual from the selectivity model for each subsample.¹⁵ The earnings densities of males and females are clearly different: the wage income of males is larger and more dispersed than that of females in both growth-centre and peripheral regions. The densities for the growth-centre and the peripheral residents also exhibit some dissimilarities. In the distributions of predicted wages the distinction between the sexes is more apparent, but the general patterns resemble the figures for actual wage income. the densities for the standardised residual terms look similar to each other, as expected.

¹⁵ A direct plug-in methodology was used to select the optimal bandwidths of the kernel density estimates (Wand and Jones 1995, 71).

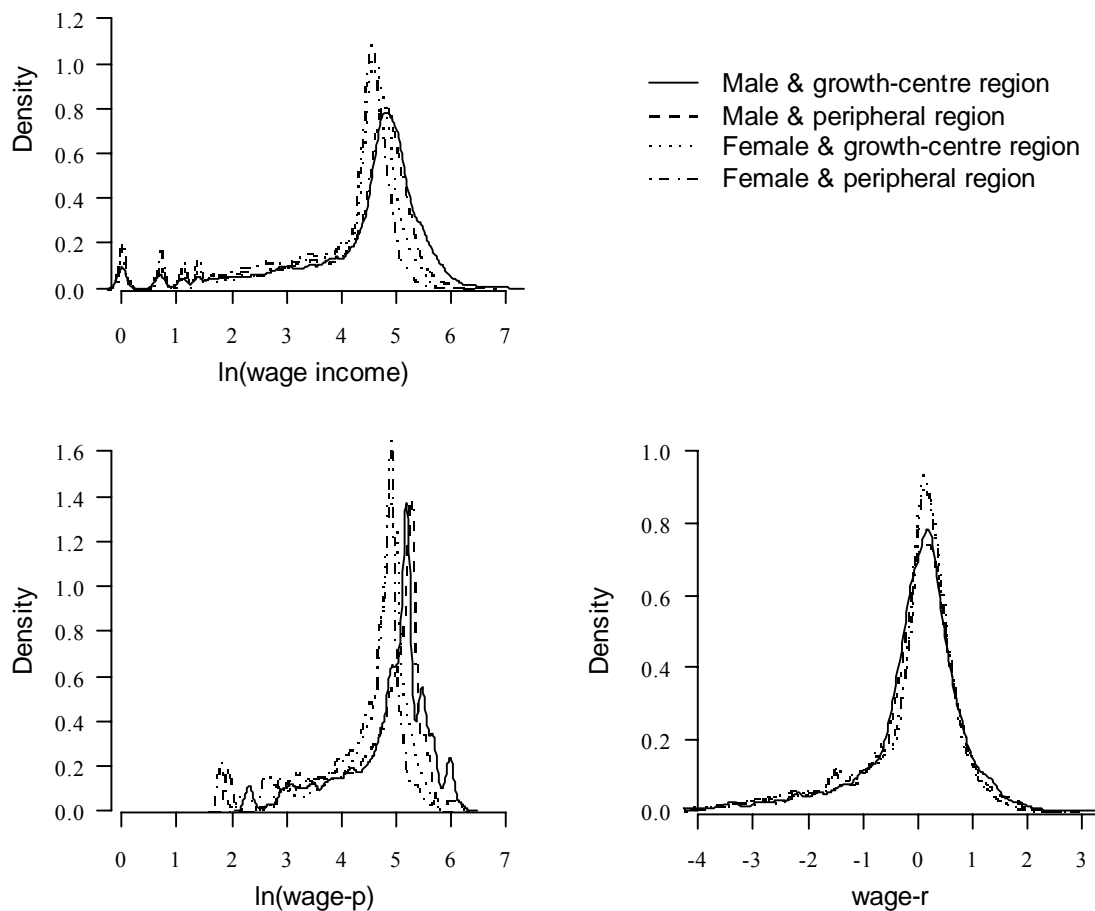


Figure 2. Density estimates by gender and region of origin

The migration equation is estimated as a part of a selectivity model. We assume that there is a latent variable, I^* :

$$I^* = \beta'X_m + \varepsilon_m, \quad (11)$$

where an individual migrates in 1995, if $I^* \geq 0$, and stays, if $I^* < 0$. X_m is a vector of variables that affect the migration decision. In the specification of X_m , the conventional human capital approach (Sjaastad 1962; see also Section 2 and Greenwood 1997) was followed, which weights the benefits of moving against the costs of moving. The probability of individual migration is modelled a function of personal and family characteristics and regional variables, such as age, education, children, home-ownership, and spouse's labour market status and education. At the regional level, for example degree of urbanisation, share of agriculture and industry were used as determinant of migration, because they may reflect the opportunities and the services in the region of origin.

The activity choice of engaging in wage employment in 1994 is specified as in equation (8). However, for persons not engaged in employment, the labour market performance norms can be imputed, but the residuals, $wage-r$, are not observable. Therefore, ε_m is integrated out for non-participants by estimating the bivariate probit model with sample selection (see e.g. van de Ven and van Praag 1981), where the error terms have bivariate normal distribution with a correlation coefficient θ_{ma} .

The bivariate probit model may suffer from limited information on dependent variables. Since we observe only the signs of latent variables, the error variances remain unidentified (Maddala 1983). Hence, we are only able to estimate ratios β/σ_m , γ/σ_a . We need to normalise the error variances equal to one. The normalisation is innocent so long as the variances are constant across individuals (homoskedasticity). But if they are not constant, the variation in σ_m and σ_a will evidently affect the estimates of the parameters of interest (β , γ). In fact, uncorrected departures from homoskedasticity bias the estimated standard errors and the parameter estimates in non-linear models (Godfrey 1988). We can proceed for example by incorporating multiplicative heteroskedasticity in the model. To do so, we specify the error terms as $\varepsilon_j \sim N\{0, [\exp(\xi_j'z_j)]^2\}$ for $j = \{m, a\}$, where z_j includes variables affecting the error variances and ξ_j is the additional parameter vector.

4. Estimates of the determinants of migration

The marginal effects on the probability of migration in 1995 are given for males in Table 2 and for females in Table 3. In both tables columns 1–3 and columns 4–6 show the results for workers originally living in the peripheral and the growth-centre regions, respectively. The marginal effects in columns 1, 2, 4 and 5 are calculated from the estimates of bivariate probit models with sample selection. First a simple wage specification is given, where the migration decision is influenced by the annual wage level prior to migration; see columns 1 and 4. Components of the labour market performance measures were then added (columns 2 and 5). The most complicated models in columns 3 and 6 add heteroskedasticity in multiplicative form to the disturbances of the models in columns 2 and 5.

Table 2. Determinants of migration: marginal effects of bivariate probit models for males by region of origin

Variable	Region of origin is periphery (N = 7202)						Region of origin is growth centre (N = 5816)					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.217	(0.129)	-0.091	(0.123)	-0.106	(0.112)	-0.039	(0.138)	0.054	(0.087)	0.056	(0.098)
(Age/10) squared	0.175	(0.165)	0.024	(0.157)	0.040	(0.143)	-0.070	(0.170)	-0.156	(0.109)	-0.162	(0.121)
Primary school education	-0.260	(0.481)	-0.079	(0.433)	-0.079	(0.400)	0.382	(0.543)	0.363	(0.325)	0.386	(0.361)
Upper secondary education	1.247	(0.469)	1.449	(0.429)	1.421	(0.404)	0.394	(0.535)	0.777	(0.334)	0.858	(0.371)
Lower academic degree	0.853	(0.668)	1.216	(0.603)	1.280	(0.557)	0.425	(0.747)	1.109	(0.507)	1.275	(0.565)
Higher academic degree	1.243	(1.028)	3.013	(0.941)	3.171	(0.876)	0.421	(0.741)	2.043	(0.599)	2.340	(0.680)
Wife not employed	-0.739	(0.509)	-0.814	(0.454)	-0.779	(0.417)	0.607	(0.541)	-0.052	(0.332)	-0.015	(0.368)
Wife employed	-1.444	(0.487)	-1.543	(0.436)	-1.483	(0.398)	-0.542	(0.528)	-0.862	(0.328)	-0.896	(0.362)
Wife has higher academic degree	0.809	(0.799)	0.913	(0.717)	0.850	(0.658)	-0.057	(0.645)	0.133	(0.400)	0.158	(0.445)
Under school-aged children only	-0.499	(0.569)	-0.192	(0.516)	-0.145	(0.474)	-1.473	(0.675)	-0.630	(0.426)	-0.716	(0.468)
School-aged children	-3.723	(0.563)	-2.948	(0.585)	-2.655	(0.593)	-2.028	(0.500)	-0.869	(0.350)	-0.994	(0.382)
Homeowner	-0.493	(0.378)	-0.409	(0.337)	-0.377	(0.308)	-0.085	(0.486)	-0.011	(0.301)	-0.010	(0.334)
Employed in the last week of 1994	-0.695	(0.480)	-0.581	(0.464)	-0.565	(0.422)	-1.007	(0.509)	-0.813	(0.334)	-0.890	(0.366)
(·)*Commuting	2.297	(0.540)	1.966	(0.474)	1.798	(0.451)	1.030	(0.683)	0.621	(0.419)	0.699	(0.459)
Living in region of birth	-1.612	(0.360)	-1.444	(0.342)	-1.318	(0.331)	-1.874	(0.390)	-1.058	(0.313)	-1.179	(0.331)
Degree of urbanisation ^(a)	0.018	(0.244)	0.019	(0.219)	0.019	(0.200)	0.391	(0.607)	0.099	(0.344)	0.129	(0.387)
Share of agriculture ^(a)	0.320	(0.367)	0.258	(0.333)	0.230	(0.307)	1.418	(1.076)	0.674	(0.662)	0.790	(0.732)
Share of industry ^(a)	-0.218	(0.277)	-0.148	(0.244)	-0.142	(0.223)	-1.358	(0.764)	-0.855	(0.467)	-0.954	(0.515)
Region of origin is Helsinki							-1.793	(0.727)	-1.002	(0.441)	-1.113	(0.484)
(Annual wage income)*10 ⁻⁴ (FIM)	0.026	(0.041)					-0.004	(0.038)				
(<i>wage-p</i>)/10			-0.149	(0.036)	-0.156	(0.033)			-0.175	(0.036)	-0.173	(0.036)
<i>wage-r</i>			0.104	(0.162)	0.091	(0.148)			0.134	(0.118)	0.149	(0.131)
θ_{ma}	-0.270	(0.184)	-0.277	(0.144)	-0.360	(0.136)	-0.018	(0.207)	-0.727	(0.080)	-0.680	(0.089)
Log-likelihood	-3344.23		-3338.04		-3325.60		-2450.02		-2437.08		-2433.93	
<i>Specification testing</i>												
Wald test for selection bias	2.145	(p=0.143)	3.686	(p=0.055)	6.997	(p=0.008)	0.008	(p=0.929)	82.736	(p=0.000)	58.865	(p=0.000)
LR test for heteroskedasticity ^(b)					24.894	(p=0.000)					6.296	(p=0.012)

Notes: Parentheses contain asymptotic standard errors. Figure shown is marginal effect multiplied by 100. It calculated assuming the individual is wage earner. N = no. of obs. (·) = Employed in the last week of 1994. ^(a) Figure is for region of origin. ^(b) In column 3 variance of the activity choice equation is a function of level of education and work experience. In column 4 variance is a function of level of education.

Table 3. Determinants of migration: marginal effects of bivariate probit models for *females* by region of origin

Variable	Region of origin is periphery (N = 7167)						Region of origin is growth centre (N = 6368)					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Age	0.029	(0.096)	0.063	(0.102)	0.054	(0.085)	-0.116	(0.121)	0.029	(0.106)	0.032	(0.107)
(Age/10) squared	-0.160	(0.123)	-0.202	(0.130)	-0.166	(0.107)	0.042	(0.152)	-0.092	(0.130)	-0.094	(0.132)
Primary school education	-0.051	(0.405)	-0.007	(0.406)	-0.080	(0.330)	0.186	(0.429)	0.043	(0.340)	0.052	(0.346)
Upper secondary education	0.696	(0.367)	0.734	(0.367)	0.579	(0.323)	0.072	(0.435)	0.207	(0.340)	0.215	(0.347)
Lower academic degree	1.391	(0.519)	1.441	(0.523)	1.270	(0.534)	0.320	(0.588)	0.836	(0.498)	0.814	(0.505)
Higher academic degree	2.518	(0.787)	2.704	(0.886)	2.470	(0.951)	0.944	(0.818)	1.969	(0.671)	1.931	(0.676)
Husband not employed	-0.635	(0.448)	-0.684	(0.444)	-0.436	(0.385)	0.330	(0.418)	0.180	(0.329)	0.179	(0.336)
Husband employed	-1.662	(0.474)	-1.715	(0.470)	-1.335	(0.442)	-0.728	(0.419)	-0.656	(0.346)	-0.671	(0.352)
Husband has higher academic degree	1.575	(0.474)	1.533	(0.476)	1.465	(1.134)	-0.145	(0.592)	-0.226	(0.478)	-0.223	(0.488)
Under school-aged children only	-0.640	(0.452)	-0.517	(0.462)	-0.341	(0.406)	-0.785	(0.510)	-0.297	(0.405)	-0.286	(0.416)
School-aged children	-2.337	(0.506)	-2.291	(0.539)	-2.038	(0.535)	-1.271	(0.468)	-0.800	(0.386)	-0.831	(0.394)
Homeowner	-0.451	(0.259)	-0.442	(0.258)	-0.409	(0.225)	-0.018	(0.407)	-0.022	(0.321)	-0.024	(0.327)
Employed in the last week of 1994	-0.326	(0.343)	-0.495	(0.333)	-0.412	(0.280)	-0.555	(0.427)	-0.282	(0.334)	-0.277	(0.341)
(·)*Commuting	1.057	(0.428)	1.018	(0.435)	0.894	(0.390)	0.998	(0.742)	0.786	(0.605)	0.806	(0.615)
Living in region of birth	-1.043	(0.292)	-1.048	(0.290)	-0.819	(0.267)	-0.991	(0.376)	-0.739	(0.309)	-0.759	(0.309)
Degree of urbanisation ^(a)	-0.420	(0.181)	-0.404	(0.185)	-0.359	(0.159)	-0.143	(0.475)	-0.130	(0.366)	-0.132	(0.375)
Share of agriculture ^(a)	0.083	(0.239)	0.115	(0.241)	0.070	(0.200)	-0.074	(0.919)	-0.025	(0.698)	-0.030	(0.717)
Share of industry ^(a)	0.419	(0.208)	0.410	(0.214)	0.368	(0.186)	-0.618	(0.599)	-0.516	(0.467)	-0.529	(0.475)
Region of origin is Helsinki							-1.399	(0.564)	-0.917	(0.437)	-0.939	(0.444)
(Annual wage income)*10 ⁻⁴ (FIM)	-0.170	(0.051)					-0.022	(0.052)				
(<i>wage-p</i>)/10			-0.131	(0.050)	-0.131	(0.050)			-0.221	(0.050)	-0.215	(0.050)
<i>Wage-r</i>			-0.311	(0.140)	-0.235	(0.121)			-0.137	(0.131)	-0.138	(0.134)
θ_{ma}	-0.087	(0.189)	-0.185	(0.203)	0.206	(0.223)	-0.188	(0.202)	-0.593	(0.116)	-0.566	(0.115)
Log-likelihood	-3435.40		-3437.82		-3419.12		-2562.12		-2553.86		-2542.05	
<i>Specification testing</i>												
Wald test for selection bias	0.209	(p=0.648)	0.831	(p=0.362)	0.856	(p=0.355)	0.867	(p=0.352)	26.361	(p=0.000)	24.113	(p=0.000)
LR test for heteroskedasticity ^(b)					37.406	(p=0.000)					23.630	(p=0.000)

Notes: See the general notes in Table 2. ^(a) Figure is for region of origin. ^(b) In column 3 variance of the activity choice (migration) equation is a function of age, level of education and work experience (husband has higher academic degree). In column 4 variance of the activity choice equation is a function of age and number of children under age 7.

The reported marginal effect is the total effect from the variables in the migration and the activity choice equations, together with the effect of error correlation and possible heteroskedastic terms, multiplied by 100. It is assumed that the individual is a wage earner in 1994. That is, the calculations are based on probabilities $P[I^* \geq 0 | J^* \geq 0]$. The other explanatory variables are kept at sample means. The activity choice equation was estimated together with the migration equation, but its parameter estimates or marginal effects (on migration) are not reported here.¹⁶

The procedure employed to determine the variables, z , included in the heteroskedastic function on the migration and activity choice equations was similar to O'Higgins (1994): (i) univariate probit model was estimated with z containing all variables in homoskedastic bivariate probit save the constant; (ii) the vector z was subsequently reduced so as to have the simplest form which, at the same time, was not rejected in comparison with the more general model; and (iii) for bivariate probit model, the basic univariate specification was used, while tests were employed to ensure that a more general model was not preferred.

The likelihood ratio (LR) statistic in Tables 2 and 3 tests for the joint significance of the heteroskedasticity correction terms. We did not find much heteroskedasticity in the migration equations. Only for females living in the peripheral regions did inclusion of a variable error variance term improve the fit of the model; see table captions. The activity choice equation was more heteroskedastic. Information on age, work experience and level of education (1–5) were eventually used to control for differences in the error variances between individuals. The necessity to control for heteroskedasticity was confirmed by all four LR tests. The null hypothesis of homoskedasticity is rejected at 1.2 percent level or smaller.

Wald tests for selection bias were conducted in order to test the significance of the error correlation, θ_{ma} , in each bivariate probit model. We found the correlation to be significantly different from zero in the preferred models except for females living in the peripheral regions; see columns 3 and 6 in Tables 2 and 3. Therefore, we concluded that

¹⁶ The parameter estimates of the migration and activity choice equations are not reported, as heteroskedasticity in the error variances and covariance makes interpretation and comparison across

it is necessary to control for the unobserved dependencies between migration and activity choices.

Before considering the impact of labour market performance on the migration decision, we briefly present the results for the other significant variables. The results indicate that education has its familiar positive impact on migration, everything else being equal. Education is human capital, which is easily transferable to a different location and which creates more employment opportunities. For the highly educated these opportunities can be rather narrow in peripheral regions. This effect shows as a larger coefficient for people living in the peripheral regions compared to people living in the growth-areas.

The presence of school-aged children or a working spouse reduces the individual's willingness to migrate, especially for those living in the peripheral regions (Tables 2 and 3).¹⁷ One can also be tied to a house, as might be the case for a homeowner, thus reducing one's willingness to migrate. In our case, the effect is present only in the subsample of females living in the peripheral regions. One reason for this is that it is much easier to find a buyer for a house in a growth-centre region than in a peripheral region, and hence the liquidity constraints are smaller.

Commuters and those who live in their region of birth show high and low propensity to move, respectively. These effects are greatest (in absolute value) for males living in the peripheral regions. This is plausible since most migrants in Finland move from peripheral regions to growth-centre region, where the employment situation is better. Hence, commuting can be seen as a state preceding migration. Urbanisation has a negative effect on migration propensity for females living in the peripheral regions, but for men and other women it has no effect (see also Axelsson and Westerlund 1998). Generally, the above results hold from one specification to another.

As regards the labour market performance measures, columns 1 and 4 report the marginal effects of annual wages, whereas columns 2, 3, 5 and 6 report the components

subsamples problematic. The results are available from the author upon request. See also Table A1 in Appendix for descriptive statistics.

¹⁷ It seems that the effect of spouse's income is captured by his/her labour market status, since we did not find any effect of spouse's wage income on the employee's migration likelihood.

of the labour market performance measures.¹⁸ Generally, a decrease in observed wages in the region of origin does not seem to have any effect on the probability of migration. This result is in line with previous studies done with Finnish data (see e.g. Ritsilä and Tervo 1999; Tervo 2000) and our prior expectations based on the Vijverberg's (1993) theoretical model and empirical findings. An exception to the rule are females living in peripheral regions: a decrease in wages significantly enhances their propensity to move. This can be an indicate that labour markets for females are scant in peripheral regions and that they find it necessary move into another region that values their work effort better.

An increase in the wage norm has a significant negative impact on the probability of migration in all four subsamples. This effect is stronger for people living in growth-centre regions than for an individual living in a peripheral region. In addition, while there are no gender differences between the peripheral residents, in the growth-centre region the effect is stronger for females than for males. However, we must remember that female wages are on average smaller than male wages, which means that the wage elasticities are fairly equal.

For males, a positive deviation from the wage norm does not significantly enhance chances of migration (Table 2), indicating that $\partial \hat{\eta}(b)/\partial \hat{\eta}(a) \approx 1$; see the results derived from equation (6) in Section 2. That is, an increase in person-specific productivity in the region of origin improves opportunities elsewhere by approximately the same amount as those locally.

For females living in peripheral regions, the results are quite different (Table 3). The parameter estimate of the person-specific productivity factor is significantly negative: a positive deviation from the norm significantly reduces chances of migration; therefore, $\partial \hat{\eta}(b)/\partial \hat{\eta}(a) < 1$, indicating that workers with the poorest local prospects decide to migrate. In other words, female migrants are less origin-productive than their non-migrant counterparts. For females living in growth-centre regions, the estimated coefficient for the person-specific productivity factor is insignificant but again negative.

¹⁸ Note that we have not adjusted the standard errors for use of predicted rather than actual values, so they can be underestimated.

Therefore, $\partial \hat{\eta}(b) / \partial \hat{\eta}(a)$ is close to one and person-specific productivity has hardly any impact on the probability of migration.

5. Conclusions

We examined the impact of labour market performance on interregional migration decisions in Finland. Our focus was on the correlation between unobservable factors in the regions of origin and destination. The results were analysed to allow a comparison with the human capital migration model developed by Vijverberg (1993). We estimated bivariate probit models with selectivity separately for males and females originally living in peripheral and growth-centre regions. The migration equation was estimated as part of a selectivity model to account for the fact that the estimation sample consists of labour force participants only, that is, wage employees. Hence, the estimated behavioural pattern should be valid for non-employees as well.

Our results depend on gender and region of origin. Firstly, a decrease in actual wages in the region of origin does not seem to have any effect on the likelihood of migration, except for females living in peripheral regions whose propensity to migrate is increased. Secondly, an increase in the wage norm has a significant negative impact on the likelihood of migration in all subsamples. Finally, person-specific productivity has hardly any impact on the likelihood of migration, except for females living in peripheral regions: women with the poorest local prospects decide to migrate. We conclude that peripheral regions are not necessarily losing their more productive workers, whereas Vijverberg's study suggested that more productive workers tend to migrate from rural areas.

Appendix

Table A1. Descriptive statistics by migration and activity status

Variable	Stayers		Migrants		Non-workers		Workers	
	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.
Work in 1994	0.709	(0.454)	0.627	(0.484)				
Migrate in 1995					0.044	(0.205)	0.031	(0.173)
Sex (1 = male)	0.490	(0.500)	0.511	(0.500)	0.485	(0.500)	0.492	(0.500)
Region of origin (1 = growth-centre region)	0.463	(0.499)	0.336	(0.473)	0.409	(0.492)	0.480	(0.500)
Reg. of orig. is Helsinki	0.240	(0.427)	0.135	(0.342)	0.189	(0.392)	0.257	(0.437)
Age	39.304	(13.540)	31.305	(12.902)	42.268	(17.040)	37.677	(11.607)
(Age/10) squared	17.282	(10.933)	11.463	(10.061)	20.769	(14.051)	15.542	(8.929)
Primary school educ.	0.384	(0.486)	0.302	(0.459)	0.576	(0.494)	0.300	(0.458)
Lower secondary educ.	0.278	(0.448)	0.212	(0.409)	0.219	(0.414)	0.299	(0.458)
Upper secondary educ.	0.210	(0.408)	0.347	(0.476)	0.151	(0.358)	0.242	(0.428)
Lower academic degree	0.077	(0.267)	0.087	(0.282)	0.037	(0.189)	0.094	(0.292)
Higher academic degree	0.050	(0.219)	0.052	(0.222)	0.016	(0.127)	0.065	(0.246)
Spouse not employed	0.264	(0.441)	0.230	(0.421)	0.332	(0.471)	0.235	(0.424)
Spouse employed	0.395	(0.489)	0.193	(0.395)	0.209	(0.407)	0.463	(0.499)
Spouse has higher academic degree	0.094	(0.292)	0.085	(0.279)	0.046	(0.209)	0.114	(0.318)
Under school-aged children only	0.102	(0.303)	0.116	(0.321)	0.072	(0.259)	0.115	(0.319)
School-aged children	0.292	(0.455)	0.083	(0.275)	0.200	(0.400)	0.320	(0.467)
Degree of urbanisation	7.729	(1.478)	7.321	(1.542)	7.555	(1.543)	7.781	(1.450)
Share of agriculture	0.404	(0.689)	0.549	(0.764)	0.482	(0.736)	0.379	(0.671)
Share of industry	2.013	(0.855)	2.148	(0.840)	2.068	(0.846)	1.996	(0.857)
Homeowner	0.406	(0.491)	0.345	(0.475)	0.421	(0.494)	0.397	(0.489)
Living in region of birth	0.550	(0.497)	0.449	(0.498)	0.572	(0.495)	0.536	(0.499)
Employed during the last week of 1994	0.550	(0.498)	0.359	(0.480)	0.011	(0.106)	0.765	(0.424)
(·)*Commuting	0.054	(0.226)	0.100	(0.300)	0.001	(0.028)	0.078	(0.269)
Annual wages	66.804	(74.608)	39.065	(57.943)	0.000		93.289	(72.485)
<i>wage-p</i>	103.285	(75.727)	63.278	(59.236)	46.830	(39.669)	124.855	(75.129)
<i>wage-r</i>	-0.137	(0.975)	-0.230	(1.166)			-0.140	(0.981)
Work experience	5.125	(3.173)	3.467	(2.879)	2.499	(2.672)	6.138	(2.727)
(Work experience) ²	36.327	(28.332)	20.296	(23.919)	13.386	(18.973)	45.103	(26.308)
Married	0.660	(0.474)	0.424	(0.494)	0.540	(0.498)	0.698	(0.459)
Spouse's income	45.975	(71.356)	20.865	(50.992)	22.907	(56.623)	54.357	(74.123)
# Spouse's months of employment	4.517	(5.538)	2.139	(4.244)	2.431	(4.603)	5.269	(5.647)
# Children under age 7 + 8 occupation dummies	0.255	(0.614)	0.201	(0.548)	0.195	(0.579)	0.278	(0.624)
Number of observations	25633		920		7812		18741	

Notes: All variables are measured in 1994 if not otherwise stated. Work experience is defined as number of months of employment during 1987–93 divided by 10. Income measures are in Finnish Marks (1000 FIM) save the *wage-r*. (·) = Employed in the last week of 1994. Occupation is given for workers and non-workers.

References

- Axelsson, R. and Westerlund, O. (1998) A Panel Study of Migration, Self-selection and Household Real Income, *Journal of Population Economics*, 11, 113–126.
- Ben-Akiva, M. and Lerman, S. R. (1985) *Discrete Choice Analysis: Theory and Application to Travel Demand*, MIT Press, Cambridge.
- Dolton, P. J. and Makepeace, G. H. (1987) Interpreting Sample Selection Effects, *Economics Letters*, 24, 373–379.
- Falaris, E. M. (1987) A Nested Logit Migration Model with Selectivity, *International Economic Review*, 28, 429–443.
- Godfrey, L. G. (1988) *Misspecification Tests in Econometrics: the Lagrange Multiplier and Other Approaches*, Cambridge University Press, Cambridge.
- Greenwood, M. (1997) Internal Migration in Developed Countries, in: Rosenzweig, M. R. and Stark, O. (eds) *Handbook of Population and Family Economics* (Vol. 1B), Elsevier Science, Amsterdam, 647–720.
- Heckman, J. (1979) Sample Selection Bias as a Specification Error, *Econometrica*, 47, 153–161.
- Heckman, J. and Sedlacek, G. (1985) Heterogeneity, Aggregation, and Market Wage Functions: an Empirical Model of Self-Selection in the Labor Market. *Journal of Political Economy*, 93, 1077–1125.
- Heckman, J. and Honoré, B. (1990) Empirical Content of the Roy Model, *Econometrica*, 58, 1121–1149.
- Islam, M. N. and Choudhury, S. A. (1990) Self-selection and Intermunicipal Migration in Canada, *Regional Science and Urban Economics*, 20, 459–472.
- Maddala, G. S. (1983) *Limited-dependent and Qualitative Variables in Econometrics*, Cambridge University Press, Cambridge.
- Mincer, J. (1978) Family Migration Decisions, *Journal of Political Economy*, 86, 749–773.
- Mood, A. M., Graybill, F. A. and Boes, D. C. (1974) *Introduction to the Theory of Statistics* (3rd ed.), McGraw-Hill, New York.
- Nakosteen, R. A. and Zimmer, M. (1980) Migration and Income: the Question of Self-selection, *Southern Economic Journal*, 46, 840–851.
- O'Higgins, N. (1994) YTS, Employment, and Sample Selection Bias, *Oxford Economic Papers*, 46, 605–628.

- Pekkala, S. (2000) Regional Convergence and Migration in Finland 1960–90, Doctoral Dissertation, Jyväskylä Studies in Business and Economics, University of Jyväskylä.
- Polachek, S. W. and Horvath, F. W. (1977) A Life Cycle Approach to Migration: Analysis of the Perspicacious Peregrinator, in: Ehrenberg, R. (ed.) *Research in Labor Economics* (Vol. 1), JAI Press, Greenwich, 103–149.
- Puhani, P. A. (2000) The Heckman Correction for Sample Selection and its Critique, *Journal of Economic Surveys*, 14, 53–68.
- Razin, A. and Sadka, E. (2000) Unskilled Migration: a Burden or a Boon for the Welfare State, *Scandinavian Journal of Economics*, 102, 463–479.
- Ritsilä, J. and Tervo, H. (1999) Regional Differences in the Role of Migration in Labour Market Adjustment: The Case of Finland, in: Crampton, G. (ed.) *Regional Unemployment, Job Matching and Migration*, Series on European Research in Regional Science, Pion, London, 166–182.
- Roy, A. D. (1951) Some Thoughts on the Distribution of Earnings, *Oxford Economic Papers*, 3, 135–146.
- Schaeffer, P. (1985) Human Capital Accumulation and Job Mobility, *Journal of Regional Science*, 25, 103–114.
- Sjaastad, L. A. (1962) The Costs and Returns of Human Migration, *Journal of Political Economy*, 70 (Supplement), 80–93.
- Stark, O. (1995) Return and Dynamics: the Path of Labor Migration When Workers Differ in Their Skills and Information Is Asymmetric, *Scandinavian Journal of Economics*, 97, 55–71.
- Tervo, H. (2000) Migration and Labour Market Adjustment: Empirical Evidence from Finland 1985–90, *International Review of Applied Economics*, 14, 343–360.
- van de Ven, W. P. and van Praag, B. M. (1981) The Demand for Deductibles in Private Health Insurance: a Probit Model with Sample Selection, *Journal of Econometrics*, 17, 229–252.
- Vijverberg, W. P. (1993) Labour Market Performance as a Determinant of Migration, *Economica*, 60, 143–160.
- Vijverberg, W. P. (1995) Dual Selection Criteria with Multiple Alternatives: Migration, Work Status, and Wages, *International Economic Review*, 36, 159–185.
- Wand, M. P. and Jones, M. C. (1995) *Kernel Smoothing*, Chapman & Hall, London.