University of Jyväskylä
School of Business and Economics

Mika Haapanen

Labour Migration and Wages

Licentiate thesis
Jyväskylä 2001

ABSTRACT

Mika Haapanen
Labour Migration and Wages

University of Jyväskylä, School of Business and Economics,
PO Box 35, FIN–40351 Jyväskylä, Finland

Jyväskylä: University of Jyväskylä 2001, 82 p.

This licentiate thesis consists of three empirical studies, which analyse the labour migration and wages in Finland. The studies are preceded by an introductory chapter, which briefly provides theoretical background and outlines the content, as well as presents the main results of the thesis. The main focus is on the impact of labour market performance and expected earnings on the decision to move.

The first empirical study examines the impact of labour market performance on interregional migration decisions. The analysis follows the human capital approach and considers observed and unobserved productivity factors. 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 move. It is concluded that peripheral regions are not necessarily losing their more productive workers.

The second study examines the impact of expected earnings on interregional migration decisions for young adults living in peripheral regions. The results indicate that the decision to move is influenced by expected earnings. Implementation of a policy that would increase expected earnings in peripheral regions would have a positive effect on retaining workers in those regions and would reduce individuals' incentives to migrate to growth regions. This latter effect is smaller, the further away from a growth region an individual lives and the younger (s)he is. On the other hand, a fall in expected earnings in the growth regions would have hardly any impact on migration probabilities.

The question of individually focused policy measures is currently at the centre of public debate in Finland. The final study analyses whether it is possible through income taxation policy to influence where people choose to live. Micro-level analyses show that the decision to migrate is influenced by expected net income, but the size of the impact depends on age, home-ownership and the regional unemployment rate. The estimation results also imply that a reduction in income taxation would be most effective if it were targeted at young individuals living in the regions with high unemployment rates.

Keywords: Migration, income, taxation, regional policy, labour markets, discrete choice models

ACKNOWLEDGEMENTS

This licentiate thesis is part of my doctoral studies in the Finnish Postgraduate Programme in Economics (FPPE). As for the further financial support, I would like to thank the Yrjö Jahnsson Foundation and Finnish Cultural Foundation. I would also grateful all those who have commented my papers, especially Jaakko Pehkonen, Hannu Tervo, Brigitte Waldorf, Kari Hämäläinen, Jari Ritsilä and Tapio Ruokolainen.

Jyväskylä, December 2001

Mika Haapanen

CONTENTS

CHAPTER 1

INTRODUCTION

The thesis consists of three empirical studies, which focus on labour migration and wages:

[I] Labour market performance and determinants of migration by gender and region of origin

[II] Interregional migration and earnings

[III] Can migration decisions be affected by income taxation policies?

This introductory chapter opens with a brief discussion of the background of the study and then presents its outline and main results.

1 Background

During recent years migration in Finland has been characterised by a shift towards the areas of economic growth. If it continues this current trend will lead to the concentration of human capital in a few attractive regions (see e.g. Pekkala 2000; Ritsilä 2001; Ritsilä and Ovaskainen 2001). At the same time, more distant regions are losing important future human capital, as the young and educated move away from them.

Figures 1 – 3 illustrate this problematic phenomenon. Population density is very low in most regions in Finland (see Figure 1 below). At the same time only a few regions experienced clear positive net migration in 1999 (Figure 2). Comparison of Figures 1 and 2 indicate that positive net-migration flows are directed into regions that already possess high population density. These regions are also characterised by high income levels. This type of trend towards urbanisation is not unique. Many western and developing countries are experiencing similar problems (see e.g. Lucas 1997, 725; United Nations 1999). Therefore, the question and answers addressed here should have wider than just Finnish interest.

The concentration of economic activity in growth-centre regions arises from individual migration decisions. The purpose of this thesis is to understand the processes behind the migration decisions, and more specifically, how prior or expected wages influence migration decisions in peripheral and growth-centre regions.

Labour migration can be seen as an investment in human capital.[1] The human capital framework is based on the modelling work of Sjaastad (1962), and is further studied, for example, in the modelling works of Weiss (1971), Seater (1977) and Schaeffer (1985). In this framework migration is assumed to result from variations in individual economic utility in different locations. Furthermore, an individual is assumed to maximise his or her economic utility. Thus, relocation takes place if the expected economic utility gained from moving exceeds the economic utility achieved by staying in the present location. Heterogeneous individuals possess different utility functions, and consequently encounter differences in the net benefits of living in a specific location.

[1] The general determinants of migration are well discussed in the literature. See, for example, comprehensive surveys by Greenwood (1975; 1985; 1997), Shields and Shields (1989), Greenwood *et al.* (1991), and Ghatak *et al.* (1996).

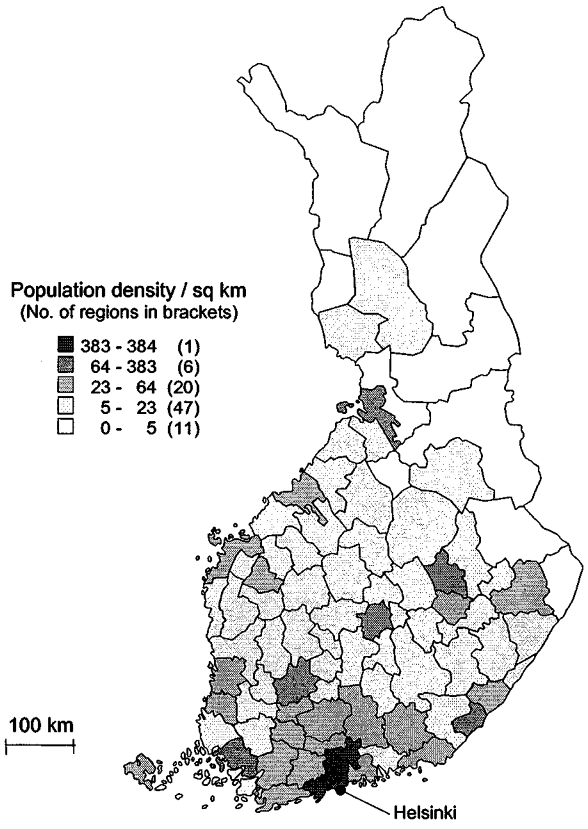


Figure 1. Population density, 1999

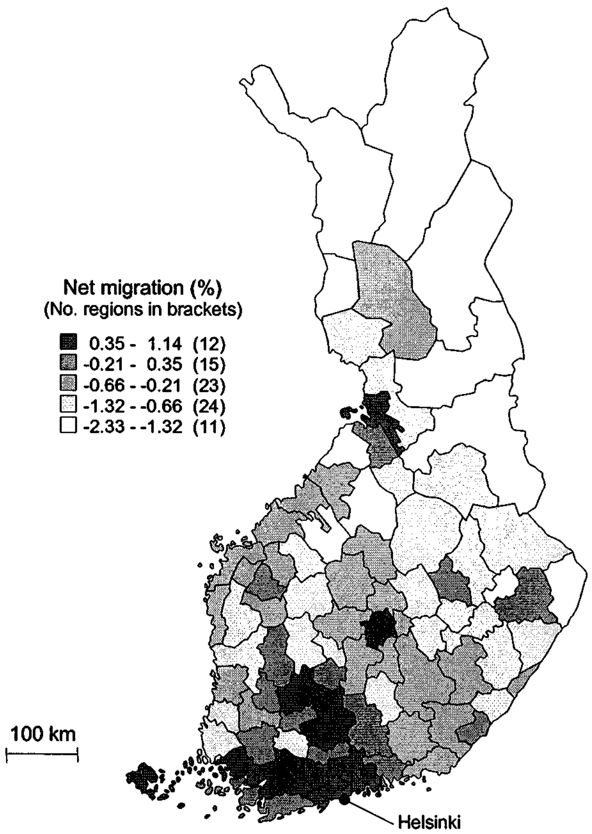


Figure 2. Net migration per population (%), 1999

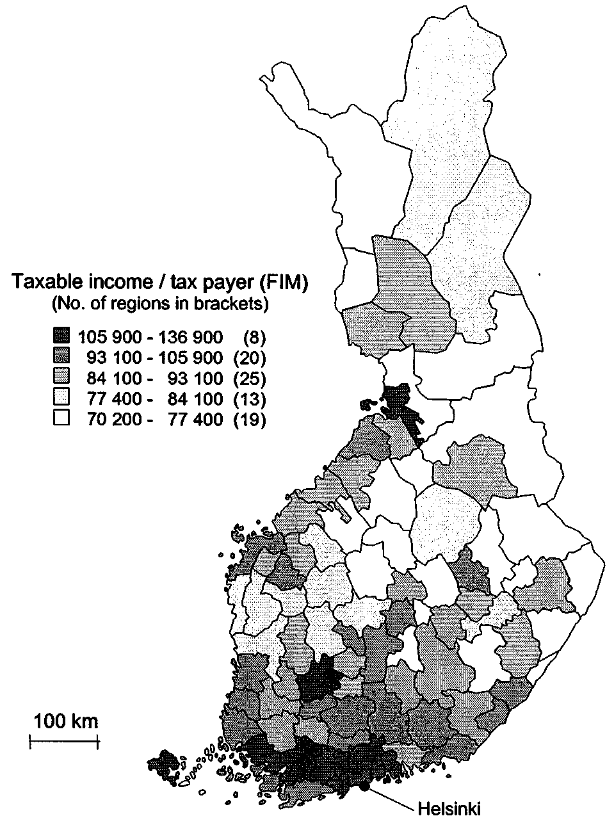


Figure 3. Yearly taxable income per tax payer (FIM), 1999

An important factor that affects economic utility, and hence the decision making of an individual, is her/his personal human capital reserve. Human capital can be considered as a heterogeneous asset, resulting from formal schooling, training and experience, etc. In addition, economic utility will depend on (expected) net income, which is a function of taxation. Formally, it is assumed that an individual i decides to migrate from location j to location k under the following utility maximisation process at a given time t:

$$E(R_{it}) = \max_{W,X}\left[E\int_0^T e^{-rt}\left\{U_{ik}(W_{ik},X_{ik})-U_{ij}(W_{ij},X_{ij})\right\}dt - CM_{ijk}\right] \quad (1)$$

under the precondition

$$\int_0^T e^{-rt}(U_{ik}-U_{ij})\,dt - CM_{ijk} \geq 0\,, \quad (2)$$

where $E(R_{it})$ is the net present value of the expected economic utility of that individual i. U_k is the expected utility level achieved in the alternative location k with assets X_{ik} and expected net income W_{ik}. Similarly, U_j is the expected utility achieved by living in the present location j with assets X_{ij} and expected net income W_{ij}. The direct costs involved in moving from location j to location k are contained in CM_{jk}. The expected utilities U_k and U_j, as well as the direct costs CM_{jk}, are formed as a result of personal, household and regional factors involved in the migration decision process. As a result of the rational decision making process, a decision in favour of migration is reached when the expected utility gained from moving exceeds the direct costs of moving.

2 Outline of the study and main results

The present study seeks to answer several important questions:

- Are the peripheral regions losing their productive workers?
- Is migration from peripheral regions driven by higher earnings in growth-centre regions?
- What kind of people choose to migrate to growth-centre regions instead of other regions?
- Would an increase in earnings in the peripheral regions reduce the geographical shift of the workforce from those regions?
- Is it possible through income taxation policy to influence where people choose to live?

Despite their importance in policy making these questions have mostly been left unanswered.

The data set used in all three papers is a one-percent random sample from the Finnish longitudinal census. The census file is maintained and updated by Statistics Finland. The papers mainly utilise data from the years 1993–1995. Variety of advanced microeconometric methods is applied in this study. We find them necessary to emphasise the importance of taking account of observed and unobserved heterogeneity in the population of potential migrants.

The analyses exploit a classification of growth-centre regions and peripheral regions (Figure 4 below). This classification is formed using information on the net migration rates and population figures for the destination subregions in 1995: 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. The growth-centre regions are Helsinki, Porvoo, Salo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu, and are also characterised by high wage levels. The other 75 subregions are mostly peripheral and stagnating regions, although, in Finnish terms, they include some of the bigger towns (Lappeenranta, Rovaniemi). The regional division allows to create separate samples for individuals in growth-centre regions and peripheral regions and hence observe differences in the migration behaviour (Chapter 2).

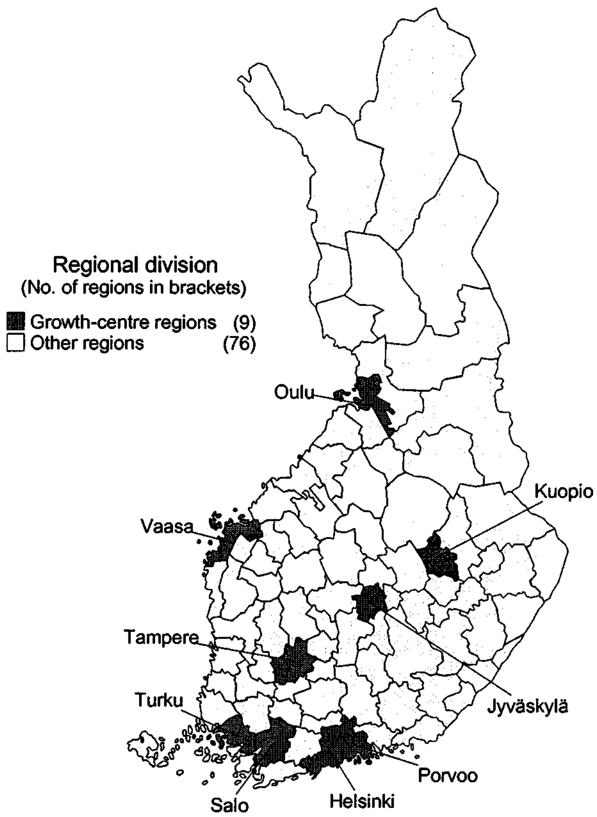


Figure 4. Regional division into growth-centre and other regions

Chapter 2 examines the impact of labour market performance on interregional migration decisions. We measure labour market performance with the annual wage income from labour that is subject to state taxation before the migration. The results depend on gender and region of origin and are analysed in a comparison with the human capital migration model developed by Vijverberg (1993). Firstly, an increase in the 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 move is decreased. Secondly, an increase in the wage norm has an expected significant negative impact on the likelihood of migration. 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 move. Hence, our results imply that peripheral regions are not necessarily losing their more productive workers.[2] Therefore, the results imply that policies that are planned to slow down migration from the peripheral and stagnating regions into the central and prosperous regions may not have a desired effect on the economy as a whole, since migrant's productivity can be smaller had he or she not migrated.

Chapter 3 studies the impact of expected earnings on the interregional migration decisions of young adults living in peripheral Finland. The main interest is now the expected performance after the migration, not on the performance before the migration. The results show that expected earnings influence migration choices. Implementation of a policy, which would increase expected earnings in peripheral regions by 10 percent, would prevent migration from the peripheral region and decrease the individual's probability of moving to a growth-centre region by 15 percent. This latter effect is smaller, the further away from growth-centre regions individual lives and the younger (s)he is. On the other hand, a decrease in expected earnings in growth-centre regions has hardly any impact on migration.

Chapter 4 also examines the impact of expected earnings on migration but concentrates more on the policy analysis. More specifically, the main interest is on whether migration decisions of working population in Finland can be affected by income taxation policies. In Norway different taxation schedules are applied in the Northern Norway, including a reduction in personal income tax and an exemption from payroll tax for employers (Eikeland 1999). So far

---

[2] Th is contrary to Vijverberg's (1993) findings on a developing country, which suggested that more productive workers tend to move from rural areas.

no such policies have been applied in Finland, but such measures have been seen as one way to combat out-migration. This paper shed some light on the effectiveness of such measures.

Our findings have important implications for public policy. First, we show that the decision to migrate is affected by net income expectations, as the human capital theory predicts. Second, we find that the size of the impact of expected net income on migration depends on age, home-ownership and regional unemployment rate. In addition, we consider the effectiveness of income taxation in reducing out-migration from stagnating regions. Our simulations imply that the effectiveness of such policy would be increased, if the reduction in taxation could be targeted at young individuals living in regions with high unemployment rates. Hence, we provide important evidence on where to target possible tax reductions.

References

Eikeland, S. (1999) Personal incentives in Norwegian regional policy, Nordregio working paper 5/1999.

Ghatak, S., Levine, P. and Wheatley Price, S. (1996) Migration theories and evidence: an assessment, *Journal of Economic Surveys*, 10, 159–198.

Greenwood, M. J. (1975) Research on internal migration in the United States: a survey, *Journal of Economic Literature*, 13, 397–433.

Greenwood, M. J. (1985) Human migration: theory, models, and empirical studies, *Journal of Regional Studies*, 25, 521–544.

Greenwood, M. J. (1997) Internal migration in developed countries, in: Rosenzweig, M. R. and Stark, O. (eds.) *Handbook of population and family economics*, Elsevier, Amsterdam, 647–720.

Greenwood, M. J., Mueser, P. R., Plane, D. A. and Schlottmann, A. M. (1991) New directions in migration research: perspectives from some North American regional science disciplines, *Annals of Regional Science*, 25, 237–270.

Lucas, R. E. B (1997) Internal migration in developing countries, in: Rosenzweig, M. R. and Stark, O. (eds.) *Handbook of Population and Family Economics*, Volume 1B, 721–798.

Pekkala, S. (2000) Regional convergence and migration in Finland 1960–90, Doctoral Dissertation, Jyväskylä Studies in Business and Economics, University of Jyväskylä.

Ritsilä, J. (2001) Studies on spatial concentration of human capital, Doctoral Dissertation, Jyväskylä Studies in Business and Economics, University of Jyväskylä.

Ritsilä, J. and Ovaskainen, M. (2001) Migration and Regional Centralization of Human Capital, *Applied Economics*, 33, 317–325.

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.

Schaeffer, P. (1985) Human capital accumulation and job mobility, *Journal of Regional Science*, 25, 103–114.

Seater, J. J. (1977) A unified model of consumption, labour supply, and job search, *Journal of Economic Theory*, 14, 349–372.

Shields, G. M. and Shields, M. P. (1989) The emergence of migration theory and a suggested new direction, *Journal of Economic Surveys*, 3, 277–304.

Sjaastad, L. A. (1962) The costs and returns of human migration, *Journal of Political Economy*, 70 (Supplement), 80–93.

United Nations (1999) World urbanization prospects: the 1999 revision, United Nations Population Division.

Vijverberg, W. P. (1993) Labour Market Performance as a Determinant of Migration, *Economica*, 60, 143–160.

Weiss, Y. (1971) Learning by doing and occupational specialization, *Journal of Economic Theory*, 4, 189–198.

CHAPTER 2

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

Mika Haapanen

Abstract

This paper examines the impact of labour market performance on interregional migration decisions in Finland. The analysis follows the human capital approach and considers observed and unobserved productivity factors. 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 move. It is concluded that peripheral regions are not necessarily losing their more productive workers.

JEL Classification: J61, J24, C35

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

---

* I would like to thank Hannu Tervo, Brigitte Waldorf 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. An earlier version of this paper was published as Haapanen, M. (2000) "Labour market performance and determinants of migration by gender and region of origin", University of Jyväskylä, School of Business and Economics, Working paper No. 226.

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; Ritsilä and Ovaskainen 2001). 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.[3] 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.

The remainder of this paper is organised as follows. Section 2 briefly reviews Vijverberg's human capital model of migration. Section 3 introduces the data and presents the empirical

[3] More elaborated versions of the Roy model include that by Heckman and Sedlacek (1985); see also Heckman and Honoré (1990).

model specifications. Section 4 discusses estimation results 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, he or she 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 his or her expected life-cycle utility function:

$$ELCU(l) = U_0(a) + V_0(l), \tag{1}$$

where

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

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, $X_t(l)$: $U_t(l) = U(W_t(l), X(l))$. 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):

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

from which follows the dichotomous variable I:

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

We can see from the above equations that amenities at the origin are appreciated and thus discourage migration ($\partial I^*/\partial X(a) < 0$). Similarly, a higher cost of living in the origin and decreased cost of migration encourage migration ($\partial I^*/\partial X(a) > 0$). 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 $\varepsilon_t(l)$:

$$W_t(l) = \mu_t(l) + \eta_t(l) + \varepsilon_t(l). \tag{5}$$

$\mu_t(l)$ 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.[4] $\varepsilon_t(l)$ 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 prediction[5] 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

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

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? In this case, 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 likelihood of migration. This would imply that the marginal

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

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

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 $\partial I^*/\partial\hat{\eta}(a) > 0$, that is, 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 are more likely to migrate.[6] 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, $\mu_t(l)$, on the migration behaviour. First, if a background variable raises migrant's wages $\mu_t(b)$ more than it raises local wages $\mu_t(a)$, 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 presence of a diminishing marginal utility of income, the potential utility payoff declines; for a proof, see Vijverberg (1993). A third effect of $\mu_t(l)$ 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 in 1994–1995.

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. The census file is maintained

---

[6] 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 $\hat{\eta}_t(b)$ makes migration more attractive.

and updated by Statistics Finland. 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.[7] The empirical analysis of this study mainly utilises data from the years 1994–1995.[8]

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.[9] 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 that is subject to state taxation. In our sample, 18,741 individuals (70.58 percent) had positive wages. Of these wage earners, 3.08 percent migrated in 1995, which is less than the population average.[10] 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. That is, wage functions that do not control for the selectivity may result in biased parameter estimates. Therefore, the wage function is specified as

$$\ln W = \delta' X_w + \varepsilon_w, \tag{7}$$

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

$$J^* = \gamma' X_a + \varepsilon_a. \tag{8}$$

---

[7] 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.

[8] During the period under study, 1994–95, the Finnish economy was recovering from recession, the unemployment rate remaining exceptionally high. The speed of migration was also considerable lower compared to situation at present (see e.g. Pekkala 2000, 18).

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

[10] 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; Vijverberg (1993).

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

This selectivity-corrected log-wage regression is estimated with maximum likelihood (see e.g. Heckman 1979; Heckman and Honoré 1990; Puhani 2000). The explanatory variables, X_w, in the log-wage equation are age, age squared, four educational dummies, work experience[11], work experience squared, and eight occupational dummies. The explanatory variables, X_a, in the activity choice equation include also household variables: marital status, number of children under age 7, and spouse's income and employment status. The non-linear specification and these exclusion restrictions ensure that the model is identified.[12]

The parameters of interest are unlikely to be same for all members of the population. Therefore, the models are 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.[13] The growth-centre regions are Helsinki, Porvoo, Salo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu, and are also characterised by high wage levels.[14] The other 75 subregions are mostly peripheral and stagnating regions, although, in Finnish terms, they include some of the bigger towns (Lappeenranta, Rovaniemi).

---

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

[12] 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).

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

[14] See e.g. Statistics Finland's Kuntafakta (statistics on Finnish municipalities).

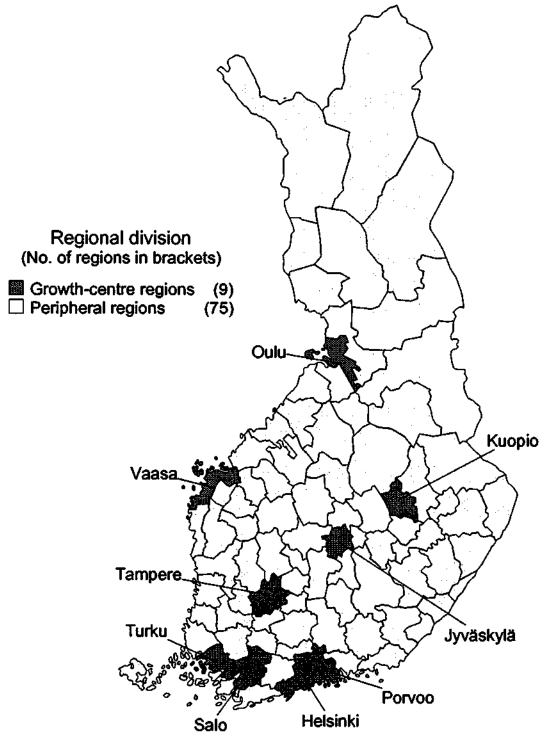


Figure 1. Regional division into growth-centre and peripheral regions

The maximum likelihood estimation results of the selectivity corrected log-wage regressions are not presented here, but are available from the author upon request.[15] 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.

After the estimations, the wage norm (*wage-p*) and wage residual (*wage-r*) were calculated as[16]

$$wage\text{-}p = \exp(\hat{\delta}'X_w + \hat{\sigma}^2/2) \tag{9}$$
$$wage\text{-}r = (\ln W - \hat{\delta}'X_w)/\hat{\sigma}, \tag{10}$$

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).

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

[15] 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).

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

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.[17] Deviations from the wage norm of the sending region, *wage-r*, show gender differences. Male (female) stayers have a larger (smaller) 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 = 192		N = 4153		N = 109	
wage	97.852	(71.04)	71.948	(68.313)	122.958	(98.878)	85.028	(72.195)
wage-p	135.826	(80.593)	85.219	(73.487)	158.01	(93.172)	99.778	(70.441)
wage-r	-0.143	(0.971)	-0.102	(1.238)	-0.098	(0.987)	-0.056	(1.091)
Females	N = 4601		N = 184		N = 4637		N = 92	
wage	71.319	(48.845)	38.511	(42.359)	87.675	(54.725)	62.739	(56.443)
wage-p	98.039	(52.557)	58.959	(53.903)	116.264	(54.021)	77.173	(50.593)
wage-r	-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 the distributions of the wage income, the predicted wage income and the residual for each subsample.[18] 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

[17] 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).

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

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. As expected, the densities for the standardised residual terms look similar to each other.

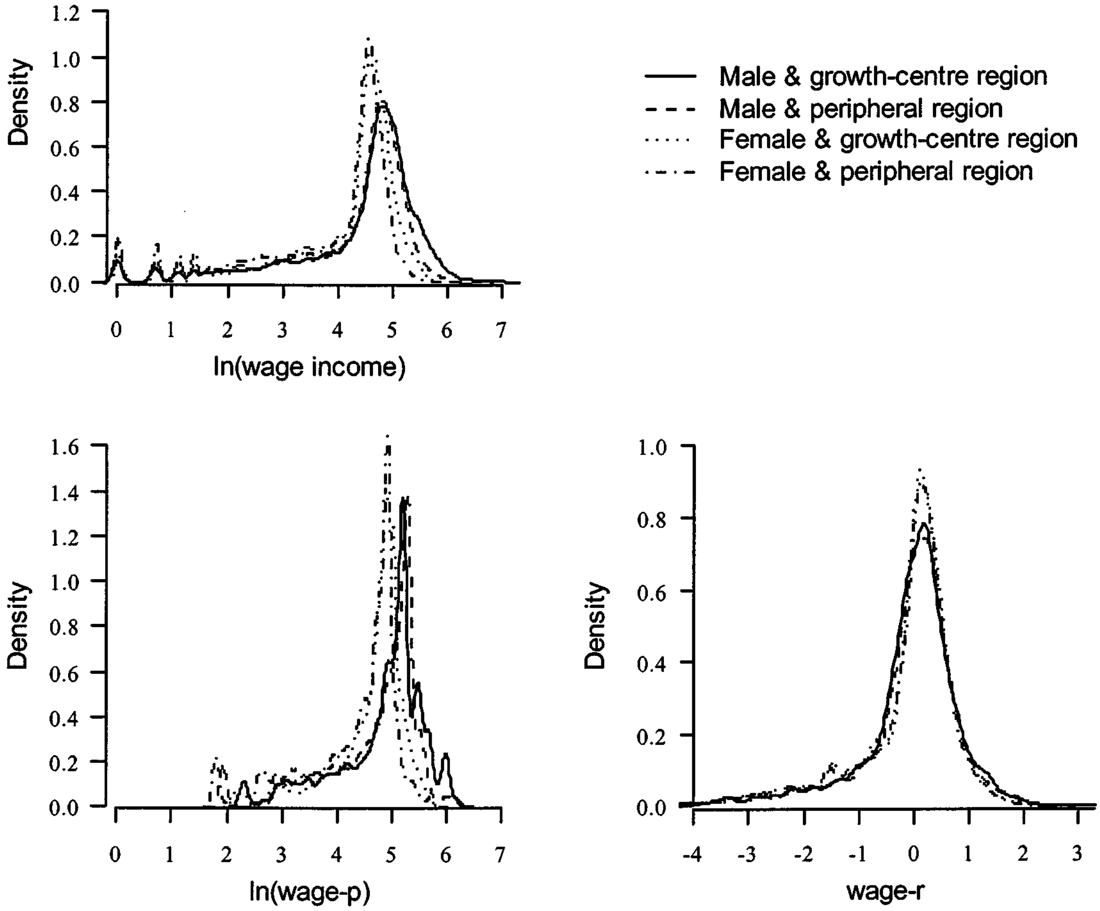


Figure 2. Density estimates by gender and region of origin

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

$$I^* = \beta' X_m + \varepsilon_m, \tag{11}$$

where an individual migrates in 1995, if $I^* \geq 0$, and stays, if $I^* < 0$. X_m is a vector of explanatory 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) is followed, which weights the benefits of moving against the costs of moving. The decision of migration is modelled as 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 are 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)	
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)				
(*wage-p*)/10			-0.149	(0.036)	-0.156	(0.033)			-0.175	(0.036)	-0.173	(0.036)
wage-r			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	
Specification testing												
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 = number of observations. (·) = Employed in the last week of 1994. [a] Figure is for region of origin. [b] In column 3 the variance of the activity choice equation is a function of level of education and work experience. In column 6 the variance of the activity choice equation is a function of level of education. Migration equation is homoskedastic.

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)	
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)				
(*wage-p*)/10			-0.131	(0.050)	-0.131	(0.050)			-0.221	(0.050)	-0.215	(0.050)
wage-r			-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	
Specification testing												
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 the 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 6 the variance of the activity choice equation is a function of age and number of children under age 7. Migration equation is homoskedastic.

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. While the marginal effects are computed, the other explanatory variables are kept at sample means. The computations are based on assumption that the individual is a wage earner in 1994. That is, they are based on probabilities $P[I^* \geq 0 \mid J^* \geq 0]$. The activity choice equation was estimated together with the migration equation, but its parameter estimates or marginal effects (on migration) are not reported here.[19]

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

[19] 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 subsamples problematic. The results are available from the author upon request.

Before considering the impact of labour market performance on the migration decision, we briefly present the results for the other significant explanatory 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-centre regions.

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).[20] 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 outside growth centres, 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 of the labour market performance measures.[21] 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; Ritsilä and Ovaskainen 2001) and our prior expectations based on the Vijverberg's (1993)

---

[20] 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 likelihood of migration.

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

theoretical model and empirical findings. Females living in peripheral regions are an exception: an increase in wages significantly reduces their propensity to move. Hence, economic welfare influences migration decisions for females living in peripheral regions.

As expected, 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 individuals living in growth-centre regions than for individuals living in peripheral regions. While there are no gender differences between the peripheral residents, in the growth-centre regions 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 the probability 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 the probability of migration; therefore, $\partial\hat{\eta}(b)/\partial\hat{\eta}(a) < 1$, indicating that workers with the poorest local prospects decide to move. 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. 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 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 labour market performance measures could be observed only for those who were engaged in wage employment. Hence, we have emphasised the importance of taking account of observed and unobserved heterogeneity in the population of potential migrants.

Our results depend on gender and region of origin. Firstly, an increase in the 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 move is decreased. Secondly, an increase in the wage norm has an expected significant negative impact on the likelihood of migration in all four 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 move. Hence, our results imply that peripheral regions are not necessarily losing their more productive workers. Our results are contrary to Vijverberg's findings on a developing country, which suggested that more productive workers tend to move from rural areas.

Our findings are of interest in a Finnish context, since in recent years population and economic activities have been concentrating into growth-centre regions in Finland. Policies are planned to slow down migration from the peripheral and stagnating regions into the central and prosperous regions. However, our results imply that such policies may not have a desired effect on the economy as a whole, since (female) migrant's productivity can be smaller had he or she not migrated.

Appendix

Table A1. Descriptive statistics by migration and activity status

Variable	Stayers Mean	Stayers Std.dev.	Migrants Mean	Migrants Std.dev.	Non-workers Mean	Non-workers Std.dev.	Workers Mean	Workers 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)
wage-p	103.285	(75.727)	63.278	(59.236)	46.830	(39.669)	124.855	(75.129)
wage-r	-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	0.255	(0.614)	0.201	(0.548)	0.195	(0.579)	0.278	(0.624)
+ 8 occupation dummies								
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. Degree of urbanisation (0-10) refers to the local proportion of the population living in built-in areas.

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.

Ritsilä, J. and Ovaskainen, M. (2001) Migration and Regional Centralization of Human Capital, *Applied Economics*, 33, 317–325.

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.

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.

CHAPTER 3

EXPECTED EARNINGS AND INTERREGIONAL MIGRATION*

Mika Haapanen

Abstract

This paper examines the impact of expected earnings on interregional migration decisions in Finland. Using a sample on young adults living in peripheral regions at the end of 1993, selectivity-corrected earnings predictions are estimated and they are used in a nested logit migration model. The results indicate that the decision to move is influenced by expected earnings. Implementation of a policy that would increase expected earnings in peripheral regions would have a positive effect on retaining workers in those regions and would reduce individuals' incentives to migrate to growth regions. This latter effect is smaller, the further away from a growth region an individual lives and the younger (s)he is. On the other hand, a fall in expected earnings in the growth regions would have hardly any impact on migration probabilities.

JEL Classification: J61, C35, R23

Keywords: Migration, expected earnings, nested logit

---

* I would like to thank Jaakko Pehkonen, Brigitte Waldorf, Jari Ritsilä and Hannu Tervo 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. An earlier version of this paper was presented at the European Regional Science Association Congress in Barcelona, 2000 and published as Haapanen, M. (2000) "Expected earnings and interregional migration", University of Jyväskylä, School of Business and Economics, Working paper No. 221.

1 Introduction

In this study, we examine the impact of expected earnings on interregional migration decisions in Finland. A widely used method in studies of migration and earnings has been to calculate selectivity-corrected earnings estimates for the alternatives of moving and staying. For example, Nakosteen and Zimmer (1980) examine the returns from interstate migration in the United States, while Robinson and Tomes (1982) and Islam and Choudhury (1990) compare the wages of movers with those of stayers in Canada. They all find that migration choice depends on the expected wage gains. Axelsson and Westerlund (1998) examine the impact of migration on income for Swedish households and find migration to have no effect on real disposable income.[22] However, these binary approaches do not allow us to distinguish between migrants' different destination regions. In this respect we extend previous studies.

In this age of urbanisation, when people are migrating from peripheral regions to growth-centre regions, it is interesting to examine a) whether migration from peripheral regions is driven by higher earnings in growth-centre regions and b) what kind of people choose to migrate to growth-centre regions instead of other regions.[23] Another important question is, would an increase in earnings in the peripheral regions reduce the geographical shift of the workforce from those regions? Despite their importance in policy making, e.g. because of regional taxation, these questions have been left unanswered.

To shed light on the above questions, we study young adults resident in Finnish peripheral regions at the end of 1993. Our hypothesis is that individuals choose where to locate on the basis of an evaluation of costs and benefits (Sjaastad 1962; Schaeffer 1985). To simplify matters, we assume that each individual may select among three mutually exclusive alternatives. These are: (i) staying in the current peripheral region, (ii) migrating to another peripheral region, and (iii) migrating to a growth-centre region in 1994.

---

[22] Other studies include Tunali (1986), Falaris (1987), Vijverberg (1995) and Krieg (1997). Falaris (1987) and Vijverberg (1995) use multinomial choice model.

[23] The general determinants of migration are well discussed in the literature. See, for example, comprehensive surveys by Greenwood (1975; 1985; 1997), Shields and Shields (1989), Greenwood *et al.* (1991), and Ghatak *et al.* (1996). Choice between different regions is less well covered: Falaris (1987) examines the choice among specific locations and considers impact of regional wages on the destination choice using nested logit model. Hughes and McCormick (1994) study destination choices with nested logit, but they do not control for self-selection in wage determination.

We measure the benefits associated with choosing a given region among others by expected earnings in the case of each alternative. Since we do not observe expected earnings we have to impute them for each alternative. To do so we apply an estimator proposed by Lee (1983). With Lee's method we are able control for possible unobserved factors, which may affect both the individual's choice of location and his earnings. These unobserved factors may result in sample selection bias if we try to estimate alternative specific earnings equations by OLS on the basis of the self-selected samples. Thus, the key advantage of sample selection models is that they allow us to investigate potential outcomes in addition to the actual outcomes for decision makers.

Individuals' choice of location is modelled by means of multinomial and nested logit models. Nested logit allows us to relax the restrictive property of independence of irrelevant alternatives imposed by the simple multinomial logit (MNL) model (McFadden 1981).[24] This is important because unobserved similarities between alternatives or attributes between migrants may arise, which are not otherwise explicitly controlled for in the model, and hence bias the results.

Estimation of the migration choice model proceeds in three steps. First a reduced form multinomial logit model is estimated. Individuals choose between staying in the current peripheral region, migrating to another peripheral region or migrating to a growth-centre region. Then earnings equations are estimated with the inclusion of selectivity correction terms calculated from the reduced form MNL model. Finally, the 'structural' nested logit migration model is estimated with predicted earnings entering as additional explanatory variables.

The remainder of this paper is organised as follows. Section 2 specifies the structure of our migration model. In Section 3, we briefly describe our data and sample selection. Section 4 reports the estimation results along with calculations of direct and cross elasticities. Finally, Section 5 concludes the study.

---

[24] MNL model assumes that the odds ratios are independent of the other alternatives, i.e. P_{ij}/P_{ik} must be independent of the remaining probabilities. The property is known as independence of irrelevant alternatives (IIA). See Maddala (1995) for further discussion and references on the subject matter.

2 Model Specifications

In this section we present a model of migration choice, which follows from the approach developed by Lee (1983). Each individual living in a peripheral region may select among three mutually exclusive alternatives: (s)he can either stay (j = 1), migrate to another peripheral region (j = 2), or migrate to a growth-centre region (j = 3). As usual, the motivating force behind the discrete choices is assumed to be the concept of random utility maximisation. The individual is always assumed to select the alternative with the highest utility (see *inter alia* McFadden 1973; 1981; 1984; Ben-Akiva and Lehman 1985).[25] However, the utilities are not known to the econometrician with certainty and are therefore treated as random variables.

We assume that individuals have a stochastic utility function, which we will write in the form:

$$U_j = \alpha'_j w_j + \beta'_j x_j + \varepsilon_j, \quad j = 1, 2, 3 \tag{1}$$

where w_j are the expected earnings in alternative j and x_j can be a function of the individual's characteristics, which are invariant across alternatives, and attributes of the alternative j. There may be parameter restrictions on or across α and β's. Individual subscripts (i) are suppressed except in cases where their omission may cause confusion. The last term in (1) is an error term, which determines the structure of the model. If it has an extreme value distribution, multinomial logit (MNL) model will arise. If the error term has a generalised extreme value (GEV) distribution, it will be a question of nested logit model.[26]

For a given individual the criterion for choosing alternative k is: $U_k > \max U_j$, for all $k \neq j$. Hence U_k is utility associated with choosing state k compared to the optimal choice. Individuals choose where to locate on the basis of an evaluation of the costs and benefits of each alternative (Sjaastad 1962; Schaeffer 1985). The migrant incurs the money cost of travelling to the new location, as well as the non-money cost of losing accrued job experience, the psychical costs of leaving friends, family, and familiar surroundings, and the discomfort

[25] Although utility-based approaches to choice making have been popular, there are alternative ways for seeing the choice process in the literature. For example, Tversky's (1972) elimination-by-aspect decision making sees choice as a process involving the elimination of alternatives, with the process terminating when only a single alternative remains. However, it has several drawbacks, which have prevented its wider use (Pudney 1989, 122). See Ben-Akiva & Lehman (1985, 35–38) and Pudney for other examples.

[26] At least four sources of randomness can be listed: unobservable attributes of alternatives, unobservable variations in preferences, measurement errors in the data, or use of instrumental (or proxy) variables (see Ben-Akiva and Lehman 1985, 56–57). See McFadden (1981) and Ben-Akiva and Lerman for the assumptions about the distribution of random term that yield the multinomial and the nested logit model.

of uncertainty. On the other hand, the migrant gains higher expected earnings flow and the psychical benefits of the new destination, if any, that are necessary to induce him or her to migrate. The future returns on staying or moving will depend on complementary human capital investment such as education and job experience.

Earnings determination is modelled by semi-log equations:

$$\ln w_j = \gamma_j' z + v_j, \quad j = 1, 2, 3 \tag{2}$$

where earnings are a function of individual-specific characteristics. This is a censored regression in that for a given individual we observe w_j only if this person chooses migration alternative j. By definition the number of earnings equations is equal to the number of migration alternatives. We will assume that the marginal distributions of v_j are normal, $N(0, \sigma^2)$.

We cannot directly estimate (1), because of censoring in earnings. Instead we formulate a 'reduced' form of equations (1) and (2), V_j, where utility V_j is a function of z and x_j. If the error terms are independently and identically distributed with the extreme value distribution, Domencich and McFadden (1975) and Ben-Akiva and Lehman (1985) show that the model implies the multinomial logit probabilities:

$$P_j = \frac{\exp(\omega_j' y_j)}{\sum_{j=1}^{3} \exp(\omega_j' y_j)}, \quad j = 1, 2, 3 \tag{3}$$

where y_j are the explanatory variables from z and x_j with estimated parameters ω_j. P_j denote the probability of choosing alternative j. The model assumes that ε_j and v_j are uncorrelated across alternatives and people, and that they are uncorrelated with the remaining right-hand-side variables in (1) and (2). We relax these simplifying restrictions when we estimate the 'structural' migration model by nested logit.[27]

Lee (1983) shows that we can write the conditional mean, on alternative j being chosen, of (2) as:

$$\ln w_j = \gamma_j' z - \sigma_j \rho_j \left[\phi(J(P_j))/P_j\right] + \xi_j \tag{4}$$

---

[27] Form of the log likelihood is in all cases:

$$\ln L = \sum_{i=1}^{n} \sum_{j=1}^{J} \delta_{ij} \ln P_{ij}, \text{ where } \delta_{ij} = 1, \text{ if alternative } j \text{ is selected.}$$

where $J(P_j) = \Phi^{-1}(P_j)$ involves the inverse of the standard normal distribution, ϕ is the standard normal density function and $E(\xi_j \mid j \text{ chosen}) = 0$.

We use the estimates of the MNL model to calculate choice probabilities and to form the sample selection correction variables $\phi(J(P_j))/P_j$ for each observation. Then we estimate equation (4) by OLS. This last step gives us consistent estimates of γ_j and $\sigma_j\rho_j$. Non-zero estimates of $\sigma_j\rho_j$'s imply sample selection in the earnings equations. Once we have obtained consistent parameter estimates for the earnings equations, we can use them to calculate the predicted, unconditional earnings for each individual in each alternative. We then replace w_j in (1) by predicted earnings $\hat{w}_j$ and estimate the structural version of the migration choice model by nested logit. Finally, from the structural equations we obtain estimates of α_j and β_j.

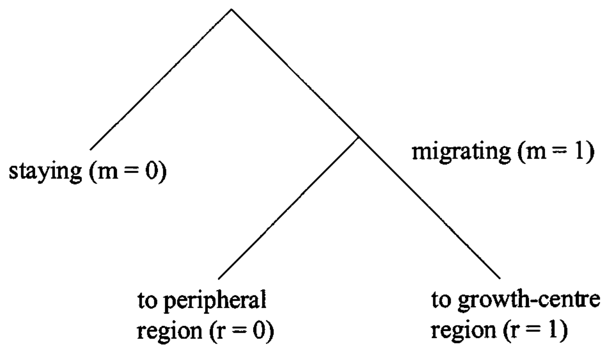


Figure 1. The structure of the nested logit migration model

We formulate the structural nested logit model by assuming a natural division of alternatives (see Figure 1). The individual first chooses whether to migrate from the current peripheral region or not (m = 1, 0) and, secondly, if (s)he does, where to migrate. If r = 0, the individual migrates to another peripheral region, and if r = 1, to a growth-centre region. Note that although it is convenient to describe the possible choices by a tree diagram, this does not mean that, under nested logit, the choices have to be made sequentially by the individual. It just means that we are relaxing the assumptions on the error terms imposed by the MNL: nested logit allows the variance of the error terms to differ across the groups (movers vs. stayers), while maintaining the IIA assumption within groups (independent and homoskedastic errors).

Although there are other nested logit formulations such as Daly (1987), we use McFadden's nested logit model, which is a member of the generalised extreme value (GEV) family and is consistent with utility maximisation (McFadden 1981; see Koppelman & Wen 1998 for discussion). To simplify the notation let the utility of alternative r in nest m be

$$U_{rm} = V_{rm} + \varepsilon_{rm} \tag{5}$$

where $V_{rm} = \alpha'_{rm} w_{rm} + \beta'_{rm} x_{rm}$ denotes the deterministic component of utility and ε_{rm} denotes the GEV distributed error term. Let P_{rm} denote the probability of choosing migration type m and destination region r. From the rules of conditional probability we know that $P_{rm} = P_{r|m} P_m$, where $P_{r|m}$ is the conditional probability of choosing region r conditional on choosing nest m, and P_m is the marginal probability of choosing nest m of which r is a member.

If we can assume that the deterministic utility has additive separable form and that ε_{rm} has the GEV distribution, we obtain the nested logit model:

$$\begin{aligned} P_{r|m} &= \frac{\exp(V_{rm}/\mu_m)}{\sum_{j\in R_m} \exp(V_{jm}/\mu_m)} = \frac{\exp(V_{rm}/\mu_m)}{\exp(I_m)}, \\ P_m &= \frac{\exp(\mu_m I_m)}{\sum_k \exp(\mu_k I_k)}, \text{ and } I_m = \ln\left(\sum_{j\in R_m} \exp(V_{jm}/\mu_m)\right) \end{aligned} \tag{6}$$

where R_m denote the set of alternatives at level 2 that are connected by branches of the tree to alternative m at level 1.[28] I_m is termed the inclusive price of alternative m at level 1 and its parameter μ_m is termed the inclusive value parameter. Thus, V_m, the utility of nest m, is equal to $\mu_m I_m$. If $\mu_m = 1$ for every m, then the model collapses to the ordinary multinomial logit model. In our case there is only one free inclusive value parameter. This is because if an individual does not migrate he cannot choose where to migrate and hence the nest is considered degenerate and μ_0 has to be normalised equal to one.

[28] In our model $R_{m=1}$ includes two alternatives: migrate to peripheral region and migrate to growth-centre region.

To sum up, the estimation of the migration choice model proceeds in three steps. First we estimate a reduced form multinomial logit model, where individuals choose between staying in the current peripheral region, moving to another peripheral region and moving to a growth-centre region. Then we estimate earnings equations including selectivity correction terms calculated from the reduced form MNL model. Finally, we estimate the structural nested logit migration model with predicted earnings entering as additional explanatory variables.[29]

3 Data

This study uses a one-percent random sample from the Finnish longitudinal census. The census file is maintained and updated by Statistics Finland. The socioeconomic status of the sample individuals and their spouses is well documented: the data include information on the personal and family status, past labour market record, and regional characteristics.[30] The empirical analysis of this study mainly utilises data from the post recession years 1993–1995, but some of the variables have been constructed using information on the preceding years (1987–1992). The fact that we have information on individuals' home subregion is especially useful for this study.

Finland divides into 85 subregions (NUTS4, "seutukunnat" in Finnish), which correspond to the actual commuting and working areas as well (see Figures 2–5).[31] Hence, data allow us to determine whether an individual is a migrant, defined there as those whose subregion of residence is different from that of year before. In addition, the place-of-residence data allow us to determine the individual's subregion of origin and the region to where (s)he migrates.

---

[29] Naturally, estimation in three steps results in some loss of efficiency.

[30] Unfortunately, the data do not allow us to use households as the unit of analysis, because we do not know who belong to same households. However, we do have wide range of household variables, which should satisfactorily control for dependencies in migration decision making.

[31] The estimation sample individuals from the two subregions of Åland have been excluded, as they have many special characteristics (self-regulation, isolated geographical location, language, small size) that distinguish them from the rest of the country.

The regional division into peripheral and growth-centre regions was done with the help of Figures 2–5. Figure 2 shows the net annual migration into the Finnish subregions. We can see (the darkest-shaded areas) that only a few regions that experienced positive net migration in 1996. Comparison of Figures 2 and 3 indicate that the destination choices of migrants have often been the already more highly populated areas of Finland. Since these growth-centre regions are characterised by high wage levels, they could be called as prosperous regions in contrast to the other, peripheral, regions which could be called depressed; see Figures 4 and 5. Given these facts we defined the growth-centre regions to include Helsinki and its neighbouring regions (Salo and Porvoo), Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu. Regions with positive migration flows in eastern Finland and Riihimäki (north of Helsinki) were not included among the growth-centre regions because they have not shown consistent positive in-migration, and they have higher unemployment and lower wage levels than the other growth areas.

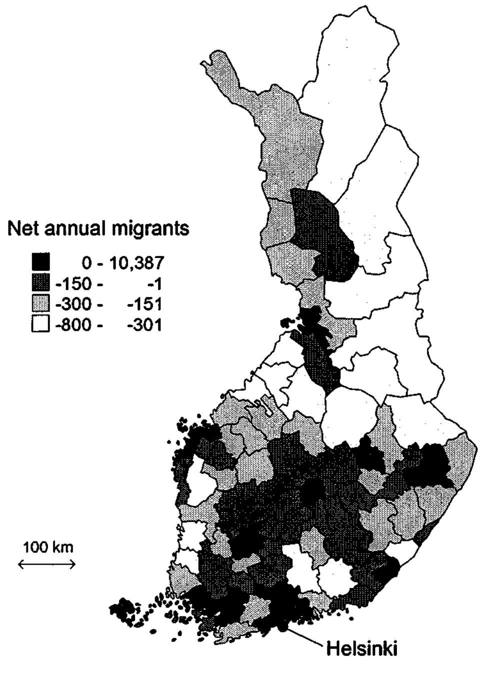


Figure 2. Net annual migrants, 1996

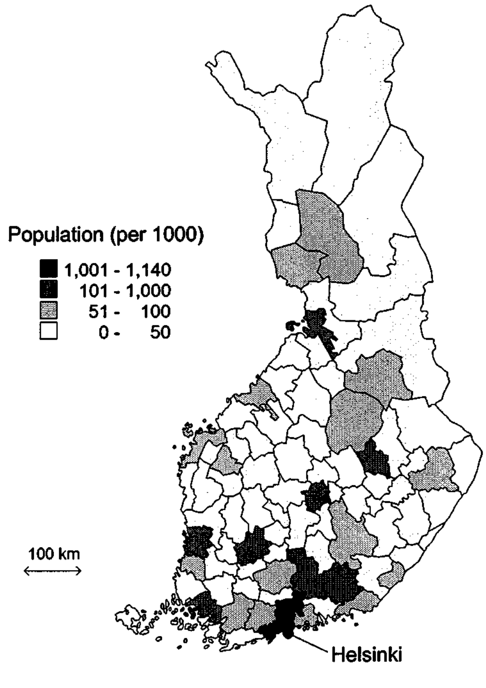
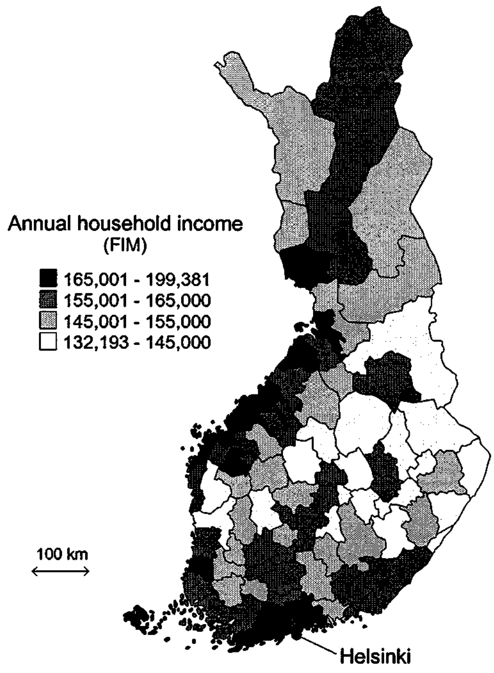


Figure 3. Population, 1996



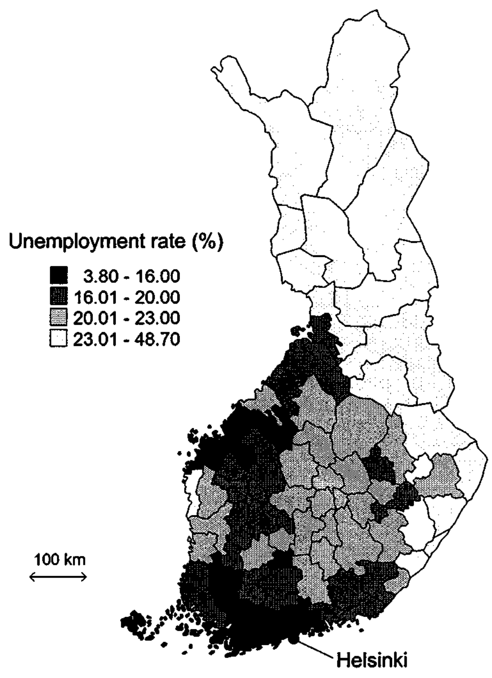


Figure 4. Annual household income (FIM), 1996

Figure 5. Unemployment rate, 1996

We measure earnings by individuals' annual income from labour plus self-employment and work-related transfers, such as unemployment insurance and sick pay. In the estimation we use data on those individuals between the ages of 18 and 40 who had positive earnings in 1993 and 1995 and whose region of origin was one of the peripheral regions at the end of 1993. Earnings before migration are obtained from 1993, because we cannot identify what were the relative proportions of annual earnings acquired in the regions of origin and destination in 1994. Entrepreneurs are excluded from the sample because their determinants of earnings and migration are likely to be different from the rest of the working population (see Vijverberg 1993).[32]

There were reasons for our sample selection. In the sample of 18 to 55-year-old peripheral residents, 3.06 percent migrated in 1994 of whom 51.25 percent migrated to growth-centre regions. By concentrating on adults aged 18 to 40, we were able to increase the migration propensity to 4.09 percent of whom 54.28 percent migrated to growth-centres in that year. One reason for this is that young people search more actively for better jobs than their old

[32] If we had included individuals with no earnings, we should have modelled the decision to participate in labour force. Similarly, if we had included entrepreneurs in the sample, we should have controlled for their selectivity in addition to modelling their earnings. These factors would have resulted in a model too complicated to handle. Instead, we decided to concentrate on individuals with positive earnings.

counterparts (see e.g. Linneman and Graves 1983; Schaeffer 1985; Kettunen 1997). This sample selection strategy increases the homogeneity of the sample and thus non-parametrically improves the reliability of the results within this age group. After these sampling procedures and omitting observations with missing data we were left with 4,546 observations.

Before considering our estimation results we introduce the other explanatory variables used in explaining individuals' migration choices. Mean values of the selected explanatory variables by the migration status are given in Table 1. Looking at Table 1, we can see that there are approximately equal numbers of males and females in the group of peripheral migrants, whereas there are more males in the group of stayers and growth-centre migrants.[33] Migrants, especially those who migrated to growth-centre regions, are younger and more educated than those who decided to stay in the peripheral regions in 1994.[34] A similar pattern holds for individuals who have obtained their last educational qualification during 1993–1994.

The mean values of the household variables lead us to expect that married people and especially those who have school-aged children, own a house or whose spouse is employed, will show a low propensity to move. Spouse's income can have an effect on migration propensity, but it may be captured by the other household variables. Furthermore, we expect that as the distance to the closest growth-centre region increases, individuals on average will prefer to migrate to another peripheral regions rather than making a costly move to a growth-centre region.[35] Similarly, we expect commuters and those who live in region of birth to show a high and low propensity to move, respectively. Population density is expected to have negative effect on migration propensity (Axelsson and Westerlund 1998).

---

[33] There are more males in the sample because labour market participation rates are higher for males.

[34] The education variable is defined using the Finnish Standard Classification of Education (31.12.1994).

[35] Distance is calculated are in kilometres by road from the largest town (centroid) of the region of origin.

Table 1. Descriptive statistics by the migration status in 1994

Variable	Mean (Std. dev.)					
	Stayers (N = 4,360)		Peripheral migrants (N = 85)		Growth-centre migrants (N = 101)	
Sex (male = 1)	0.551	(0.497)	0.518	(0.503)	0.564	(0.498)
Age	31.574	(5.808)	28.929	(6.395)	27.406	(4.813)
Level of education (1–5)	2.106	(1.320)	2.412	(1.613)	3.020	(1.216)
Last educational qualification obtained during 1993–94	0.042	(0.202)	0.106	(0.310)	0.228	(0.421)
Married or cohabiting	0.699	(0.459)	0.600	(0.493)	0.545	(0.500)
Spouse is employed	0.426	(0.495)	0.294	(0.458)	0.267	(0.445)
Spouse's annual income from employment in 1993 (FIM)	44.390	(57.638)	28.859	(47.793)	28.663	(47.677)
# Children under 7	0.462	(0.757)	0.447	(0.809)	0.307	(0.612)
# 7–18-year-old children	0.665	(0.944)	0.341	(0.733)	0.158	(0.441)
Homeowner	0.486	(0.500)	0.294	(0.458)	0.327	(0.471)
# Months of employment in 1993	8.387	(4.815)	6.635	(4.992)	6.495	(4.685)
Commuting	0.368	(0.482)	0.600	(0.493)	0.683	(0.468)
Living in region of birth	0.632	(0.482)	0.424	(0.497)	0.475	(0.502)
Distance from the closest growth-centre (km)	109.525	(65.091)	117.047	(75.990)	110.545	(73.675)
Distance from Helsinki (km)	320.632	(218.076)	306.200	(202.517)	295.366	(220.258)
Degree of population density	6.817	(1.324)	6.459	(1.419)	6.693	(1.355)
Annual earnings in 1993 (FIM)	91.143	(43.565)	77.529	(52.512)	79.604	(55.311)
Annual earnings in 1995 (FIM)	100.882	(46.719)	95.384	(55.659)	102.383	(54.041)

Notes: Sample includes adults aged 18 to 40, who were originally living in peripheral regions at the end of 1993. N is the number of observations. All earnings variables are expressed in 1993 prices (1,000FIM). Variables are measured in the region of origin at the end of 1993 if not otherwise stated.

Table 1 also shows that the increase in earnings has been largest in the group of growth-centre migrants. A large proportion of the increase in earnings can be explained by the marked increase in the months of employment in this age group of young adults – they are two years older and hence more experienced in 1995 than in 1993 – and the improvement in the economic conditions in Finland in 1993–1995. The earnings variable for 1995 is expressed in 1993 prices using the cost-of-living index.

Looking at Figure 6, which presents the bivariate densities of earnings in 1993 and 1995 by the three migration categories, we can see a clearer picture of the earnings distribution.[36] The distribution of the earnings for migrants is more dispersed, while the autocorrelation in

[36] We calculated the densities using nonparametric kernel estimation methods (see e.g. Silverman 1986; Wand and Jones 1995).

earnings is more evident within the group of non-migrants. Migration is associated with an increase in earnings: there are groups of workers in the sample who had low earnings in 1993 and were able to increase them considerably in 1995. The densities for growth-centre and peripheral migrants also show slight differences.

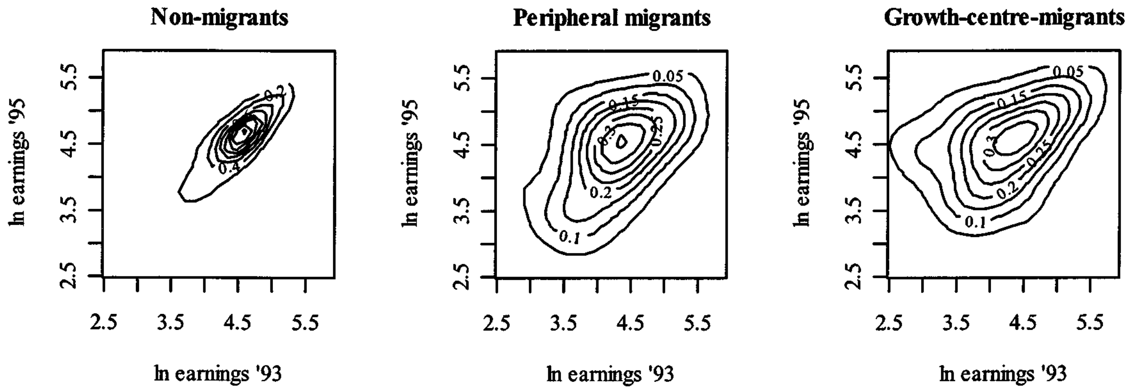


Figure 6. Bivariate density of earnings for 18–40-year-olds originally living in the peripheral regions at the end of 1993

4 Estimation Results

We first estimated the reduced form migration model, where individuals choose between staying in the current peripheral region, migrating to another peripheral region and migrating to a growth-centre region. The selectivity correction terms were calculated and included in the OLS regressions of the log of earnings in 1995. Other explanatory variables included sex, age, education, work experience[37], months of employment, and information on spouse and children, all measured at the end of 1993. Thus we assumed that each individual can adequately predict his/her expected earnings in 1995, conditional on his/her characteristics, e.g. education, experience, at the moment of migration choice.[38]

It is worth reporting the results of the selection terms, since they were statistically significant at the 5 percent level in all three earnings equations. This implies that selection to migration categories is not random. It is only by including the selection terms that consistent estimates

[37] Work experience was measured by the number of months of employment during 1987–1993.

[38] The estimation results are available from the author upon request. Due to the small number of observations in the migration categories, the selectivity-corrected earnings equations were not estimated for men and women separately.

of other regression coefficients can be ensured. The estimated coefficients for the stayers and growth-centre migrants were negative ($-\sigma_j\rho_j < 0, j = 1, 3$), and for the peripheral migrants positive ($-\sigma_j\rho_j > 0, j = 2$). However, because the interpretation of the selectivity parameters is problematic (Dolton and Makepeace 1987) and because they are not the focus of this paper, we shall omit further discussion of them. Instead, the earnings equations were used to calculate unconditional earnings predictions for each individual for all three alternatives.[39]

The estimated utility function parameters specified in equations (1) and (5), estimated by the structural multinomial and nested logit models with full information maximum likelihood, are reported in Table 2.[40] Because not all the individual specific parameters are identified, we normalised the models with respect to the first alternative (staying in the periphery). The likelihood ratio (LR) tests show that the preferred model specification does not restrict the earnings parameters α_j to be the same. That is, an increase in expected earnings has a different marginal effect on utility of each alternative. This holds for the multinomial and the nested logit specifications.

The Wald test indicates that the IV parameter in the nested logit model is not significantly different from one. This means that the more parsimonious model would be the MNL (see also the log likelihood values) and that its independence of irrelevant alternatives -assumption is not rejected.[41]

---

[39] The unconditional earnings predictions for the three alternatives were calculated by setting the selectivity correction terms to zero.

[40] While our data in principle permits a longitudinal analysis, implementing it in the present setting would result in a model too complicated to handle.

[41] Note that by looking elasticities in the Table 3, this conclusion is somewhat questionable. We also estimated the nested logit with alternative nesting structures, but we could not find any improvement on the fit of the model. Hence, we report the most intuitive model, which was introduced in Figure 1. Because the IIA assumption seems valid, we use MNL and nested logit models instead of the more complicated mixed logit (McFadden and Train 2000) or multinomial probit models (Daganzo 1979; Weeks 1997).

Table 2. Estimation results of the multinomial and nested logit models

Variable	Multinomial logit			Nested logit		
	Staying	Migrating to periphery	Migrating to growth-centre	Staying	Migrating to periphery	Migrating to growth-centre
Constant		-1.227 (0.988)	-3.166 (0.977)		-1.076 (1.080)	-2.996 (1.225)
Predicted annual earnings*10^{-5} in 1995	0.144 (0.061)	0.420 (0.163)	-0.017 (0.027)	0.139 (0.070)	0.391 (0.213)	-0.012 (0.029)
Annual earnings*10^{-5} in 1993		-0.041 (0.040)	0.052 (0.034)		-0.034 (0.039)	0.047 (0.035)
Sex (1 = male)		0.218 (0.277)	0.333 (0.248)		0.206 (0.284)	0.313 (0.240)
Age (10 years)		-0.382 (0.240)	-0.636 (0.262)		-0.413 (0.253)	-0.627 (0.292)
Primary or lower secondary school		-0.317 (0.298)			-0.359 (0.349)	
Academic degree		0.693 (0.403)			0.723 (0.382)	
Level of education (1–5)			0.951 (0.163)			0.913 (0.200)
Last ed. qual. obtained during 1993–94		0.229 (0.406)	0.888 (0.300)		0.278 (0.481)	0.862 (0.305)
Married or cohabiting		0.431 (0.338)	0.500 (0.291)		0.426 (0.324)	0.486 (0.318)
Spouse is employed		-0.410 (0.296)	-0.395 (0.290)		-0.401 (0.293)	-0.407 (0.280)
# Children under 7		-0.222 (0.200)	-0.321 (0.182)		-0.226 (0.189)	-0.295 (0.188)
# 7–18-year-old children		-0.183 (0.182)	-0.638 (0.235)		-0.205 (0.220)	-0.615 (0.257)
Homeowner		-0.661 (0.260)	-0.387 (0.240)		-0.625 (0.270)	-0.415 (0.275)
# Months of employment in 1993		0.071 (0.038)	0.070 (0.038)		0.069 (0.040)	0.064 (0.041)
Commuting		0.883 (0.268)	1.302 (0.247)		0.905 (0.310)	1.278 (0.252)
Degree of population density		-0.228 (0.084)	-0.128 (0.082)		-0.223 (0.088)	-0.133 (0.084)
Living in region of birth		-0.844 (0.234)	-0.625 (0.219)		-0.825 (0.255)	-0.642 (0.228)
Distance from the closest growth-centre (10 km)		0.018 (0.014)	0.009 (0.015)		0.017 (0.016)	0.010 (0.015)
IV parameter					1.136 (0.623)	
Log likelihood		-772.163			-772.162	
Likelihood ratio index		0.1467			0.1467	
LR test for equal expected earnings parameters		10.261 (p=0.006)			8.544 (p=0.014)	
Wald test for IV parameter = 1					0.477 (p=0.827)	
Number of observations	4360	85	101	4360	85	101

Notes: First the estimated parameter is given, followed by the asymptotic standard errors in parenthesis. Variables are measured in the region of origin at the end of 1993 if not otherwise stated. See Table 1 for the descriptive statistics.

Table 2 shows that – in the group of 18–40-year-olds – old people are less likely to migrate than younger. The older the migrant, the fewer the years of payoff from the human capital investment in migration, while the cost of migration remains just as high, which helps to explain why migration diminishes with age. In addition, younger individuals are expected to have lower psychical costs, because of fewer local family ties. Table 2 shows no general gender differences in migration, which is not surprising given that we have controlled for various household characteristics.

In order to examine the influence of education on migration, we used various specifications for the education variables. The most useful proved to be that, where the utility in growth-centre migration alternative is influenced by level of education (1–5) and where the utility of the peripheral migration alternative is influenced by the two indicator variables.[42] The results significantly indicate that highly educated people are more likely to move than the less educated, especially to growth-centre regions. One explanation for the increased mobility of highly educated people is the narrowness of the relevant labour market (in peripheral regions). Education is general human capital which is easily transferable to a different location and which creates more employment opportunities. Therefore education reduces the risks of migration and increases the gains from moving to a region with a wider labour market. In addition, career-orientated life planning often involves moving to a new location as a rationale for career development. (See e.g. DaVanzo 1983; Shields and Shields 1989.)

By comparing the coefficients for migrating to the periphery and growth-centre alternatives, we were able to identify other factors, apart from age and education, which influence destination choice. Clearly, an individual who has just obtained an educational qualification will have an increased propensity to move to growth-centre region. Commuting increases a worker's propensity to move and it increases the odds of moving to growth-centre region over moving to another peripheral region. This phenomenon can be explained by the lowered opportunity cost of moving to the location of one's job and by the fact that most jobs are located in growth regions. The larger the population density of their region of origin, the less likely people are to migrate to periphery. This can be viewed as a proxy for labour market diversification and career opportunities in the current region. The negative effect is in line with previous studies (see e.g. Axelsson and Westerlund 1998). Individuals, who have never moved before, are less willing to move.

As Mincer (1978) points out, family considerations appear to influence migration decisions. People are tied to other people and hence the individual's migration propensity is decreased in the presence of children. The results in Table 2 show that as the number of school-aged children in the family increases, a parent becomes less willing to move and is even less likely to migrate to a growth-centre region. 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, homeowners are especially reluctant to move to another peripheral region. In addition, higher initial earnings increase odds of a worker choosing to migrate to a growth-centre region over staying in current region or moving to another peripheral region. Spouse's labour income did not have an effect on migration decisions and thus was excluded from the final specification of the models.

Table 3 reports the elasticities of the estimated probabilities with respect to changes in expected earnings for all three alternatives. In interpreting the elasticities, one should keep the absolute probabilities of making each choice in mind: the elasticities tend to be very high at very low probabilities (migration alternatives) and vice versa, reflecting saturation effects (Börsch-Supan 1987, 49). In addition, because they are derived from a highly non-linear model, elasticities at variable means are generally different from the elasticities of individuals. The relaxation of the IIA assumption in the nested logit model can be seen from the direct and cross elasticities: in the MNL model the cross elasticities for each attribute are all equal, while in the nested logit model the IIA property only holds within the branch of migrants.[43]

To interpret the elasticities, suppose a decision maker in a peripheral region expects, *ceteris paribus*, his/her expected earnings to increase by 10% in his/her present region of residence. This would increase the propensity to stay by 1.11% (0.59%) in the nested

---

[42] These indicator variables are defined as follows: Primary or lower secondary school = 1, if level of education = 1 or 2; elsewhere 0. Academic degree = 1, if level of education = 4 or 5; elsewhere 0.

[43] Note that in the MNL model cross elasticities are not realistic because the mean migration and staying probabilities are very different from each other. For example, it is not feasible that a rise in the earnings a person is expecting to earn in growth-centre regions would reduce staying and peripheral migration probabilities by the same percentage figure.

(multinomial) logit model. Similarly, the propensity to migrate would fall by around 13% in both models.

Table 3. Estimated elasticities of probabilities with respect to expected earnings

Effect on probability	Expected change in the earnings		
	Staying	Migrating to periphery	Migrating to growth-centre
Multinomial logit			
Staying	0.0588	- 0.0213	- 0.0081
Migrating to periphery	- 1.3774	1.1182	- 0.0081
Migrating to growth-centre	- 1.3774	- 0.0213	- 0.3573
Nested logit			
Staying	0.1114	- 0.0011	- 0.0013
Migrating to periphery	- 1.2779	1.5734	- 0.0056
Migrating to growth-centre	- 1.2779	- 0.0046	1.5725

Notes: Estimated elasticities are calculated at the sample means of the explanatory variables using Table 2 estimates. See Koppelman and Wen (1998) for elasticity formulas in the two-level nested logit model.

Suppose instead that the decision maker expects, *ceteris paribus*, his earnings to increase by 10% if (s)he were to select the other periphery-region alternative. This would ultimately reduce incentives to stay in the present region. It would increase his/her incentives to migrate to a peripheral region by 15.73% (11.18%) in the nested (multinomial) logit model. Nested logit also allows us to decompose the effect into two parts. It increases a person's propensity to move (0.25%) and, more importantly, it increases that person's chances of choosing a peripheral region over a growth-centre region (15.48%). Having said that, these decomposition effects should be interpreted with caution, as the migration decision and choice of destination are most likely to be simultaneous in nature. The cross elasticities are very small.

Finally, suppose the decision maker expects, *ceteris paribus*, his earnings to increase by 10% if (s)he were to migrate to a growth-centre. This would increase his/her migration propensity to the growth-centre region by 15.73% in the nested logit, but decrease by 3.57% in the multinomial logit model. The figure for nested logit seems more plausible and is in line with Sjaastad's (1962) human capital theory. Again, the figure for the nested logit model can be decomposed into two parts. It increases a person's propensity to move (0.30%) and it increases that person's likelihood of choosing a growth-centre over a peripheral region (15.43%). Again, the cross elasticities are small in both models.

In practice it would be difficult to implement a policy that would *only* influence the expected earnings of those individuals who decide to stay in their present peripheral region. This is why we consider what impact a 10-percent increase in the expected earnings of all periphery residents would have on their migration probabilities. Moreover, we have so far assumed that these earnings effects are same for all types of individuals. This assumption may or may not be valid and it needs to put under scrutiny.

To examine more closely both the policy and the assumption described above, we estimated the nested and multinomial logit models with additional explanatory variables. Interaction terms with predicted earnings for 1995 were used to take into account the possibility of heterogeneity in earnings effects. After various attempts at different specifications, we came up with the following variables. Firstly, predicted earnings in 1995 were divided by the distance to the closest growth-centre region to form a benefit/cost variable. Secondly, predicted earnings in 1995 were divided by age to form a benefit per age variable. Distance to Helsinki was also used as an additional explanatory variable.

The estimates reported in Table 4 provide a significant improvement on the fit of the model. On a likelihood ratio test, the nested (multinomial) logit model in the Table 2 is rejected at the 4% (6%) level of significance in favour of Table 4 model.[44] As in Table 2, the LR tests reject the equality of the expected earnings parameters. The two distance variables, distance from Helsinki and distance from the closest growth-centre, interact well, with both variables significant. The interpretations and results of the other variables, apart from the ones involved in the interaction terms, remain about the same, they are not repeated.

[44] The test values are $\chi^2(4) = 9.06$ (p = 0.06) and $\chi^2(4) = 10.00$ (p = 0.04), respectively.

Table 4. Estimation results of the multinomial and nested logit models with interaction terms

Variable	Multinomial logit			Nested logit		
	Staying	Migrating to periphery	Migrating to growth-centre	Staying	Migrating to periphery	Migrating to growth-centre
Constant		-1.601 (1.200)	-1.547 (1.441)		-0.864 (1.119)	-1.113 (1.254)
Predicted annual earnings*10^{-5} in 1995	0.277 (0.122)	0.553 (0.200)	0.101 (0.100)	0.213 (0.114)	0.390 (0.195)	0.087 (0.085)
(·)/Distance to the closest growth-centre region (10 km)[a]	0.131 (0.124)	0.131 (0.124)	0.131 (0.124)	0.116 (0.111)	0.116 (0.111)	0.116 (0.111)
(·)/Age (10 years)[a]	-0.422 (0.304)	-0.422 (0.304)	-0.422 (0.304)	-0.315 (0.271)	-0.315 (0.271)	-0.315 (0.271)
Annual earnings*10^{-5} in 1993		-0.036 (0.040)	0.044 (0.034)		-0.015 (0.030)	0.027 (0.030)
Sex (1 = male)		0.223 (0.278)	0.345 (0.249)		0.155 (0.244)	0.235 (0.210)
Age (10 years)		-0.112 (0.315)	-1.125 (0.442)		-0.298 (0.285)	-0.991 (0.384)
Primary or lower secondary school		-0.326 (0.299)			-0.482 (0.239)	
Academic degree		0.698 (0.404)			0.766 (0.303)	
Level of education (1–5)			1.019 (0.169)			0.824 (0.178)
Last ed. qual. obtained during 1993–94		0.186 (0.409)	0.831 (0.303)		0.371 (0.366)	0.748 (0.270)
Married or cohabiting		0.444 (0.339)	0.516 (0.293)		0.416 (0.281)	0.451 (0.278)
Spouse is employed		-0.417 (0.296)	-0.428 (0.291)		-0.388 (0.258)	-0.463 (0.248)
# Children under 7		-0.210 (0.201)	-0.327 (0.183)		-0.214 (0.158)	-0.229 (0.153)
# 7–18-year-old children		-0.169 (0.183)	-0.641 (0.236)		-0.258 (0.183)	-0.553 (0.206)
Homeowner		-0.637 (0.261)	-0.373 (0.241)		-0.524 (0.229)	-0.463 (0.241)
# Months of employment in 1993		0.070 (0.038)	0.087 (0.040)		0.056 (0.036)	0.055 (0.039)
Commuting		0.893 (0.268)	1.274 (0.247)		0.968 (0.245)	1.183 (0.220)
Degree of population density		-0.274 (0.086)	-0.151 (0.085)		-0.243 (0.077)	-0.178 (0.076)
Living in region of birth		-0.813 (0.235)	-0.617 (0.220)		-0.761 (0.211)	-0.664 (0.196)
Distance from the closest growth-centre region (10 km)		0.046 (0.023)	0.043 (0.023)		0.040 (0.019)	0.047 (0.022)
Distance from Helsinki (10 km)		-0.016 (0.008)	-0.012 (0.007)		-0.014 (0.007)	-0.013 (0.007)
IV parameter					1.822 (0.795)	
Log likelihood		-767.633			-767.159	
Likelihood ratio index		0.1517			0.1522	
LR test for equal expected earnings parameters		11.473 (p=0.003)			9.465 (p=0.009)	
Wald test for IV parameter = 1					1.070 (p=0.301)	
Number of observations	4360	85	101	4360	85	101

Notes: First the estimated parameter is given, followed by the asymptotic standard errors in parenthesis. Variables are measured in the region of origin at the end of 1993 if not otherwise stated. See Table 1 for the descriptive statistics. (·) = Predicted annual earnings*10^{-5} in 1995. [a] Parameter estimates are restricted to be equal for all alternatives.

Table 5 reports the estimated probabilities of the alternative choices before and after a 10-percent increase in expected peripheral earnings using the nested logit model.[45] The calculations were performed with different values for the distance and age variables while keeping the other explanatory variables at their sample means. On average the policy would have positive effect on staying in the peripheral region. It would also decrease the individual's probability of moving to a growth-centre region by 15 percent (from 0.0080 to 0.0068). We can calculate from the reported probabilities that this latter effect is smaller, the further away from a growth-centre region one lives and the younger one is; see rows (3) and (6). We also conducted a similar experiment by decreasing expected earnings in the growth-centre regions, but this policy had hardly any impact on the choice probabilities.

Table 5. Estimated probabilities before and after 10% increase in expected peripheral earnings (nested logit model)

Alternative	Average individual	Distance to the closest GCR		Age	
		50 km	150 km	20 years	40 years
Before increase in earnings					
Staying	0.9797	0.9840	0.9760	0.9617	0.9873
Migrating to periphery	0.0123	0.0083	0.0148	0.0281	0.0087
Migrating to growth-centre	0.0080	0.0078	0.0092	0.0102	0.0041
After increase in earnings					
Staying	0.9811	0.9854	0.9775	0.9623	0.9883
Migrating to periphery	0.0121	0.0081	0.0146	0.0285	0.0084
Migrating to growth-centre	0.0068	0.0065	0.0079	0.0092	0.0034

Notes: Probabilities are calculated at the sample means of the other explanatory variables using the nested logit estimates in Table 4. For comparison, the average individual lives 110 km from the closest growth-centre region and is 31 years old (mean values from the sample). GCR = growth-centre region.

The results reported in Table 5 also illustrate that migration is more likely, the younger one is and the further away from growth regions one lives, everything else being equal. Note however, that if the increase in distance to growth regions simultaneously increases with the distance to Helsinki, it reduces this positive distance effect (see Table 4).

[45] The results for the multinomial logit model are given in the Appendix (Table A1).

5 Conclusions

Aim of this study was examine the impact of expected earnings on the interregional migration decisions of young adults in Finland. Rather than modelling migration as a binary choice, we implemented a nested logit model, where individuals may choose between three alternatives. Such a model specification allows us to study how the propensity to migrate from peripheral regions is influenced by changes in expected earnings in two different types of regions and what kind of people choose to migrate to growth-centre regions instead of peripheral regions.

Our results show that migration choices are influenced by expected earnings. Implementation of a policy, which would increase expected earnings in peripheral regions by 10 percent, would prevent migration from the peripheral region and decrease the individual's probability of moving to a growth-centre region by 15 percent. This latter effect is smaller, the further away from growth-centre regions individual lives and the younger (s)he is. On the other hand, a decrease in expected earnings in growth-centre regions has hardly any impact on migration.

Appendix

Table A1. Estimated probabilities before and after 10% increase in expected peripheral earnings (MNL model)

Alternative	Average individual	Distance to the closest GCR		Age	
		50 km	150 km	20 years	40 years
Before increase in earnings					
Staying	0.9804	0.9846	0.9766	0.9662	0.9871
Migrating to periphery	0.0113	0.0078	0.0139	0.0222	0.0084
Migrating to growth-centre	0.0083	0.0076	0.0094	0.0116	0.0045
After increase in earnings					
Staying	0.9820	0.9861	0.9784	0.9667	0.9883
Migrating to periphery	0.0109	0.0074	0.0135	0.0226	0.0080
Migrating to growth-centre	0.0071	0.0064	0.0081	0.0107	0.0037

Notes: Probabilities are calculated at the sample means of the other explanatory variables using the MNL estimates in Table 4. For comparison, the average individual lives 110 km from the closest growth-centre region and is 31 years old (mean values from the sample). GCR = growth-centre region.

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.

Börsch-Supan, A. (1987) Econometric analysis of discrete choice with applications on the demand for housing in the U.S. and West-Germany, Lecture Notes in Economics and Mathematical Systems No. 296, Springer–Verlag, Heidelberg.

Daganzo, C. (1979) *Multinomial probit: the theory and its application to demand forecasting*, Academic Press, London.

Daly, A. (1987) Estimating 'tree' logit models, *Transportation Research*, 21B, 251–267.

DaVanzo, J. (1983) Repeat migration in the United States: Who moves back and who moves on? *Review of Economics and Statistics*, 65, 552–559.

Dolton, P. J. and Makepeace, G. H. (1987) Interpreting sample selection effects, *Economics Letters*, 24, 373 – 379.

Domencich, T. A. and McFadden, D. (1975) *Urban Travel Demand: A Behavioral Analysis*, North-Holland, Amsterdam.

Falaris, E. M. (1987) A nested logit migration model with selectivity, *International Economic Review*, 28, 429–443.

Ghatak, S., Levine, P. and Wheatley Price, S. (1996) Migration theories and evidence: an assessment, *Journal of Economic Surveys*, 10, 159–198.

Greene, W. H. (1997) *Econometric analysis* (3rd edition), Prentice Hall, New Jersey.

Greenwood, M. J. (1975) Research on internal migration in the United States: a survey, *Journal of Economic Literature*, 13, 397–433.

Greenwood, M. J. (1985) Human migration: theory, models, and empirical studies, *Journal of Regional Studies*, 25, 521–544.

Greenwood, M. J. (1997) Internal migration in developed countries, in: Rosenzweig, M. R. and Stark, O. (eds.) *Handbook of population and family economics*, Elsevier, Amsterdam, 647–720.

Greenwood, M. J., Mueser, P. R., Plane, D. A. and Schlottmann, A. M. (1991) New directions in migration research: perspectives from some North American regional science disciplines, *Annals of Regional Science*, 25, 237–270.

Hughes, G. and McCormick, B. (1994) Did migration in the 1980s narrow the north-south divide? *Economica*, 61, 509–527.

Islam, M. N. and Choudhury, S. A. (1990) Self-selection and intermunicipal migration in Canada, *Regional Science and Urban Economics*, 20, 459–472.

Kettunen, J. (1997) Essays on wages, job tenure and unemployment duration in the Finnish labour market, ETLA, The Research Institute of the Finnish Economy, A-25, Helsinki.

Koppelman, F. S. and Wen, C. H. (1998) Alternative nested logit models: structure, properties and estimation, *Transportation Research*, 32B, June, 289–298.

Krieg, R. G. (1997) Occupational change, employment change, internal migration, and earnings, *Regional Science and Urban Economics*, 27, 1–15.

Lee, L.-F. (1983) Generalized econometric models with selectivity, *Econometrica*, 51, 507–512.

Linneman, P. and Graves, P. E. (1983) Migration and job change: a multinomial logit approach, *Journal of Urban Economics*, 14, 263–279.

Maddala, G. S. (1983) *Limited-dependent and qualitative variables in econometrics*, Cambridge University Press, Cambridge.

Maddala, G. S. (1995) Specification tests in limited dependent variable models, in: Maddala, G. S., Phillips, Peter C. B. and Srinivasan, T. N. (eds.) *Advances in econometrics and quantitative economics: essays in honor of professor C. R. Rao*, Blackwell, Oxford, 1–49.

McFadden, D. (1973) Conditional logit analysis of quantitative choice behavior, in: Zarembka, P. (ed.) *Frontiers in econometrics*, Academic Press, New York, 105–142.

McFadden, D. (1981) Econometric models of probabilistic choice, in: Manski, C. and McFadden, D. (eds.) *Structural analysis of discrete data with econometric applications*, MIT Press, Cambridge, 198–217.

McFadden, D. (1984) Econometric analysis of qualitative response models, in Griliches, Z. and Intrilligator, M. (eds.) *Handbook of econometrics*, Volume II, Elsevier, Amsterdam, 1396–1457.

McFadden, D. and Train, K. (2000) Mixed MNL models for discrete response, *Applied Econometrics*, Forthcoming.

Mincer, J. (1978) Family migration decisions, *Journal of Political Economy*, 86, 749–773.

Nakosteen, R. A. and Zimmer, M. (1980) Migration and income: the question of self-selection, *Southern Economic Journal*, 46, 840–851.

Pudney, S. (1989) *Modelling individual choice: the econometrics of corners, kinks and holes*, Blackwell, Cambridge.

Robinson, C. and Tomes, N. (1982) Self-selection and interprovincial migration in Canada, *Canadian Journal of Economics*, 15, 474–502.

Schaeffer, P. (1985) Human capital accumulation and job mobility, *Journal of Regional Science*, 25, 103–114.

Shields, G. M. and Shields, M. P. (1989) The emergence of migration theory and a suggested new direction, *Journal of Economic Surveys*, 3, 277–304.

Sjaastad, L. A. (1962) The costs and returns of human migration, *Journal of Political Economy*, Supplement, 70, 80–93.

Silverman, B. W. (1986) *Density estimation for statistics and data analysis*, Chapman & Hall, London.

Tunali, I. (1986) A general structure for models of double-selection and an application to a joint migration/earnings process with remigration, *Research in Labor Economics*, 8, Part B, 235–282.

Tversky, A. (1972) Elimination by aspects: a theory of choice, *Psychological Review*, 79, 281–299.

Vijverberg, W. P. M. (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.

Weeks, M. (1997) The multinomial probit model revisited: a discussion of parameter estimability, identification and specification testing, *Journal of Economic Surveys*, 11, 297–320.

CHAPTER 4

CAN MIGRATION DECISIONS BE AFFECTED BY INCOME TAXATION POLICIES?*

Mika Haapanen[¤] and Jari Ritsilä[¤¤]

Abstract

The question of individually focused policy measures is currently at the centre of public debate in Finland. Is it possible through income taxation policy to influence where people choose to live? This paper analyses the role which expected net income might play in the redistribution of population. Random parameter logit model is used in the empirical analyses of migration. Micro-level analyses of the Finnish data show that the decision to migrate is influenced by expected net income, but the size of the impact depends on age, home-ownership and the regional unemployment rate. The estimation results also imply that a reduction in income taxation would be most effective if it were targeted at young individuals living in the regions with high unemployment rates.

JEL Classification: J61, H21, C35

Keywords: Migration, taxation, expected income, regional policy

---

* An earlier version of this paper was published as Haapanen, M. & Ritsilä, J. (2001) "Can migration decisions be affected by income taxation policies?", University of Jyväskylä, School of Business and Economics, Working paper No. 238.

[¤] Corresponding author.

[¤¤] Jari Ritsilä, University of Jyväskylä, School of Business and Economics, Centre for Economic Research. Email: jarrits@tase.jyu.fi

1 Introduction

During recent years migration in Finland has been characterised by a shift towards the areas of economic growth. If it continues this current trend will lead to the concentration of human capital in a few attractive regions (see e.g. Pekkala 2000; Ritsilä 2001).[46] At the same time, more distant regions are losing important future human capital, as the young and educated move away from them.

The role of interregional migration in the concentration of human capital and economic activities is a very important and problematic question from the perspective of regional policy. The key problems are the legitimacy of the different policy options and the effectiveness of the tools used in their implementation. The first question concerns how desirable in terms of efficiency and equality the trend towards concentration is (Lucas 1997, 758). The question of effectiveness is exceedingly important when new regional policies are being planned and implemented.

The question of individually focused policy measures is currently at the centre of public debate in Finland. For example, is it possible through income taxation policy to influence where people choose to live? In Norway different taxation schedules are applied in Northern Norway, including a reduction in personal income tax and an exemption from payroll tax for employers (Eikeland 1999). So far no such policies have been applied in Finland, but such measures have been seen as one way to combat out-migration. However, there has been no rigorous examination of whether and how migration decisions can be affected by individual taxation measures in the first place. In this respect we extend previous studies[47] and examine, for example, how significant an effect an increase in expected net income would have on migration decisions.

The empirical analysis of the paper is based on data from the Finnish Longitudinal Census File for period 1993–95. The data set used herein is a random sample of over 20,000

[46] The trend towards urbanisation is not unique. Many western and developing countries are experiencing similar problems (see e.g. Lucas 1997, 725; United Nations 1999).

[47] Previous studies on the impact of expected income gains on migration include Nakosteen and Zimmer (1980) for the United States, Robinson and Tomes (1982) and Islam and Choudhury (1990) for Canada and Haapanen (2000) for Finland. However, these studies do not consider taxation.

individuals. It includes information on personal and family status, economic activity and region of residence. The analysis focuses on persons of working age.

Our modelling is based on the human capital framework, where migration decisions are assumed among other factors to depend on expected net income. Estimations are implemented in two steps. Firstly, endogenous switching regression model of income determination is estimated and expected income after taxes is calculated for the alternatives of migration and non-migration. Secondly, the net income predictions are used as additional explanatory variables in a migration model.

Policies can however have different impacts on the propensity to move to peripheral regions compared to growth-centre regions. Therefore, in our migration model an individual can choose between three alternatives: (s)he can either (i) stay in the region of origin, (ii) migrate to a peripheral region, or (iii) migrate to a growth-centre region. In this framework it is possible to test whether the policy if implemented would have varying impacts on migration to the two different types of regions. This could not be done with the simple and commonly used model, in which an individual can only migrate or stay.

The discrete migration decisions are modelled with a random parameter logit model.[48] In this flexible model the parameter of expected net income – and therefore the impact of expected net income on migration – can be specified as a function of set of explanatory variables, including a random factor. Thus the effect of expected net income on migration can vary among different types of individuals and regions of origin. This makes it possible to estimate which demographic groups and regions would be the most affected by a regional taxation policy. To be more precise, migration propensities are calculated before and after the implementation of taxation policies to examine their effectiveness. These calculations give guidelines on where to target the possible tax reductions. This in turn gives us information about the cost-effectiveness of the regional policy measures in question.

The remainder of the paper is organised as follows. Section 2 presents the theoretical background of the paper. Section 3 outlines the econometric methods, while the data and variables used in the empirical analysis are introduced in Section 4. The outcomes of the

---

[48] Random parameters ("mixed") logit models have been used in various applications e.g. in marketing and consumer research (Jain, Vilcassim, and Chintagunta 1994; Train 1998; Brownstone and Train 1999), but, to our knowledge, they have not been applied to migration problems.

estimations are reported in Section 5, and the policy implications are discussed in Section 6. Finally, Section 7 concludes the paper.

2 Theoretical framework

2.1 Human capital theory and migration

The theoretical setting of this paper is related to the human capital framework. This framework is based on the modelling work of Sjaastad (1962), Weiss (1971), Seater (1977) and Schaeffer (1985). In it migration is assumed to result from variations in individual economic utility in different locations. Furthermore, an individual is assumed to maximise his or her economic utility. Thus, relocation takes place if the expected economic utility gained from moving exceeds the economic utility achieved by staying in the present location. Heterogeneous individuals possess different utility functions, and consequently encounter differences in the net benefits of living in a specific location.

An important factor that affects economic utility, and hence the decision making of an individual, is her/his personal human capital reserve. Human capital can be considered as a heterogeneous asset, resulting from formal schooling, training and experience, etc. In addition, economic utility will depend on (expected) net income, which is a function of taxation. Formally, it is assumed that an individual i decides to migrate from location j to location k under the following utility maximisation process at a given time t:

$$E(R_{it}) = \max_{W,X}\left[E\int_0^T e^{-rt}\{U_{ik}(W_{ik},X_{ik}) - U_{ij}(W_{ij},X_{ij})\}dt - CM_{ijk}\right] \tag{1}$$

under the precondition

$$\int_0^T e^{-rt}(U_{ik} - U_{ij})dt - CM_{ijk} \geq 0, \tag{2}$$

where $E(R_{it})$ is the net present value of the expected economic utility of that individual i. U_k is the expected utility level achieved in the alternative location k with assets X_{ik} and expected net income W_{ik}. Similarly, U_j is the expected utility achieved by living in the present location j with assets X_{ij} and expected net income W_{ij}. The direct costs involved in moving from location j to location k are contained in CM_{jk}. The expected utilities U_k and U_j, as well as the direct costs CM_{jk}, are formed as a result of personal, household and regional factors involved in the migration decision process. As a result of the rational decision making process, a decision in favour of migration is reached when the expected utility gained from moving exceeds the direct costs of moving.

2.2 Taxation, migration and formation of income after taxes

Taxation in the region of origin and in the region of destination may have effects on migration decisions. Firstly, because it has a direct effect on expected net income and thus on the propensity to migrate. For example, Nakosteen and Zimmer (1980) examine the returns from interstate migration in the United States, while Robinson and Tomes (1982) and Islam and Choudhury (1990) compare the wages of movers with those of stayers in Canada. Haapanen (2000) considers the case of Finland. They all find that choosing whether to migrate depends positively on the expected gains in wages.

Secondly, taxation in the region of origin can have an indirect effect on migration, because the net wage rate influences labour supply decisions.[49] According to theoretical models, a fall in taxation (an increase in the net wage rate) will cause an increase in labour supply, if the substitution effect dominates the income effect (i.e. if labour supply curve is upward sloping; see e.g. Connolly and Munro 1999). In addition, there has been considerable empirical evidence in the literature suggesting that employed people are less likely to move than non-employed people (see e.g. Ritsilä and Tervo 1999; Juarez 2000). Therefore, we would expect a reduction in the taxation of the region of origin to have a negative effect in the propensity to migrate.[50]

The implementation of a regional taxation policy presupposes knowledge about the formation of earned income after taxes so that the policy can be targeted at the right individuals and the costs can be assessed. Figure 1 illustrates how earned income was taxed in Finland in 1995.[51] We can see that income taxation is progressive. For example, if a taxpayer earned 17,000 euro in 1995, his income tax rate was approximately 10%. If a taxpayer earned 35,000 euro, (s)he had to pay approximately 20% in taxes (twice as much).

---

[49] It is unlikely that taxation in the region of destination would have an indirect effect on migration. In other words, it is unlikely that a change in the net wage rate in the other regions would significantly alter the amount an individual would be willing to work in the region of origin, everything else being equal.

[50] Naturally, the impact of taxation may also depend on the form of taxation. For example, lump-sum, proportional and progressive taxes may each have different impacts on the labour supply and hence on the propensity to move.

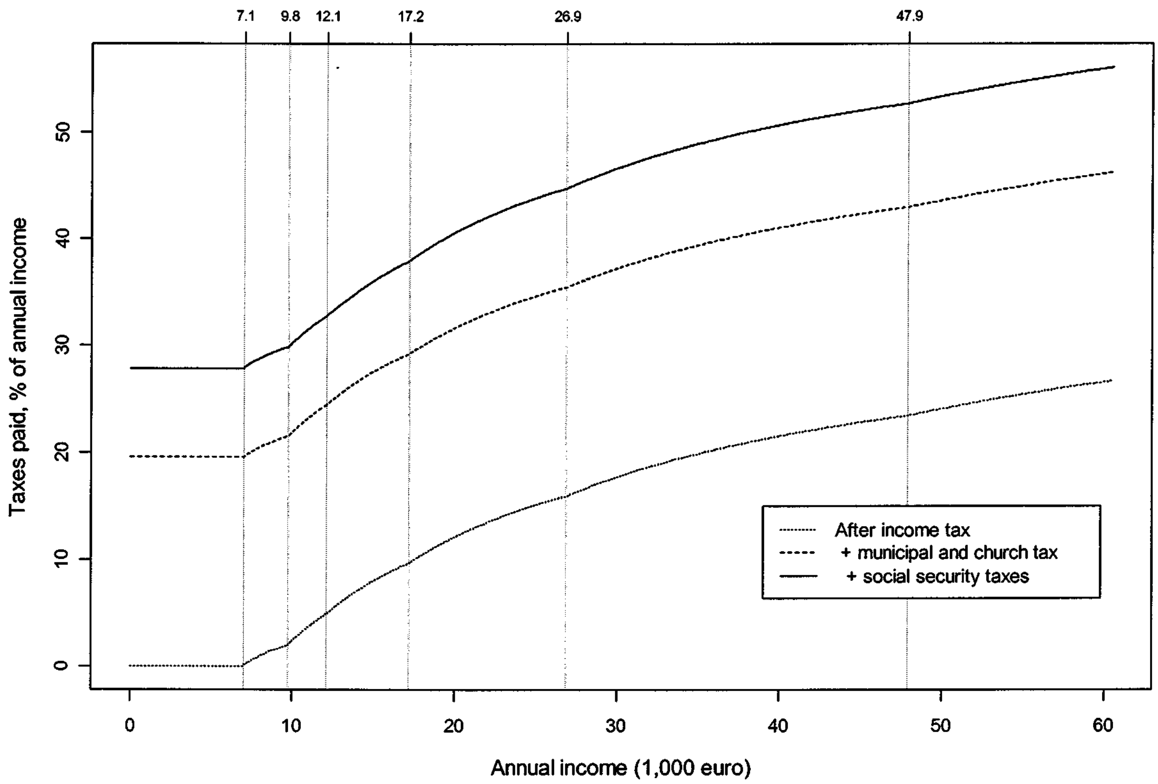


Figure 1. Illustration of progressive taxation in Finland in 1995[52]

Municipal and church taxes are levied at flat rates on taxable income. The municipal tax rate varied between 15% and 20% in 1995, depending on the municipality. Church tax is paid by the members of the Finnish Evangelical Lutheran (and Orthodox) churches at flat rates on taxable income. These rates varied between 1% and 2.25% in 1995.

Social security taxes consist of a sickness insurance premium, pension and unemployment insurance premiums. In 1995 a sickness insurance premium of 1.9% was collected on earned income (3.8% in the case of incomes exceeding 13,452 euro). Pension and unemployment insurance premiums were deducted at source at a rate of 6.4%. These facts on the Finnish taxation system were used when calculating income after taxes for 1995.

---

[51] In addition, personal earned income subject to tax not only includes wages and salaries paid in money, but also directors' bonuses, commission, rental value of an employee's free housing, pensions and annuities, living and housing allowances, car benefits and unemployment benefits.

[52] Mean values of municipal and church taxes were used in producing the figure. Tax deductions were not taken into account.

3 Empirical model specifications

In Section 3.1 we introduce the model that we used to predict the individual's net income after the migration period for both alternatives: staying in the region of origin and migrating. The income predictions are later used in the migration choice model presented in Section 3.2.

3.1 Modelling income predictions

Variations in income arise from differences in human capital, measured by education and work experience (see e.g. Mincer 1978). However, there may be other, unobserved factors which influence income determination and migration. Therefore, we proceed with a self-selection endogenous switching model (see e.g. Powers 1993; Maddala 1983; Poirier and Ruud 1981):

$$y_{ji} = \beta_j' x_{ji} + \varepsilon_{ji}, \quad j = 0, 1 \tag{3}$$

$$y_i = (1 - m_i) y_{0i} + m_i y_{1i}, \tag{4}$$

where y_{ji} is the annual net income of an individual i obtained by choosing alternative j and β_j is the parameter vector associated with income-determining attributes x_{ji} such as level of education and work experience. The observed income, y_i, which will be in state 1, if the premium ($y_{1i} - y_{0i}$) exceeds the cost of moving from state 0 (stay) to alternative state 1 (migrate), $m_i^* = \delta' z_i + u_i$. Otherwise, y_i is observed in state 0 and no movement of labour takes place. To be more specific, $m_i = 1$ if $\delta' z_i + u_i > 0$, $m_i = 0$ otherwise (an endogenous selection process). In the selection process, the difference between income offers will affect the worker's choice. Consequently, we combine the variables included in vector x_i with other personal characteristics to form a comprehensive vector z_i, which with parameter vector δ determines the sector process. Finally, ε_{ji} and u_i are disturbance terms.[53]

Thus, the complete switching regression model contains two income equations and a switching equation. Ordinary least squares (OLS) estimation of the above equations will provide unbiased estimates of income parameters only if u_i is uncorrelated with ε_{0i} and ε_{1i}.

[53] The stochastic specification for the disturbance terms is $(\varepsilon_0, \varepsilon_1, u) \sim N(0, \Sigma)$. $\text{cov}(\varepsilon_0, \varepsilon_1)$ is not identified because each individual in the sample realises either y_0 or y_1, but not both. Therefore, $\text{cov}(\varepsilon_0, \varepsilon_1)$ is set equal to zero. By means of normalisation var(u) is set equal to one. If the estimated error covariances are non-zero, this provides evidence of non-random selection into one or both of the selection regimes (Powers 1993, 251).

For example, if unobserved preferences influence the selection process as well as income determination, then this assumption is violated and income predictions based on OLS are misleading. Therefore, the full information maximum likelihood (FIML) is used to jointly estimate the parameters.[54] Then, expected incomes for the two migration alternatives are calculated as unconditional linear predictions

$$\hat{y}_{ji} = \hat{\beta}_j{}' x_{ji}, \quad j = 0, 1 \tag{5}$$

where ^ denotes estimated values. These predictions are used in the migration model specified in the next section.

3.2 Modelling migration choices

Let us consider a migration model where an individual can choose between several alternatives instead of just two alternatives (migrate or stay). For the sake of generality, we assume that an individual i faces a choice among J mutually exclusive alternatives. It is also assumed that choices are made according to the well-known random utility maximisation hypothesis (see e.g. Ben-Akiva and Lerman 1985), where the (indirect) utility of alternative j is the sum of a deterministic component and a random component.[55] The deterministic component of the utility depends on the attributes of the alternatives (such as expected income) and the characteristics of the individual (such as age and education). In our case, individual can choose between three alternatives: he or she can either (i) stay in the region of origin, (ii) migrate to a peripheral region, or (iii) migrate to a growth-centre region.

The traditional way to model choice situations has been to use the multinomial logit (MNL) model, because its likelihood function can be easily maximised due to a closed-form solution and because its results are convenient to interpret (Ben-Akiva and Lerman 1985). It is also well known that the choice probabilities of MNL have the IIA property. That is, for each individual, the ratio of the choice probabilities of any two alternatives is independent of the utility of any other alternatives. Hence, the tractability of the MNL model comes at a cost.[56]

---

[54] For a derivation of the likelihood function, see Maddala (1983, Ch. 9).

[55] Although utility-based approaches to choice making have been popular, there are alternative ways of seeing the choice process in the literature. For example, Tversky's (1972) elimination-by-aspect decision making sees choice as a process involving the elimination of alternatives, with the process terminating when only a single alternative remains. However, it has several drawbacks, which have prevented its wider use (Pudney 1989, 122). See Ben-Akiva & Lerman (1985, 35–38) and Pudney for other examples.

[56] See Maddala (1995) a review of tests for the IIA property.

To obtain efficient and accurate estimates of the choice model parameters one should include a specification of the heterogeneity structure in the model: the presence of heterogeneity will alter cross-income elasticities, marginal rates of substitution between choices, and lead to IIA violations (Hensher 2001). We take this perspective in setting out a choice model that can incorporate the unobserved effects using random parameters logit model (RPL; see e.g. McFadden and Train 2000).

We derive the RPL model by assuming that the utility, $U(i,j)$, that individual i receives given a choice of alternative j is

$$U(i,j) = \alpha_{ji} + \theta_j{}'g_i + \phi_j{}'f_{ji} + \eta_{ji}{}'w_{ji} + \varepsilon_{ji}, \tag{6}$$

where α_{ji} is an alternative specific constant (fixed or random). θ_j is a vector of fixed coefficients (with a normalisation: $\theta_1 = \mathbf{0}$). ϕ_j is a vector of fixed coefficients. η_{ji} is a coefficient vector randomly distributed across individuals. g_i is a set of choice-invariant individual specific characteristics (such as age and education). f_{ji} and w_{ji} are vectors of alternative specific characteristics (such as expected income).

We first assume that the random parameters η follow a general distribution $g(\eta\,|\,\Omega)$. Estimation of the RPL model involves estimating the vectors Ω in addition to the fixed parameters as in the standard MNL model. In practice, we specify the random parameters as[57]

$$\eta_{ji} = \gamma_j + \delta_j{}'h_i + \sigma_j u_{ji}, \tag{7}$$

where $u_{ji} = N(0,1)$ and $\eta_{j|i} = N(\gamma_j + \delta_j{}'h_i, \sigma_j^2)$. h_i is the set of individual specific characteristics that influence the expected income parameter η. The unobserved disturbance term u_{ji} is individual and choice-specific.

For each individual, the migration choice probabilities will be

$$P(j\,|\,\eta) = \frac{\exp(U(i,j))}{\sum_{j=1}^{J}\exp(U(i,j))},\ i = 1,\ldots,N;\ j = 1,2,\ldots,J. \tag{8}$$

If the value of η was known for each individual, the solution to Equation (8) would be straightforward (resulting into the MNL model). However, η is unobserved, although it is

---

[57] A number of other error covariance structures can be specified in random parameters logit models (see e.g. Hensher 2001).

drawn from a known joint density function g. Thus, in order to obtain the unconditional choice probabilities for each individual the logit probability must be integrated over all values of η weighted by the density of η:

$$P(j) = \int_{\eta} \frac{\exp(U(i,j))}{\sum_{j=1}^{J} \exp(U(i,j))} g(\eta \mid \Omega) \partial \eta . \tag{9}$$

Examination of the above equation reveals that the choice probability is a mixture of MNL probabilities with g as the mixing distribution. The integrals in Equation (9) cannot be evaluated analytically since it does not have a closed-form solution. Therefore, the integrals in the choice probabilities are approximated using a Monte Carlo technique and the resulting simulated log-likelihood function is maximised.

4 Data

The impact of expected income on the migration decisions is tested with a one-percent random sample from the Finnish longitudinal census. The census file is maintained and updated by Statistics Finland. The socioeconomic status of the sample individuals and their spouses is well documented: the data include information on personal and family status, labour market record, and regional characteristics.[58] The empirical analysis of this study mainly utilises data from the years 1993–1995.[59]

The observed trends in the spatial distribution of population and employment are fundamentally related to three key choices made by the working population: (i) where to live, (ii) whether or not to work, and (iii) where to work. The model used here focuses exclusively on the workplace and residential decisions and does not consider the labour market participation decision. Furthermore, because we are interested in the effects of tax reductions, only individuals aged between 16 and 65 with a positive annual income in 1995 were included in the sample.[60] Self-employed, retired and foreign-born individuals were excluded from the sample, as their income determination is likely to differ from that of the rest of the

[58] 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.

[59] During the period under study, 1993–95, the Finnish economy was recovering from recession, the unemployment rate remaining exceptionally high. The speed of migration was also considerable lower compared to situation at present (see e.g. Pekkala 2000, 18).

[60] An annual income greater than 1,000 euro was considered positive.

population. After these restrictions and omitting observations with missing information we are left with 20,213 observations. Figure 2 illustrates their labour market status during the last week of 1993. Most of them were employed (73.0%) or unemployed (13.9%), but some (3.2%) had no earned income at all in 1993.

Figure 2. Main type of activity during the last week of 1993 (number of observations in brackets)

The present analysis exploits a classification of growth-centre regions and peripheral regions (Figure 3). This classification is formed using information on the net migration rates and population figures for the destination subregions in 1995: 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.[61] The growth-centre regions are Helsinki, Porvoo, Salo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu, and are also characterised by high wage levels.[62] The other 75 subregions are mostly peripheral and stagnating regions, although, in Finnish terms, they include some of the bigger towns (Lappeenranta, Rovaniemi).

---

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

[62] See e.g. Statistics Finland's Kuntafakta (statistics on Finnish municipalities).

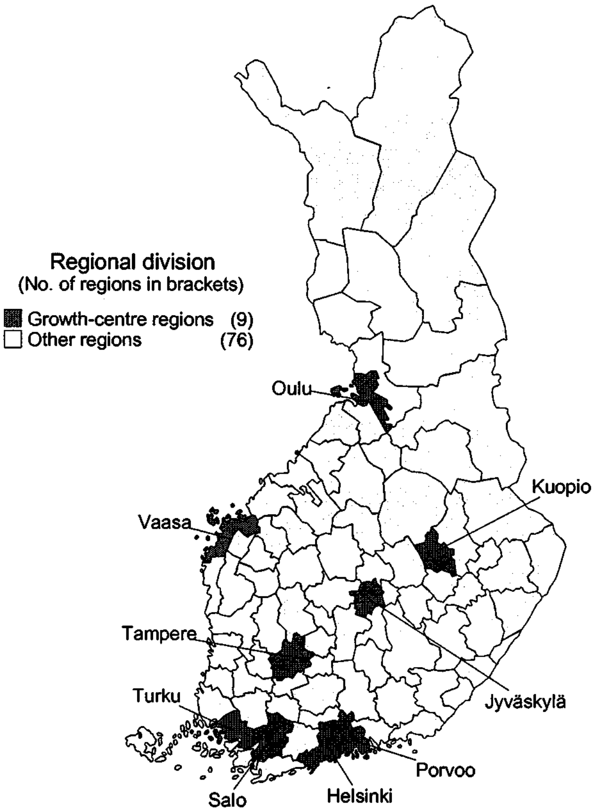


Figure 3. Regional division into growth-centre and other regions

The sample data will allow us to determine whether and where an individual migrated in 1994 by using information on the subregion of residence and the above regional division.[63] An individual is classified as a growth-centre migrant, if (s)he migrates in 1994 and his/her region of destination is one of the growth-centre regions. In the sample of 20,213 individuals, 558 individuals (2.76%) migrated in 1994, of whom 285 individuals migrated to growth-centre regions (1.35%) and 273 individuals migrated to other regions (1.41%).

Measure of income after taxes (net income) is constructed using the information on the Finnish tax system described in Section 2.2. The state, municipal, church and social security taxes are subtracted from the individual's earned annual income.[64] We know in which subregion an individual lives, but not in which municipality; therefore, we have to use a proxy for the municipal tax paid by each individual. It was calculated as a population-weighted average of all the municipal taxes in his/her subregion.

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

Next we briefly introduce the variables that are used to explain individuals' migration decisions and income determination. Mean values and variable descriptions are given in the Appendix (Table A1). All the explanatory variables, except for net expected income, are measured at the region of origin before the migration period in the migration and income equations (see Figure 4).

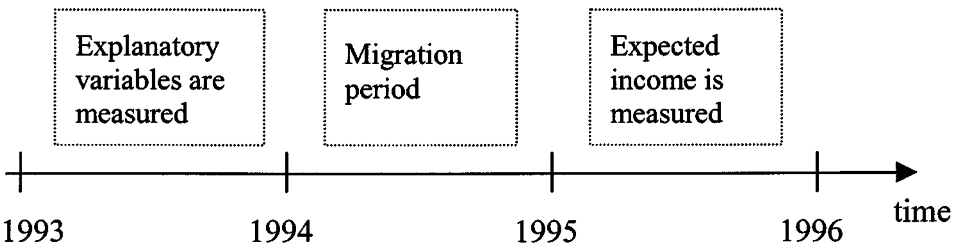


Figure 4. Composition of the data

The explanatory variables include age, sex, and level of education (academic degrees). Information on spouses is used to construct dummies that indicate whether the individual is married or cohabiting and whether his/her spouse is employed. Because the presence of children can influence migration decisions, we have created two dummies that reveal whether an individual has school-aged children, under school-aged children only, or does not have children at all. Work experience is defined simply as number of months of employment during 1987–93. We also use information about the home-ownership and commuting status, the number of months of employment, and whether the individual was employed during the last week of 1993.

We use several variables that describe the individual's region of origin. They include the regional rate of unemployment and the degree of urbanisation in the region of origin. In addition, the individual's distance to the closest growth-centre region is used as a measure of geographical location. It was calculated using distances by road (10 km). Firstly, the distance between two regions was calculated by using a distance matrix based on municipalities. Then in each subregion the most populated municipality was chosen to represent the location of the region.

---

[64] For simplicity, tax deductions were not taken into account when income after taxes was calculated.

5 Estimation results

5.1 Switching regression for expected income

In this section we report the estimation results of the switching regression model. The model contains two components: two income equations and a switching equation. The entire model is estimated by full information maximum likelihood. The first set of dependent variables are net income for the migration and staying alternatives in 1995. They are specified with explanatory variables measured in 1993. We have followed the standard convention of specifying the income equations with education, experience, and experience squared as the central explanatory variables. In addition to these human capital variables, we have included some individual characteristics like sex, age, and age squared. Furthermore, we have included information on the degree of urbanisation in the income equation for stayers, because it reflects their opportunities in the regions of origin.[65]

The switching equation is specified with variables commonly used in the migration literature, such as age, education, home-ownership, and status of spouse and children. As speculated earlier, the difference in income between the migration and staying alternatives may well play a role in the selection process, affecting the willingness to migrate. Therefore, the variables that determine the individual's net income are also included in the selection equation. In addition, information on the region of origin is used.

The estimations results are reported in Table 1. The results fully correspond to our prior expectations. Because they are not the focus of this paper, we shall omit further discussion of them; they are merely used to generate expected net income for the migration and staying alternatives. However, it is worth reporting the results of the covariance parameters, since their statistical significance implies that selection to migration categories is not random.

[65] The variable is not relevant for migrants, because it is measured in the region of origin. For them, it does not reflect their income opportunities, because their region of residence has changed.

Table 1. Parameter estimates of the switching regression model

Variable	Income equations: Stayer		Income equations: Migrant		Switching equation	
Constant	-0.168**	(0.056)	-0.009	(0.524)	-2.024**	(0.259)
Sex (male = 1)	0.195**	(0.010)	0.193**	(0.064)	-0.106**	(0.035)
Age	0.597**	(0.032)	0.715**	(0.267)	0.108	(0.155)
Age squared	-0.071**	(0.004)	-0.094*	(0.037)	-0.036	(0.022)
Lower academic degree	0.412**	(0.016)	0.469**	(0.114)	0.330**	(0.061)
Higher academic degree	0.694**	(0.021)	0.803**	(0.150)	0.407**	(0.068)
Spouse employed					-0.164**	(0.041)
School-aged children					-0.194**	(0.050)
Homeowner					-0.031	(0.040)
Living in region of birth					-0.204**	(0.036)
Work experience	0.068**	(0.007)	0.103**	(0.017)	0.119**	(0.027)
Work experience squared	0.005**	(0.001)			-0.004	(0.003)
Commuting					0.419**	(0.040)
Degree of urbanisation	0.049**	(0.003)			-0.013	(0.014)
Distance to the closest growth-centre					0.010**	(0.002)

Covariance parameters

σ_{00} = 0.663** (0.003), σ_{u0} = 0.932** (0.005), σ_{11} = 0.725** (0.026), σ_{u1} = 0.014 (0.208)

Notes: First the estimated parameter is given, followed by the asymptotic standard errors in brackets. Log-likelihood: –21,535.29. Number of observations N = 20,213. The staying alternative is the reference state in the switching equation. All variables measured at the region of origin (see Appendix, Table A1). * (**) = statistically significant at the 5% (1%) level.

The terms σ_{uj}, j = 0, 1, measure the correlation of the income equation disturbance term in migration alternative j with that of the switching regression. The term σ_{u0} is highly significant and shows that the migration choice equation has a strong correlation with the income equation in the staying alternative. Hence, it is likely that the OLS estimates would have been seriously biased, had they been used.[66] The sign of σ_{u0} conform to intuition: someone expecting, for some unobserved reason, a high income offer in the present region is also more likely to stay in that region.

Note finally the intuitive result that the variance of the migration income offers (σ_{11}) is larger than that of the staying income offers (σ_{00}), reflecting the uncertainty of income determination following migration or the smaller number of observations in the migration category than in the staying category.

[66] Having said that, the OLS estimates were not very different from the estimates obtained from the switching regression model. The results are not reported here but are available from the corresponding author upon request.

5.2 Random parameters logit model for migration decision

The net income predictions from the switching regression model are used as additional explanatory variables in a random parameter logit model of migration choice. In the migration model an individual can choose between three mutually exclusive alternatives: (s)he can either (i) stay in the region of origin, (ii) migrate to a peripheral region, or (iii) migrate to a growth-centre region. The first alternative is used as a normalising base category.

In order to determine whether any parameters can be eliminated, we estimated the random parameters model with various parameter restrictions. Starting from the most general model we searched for the most parsimonious specification: group-by-group equality and zero restrictions were imposed and tested. The final estimation results are reported in Table 2; see also Equations (6) and (7).

Table 2. Parameter estimates of the random parameters logit model

	Alternative		
Non-random parameters	Staying (reference state)	Migrating to periphery	Migrating to growth-centre
Constant		-1.089* (0.523)	-8.407** (0.650)
Age		-0.339** (0.108)	-0.527** (0.128)
Academic degree		0.209 (0.149)	0.209 (0.149)
Spouse is employed		-0.415** (0.151)	-0.595** (0.191)
Under school-aged children only		0.003 (0.184)	-0.355 (0.210)
School-aged children		-0.436* (0.180)	-1.246** (0.253)
Homeowner		-0.803** (0.149)	0.460** (0.177)
Months of employment		-0.028 (0.019)	0.012 (0.023)
Commuting		0.553** (0.178)	1.250** (0.187)
Regional rate of unemployment		0.015 (0.018)	0.073** (0.025)
Living in region of birth		-0.831** (0.142)	-1.073** (0.163)
Living in growth-centre region		-2.904** (0.243)	5.591** (0.212)
Distance to the closest growth-centre		-0.095** (0.011)	0.112** (0.011)
Initial earnings		-0.017 (0.092)	-0.158 (0.119)

Constant of the random parameter ln(predicted annual income)	*Parameters influencing Heterogeneity in mean*			*Derived s.d. of the parameter distribution, σ*
	Age	Homeowner	Regional rate of unemployment	
14.941**	-1.356**	3.335**	-0.294*	0.018
(3.221)	(0.498)	(1.002)	(0.117)	(9.665)

Notes: First the estimated parameter is given, followed by the asymptotic standard errors in brackets. See Appendix (Table A1) for the variable definitions and mean values. Log-likelihood: –2,111.12. Number of observations N = 20,213. Replications for simulated probabilities: 500. * (**) = statistically significant at the 5% (1%) level.

We tried other specifications for the random parameter of ln(predicted annual income), but variables age, homeowner, and regional rate of unemployment seemed to describe accurately the variation in the income expectations parameter of the utility functions. This is reflected on the insignificance of the derived standard deviation of the parameter distribution, σ. We also estimated the model with different expected income parameters for each utility function (j), but the parameters were very similar to each other and thus the equality restriction was not rejected. A comparison of the random parameters logit model against the multinomial logit model[67] (log-likelihood of –2,124.65) indicates an important contribution to the overall statistical fit from a less restrictive specification of the unobserved effects.

Before considering the impact of expected net income on the migration choices more closely, we briefly report the results for the other significant variables. Because the age-variable affects the utilities not only directly but also indirectly through the expected income parameter, our interpretations are based on simulated probabilities. As expected, old people are less likely to migrate than young. The older the migrant, the fewer will be the years of payoff from the human capital investment in migration, while the cost of migration remains just as high, which helps to explain why migration diminishes with age. In addition, younger individuals are expected to have lower psychical costs, because of fewer local social ties.

As Mincer (1978) points out, family considerations appear to influence migration decisions.[68] People are tied to other people and hence the individual's propensity to move is decreased in the presence of children. The results presented in Table 2 show that in the presence of school-aged children, a parent becomes less willing to move and is even less likely to move to a growth-centre region. One can also be tied to a house, as might be the case for a homeowner. Our results indicate that owning a house reduces the probability to move to peripheral regions (see Table 4).

The results for the distance variable are illustrated in Table 3. On the basis of simulated probabilities, we find that individuals living in the growth-centre regions are less likely to stay in their present region and more likely to migrate to another growth-centre region than individuals living in the peripheral regions. For individuals living in peripheral regions, an increase in the distance to the closest growth-centre region reduces (marginally increases) the

---

[67] The MNL results are available from the corresponding author upon request.

[68] In general, we did not find gender differences in migration, which is not surprising given that we have controlled for various household characteristics.

probability of moving to other peripheral regions (growth-centre regions). Living in one's region of birth reduces willingness to move. The larger the unemployment rate in the region of origin, the more likely one is to move to a growth-centre region. The unemployment rate can be viewed as a proxy for labour market diversification and career opportunities in the region of origin.

Table 3. Simulated choice probabilities by distance to the closest growth-centre region

	Alternative		
	Staying	Migrating to periphery	Migrating to growth-centre
Individual 1	0.9594	0.0026	0.0380
Individual 2	0.9684	0.0313	0.0003
Individual 3	0.9794	0.0201	0.0005
Individual 4	0.9863	0.0127	0.0009

Notes: Individual 1 lives in a growth-centre region and thus his/her distance to the closest growth-centre region is 0 km. Individual 2 (3, 4) lives in a peripheral region and his/her distance to the closest growth-centre region is 50 (100, 150) km. The probabilities are simulated using estimates given in Table 2. They are calculated as averages over all observations. Replications for simulated probabilities: 1,000.

Finally, we consider the impact of expected net income on the migration decision. Table 2 suggests that the impact of expected net income on the migration decision is dependent on age, home-ownership and the regional rate of unemployment, but again simulated probabilities are necessary to get a clearer picture of the migration decision process.

Table 4 reports the simulated probabilities before and after a 10% increase in expected net income for the *staying* alternative.[69] Hence, this policy would increase individuals' income in their region of origin. Absolute and percentage changes in the probabilities are also reported. The simulations were performed with different values for the variables age, homeowner and regional rate of unemployment. The reported figures are averages over all observations. On average, the policy would increase individuals' probability of staying in the region of origin by 2.09% and it would decrease their probability of moving to a growth-centre (peripheral) region by 73.61% (73.54%).

[69] Of course, we can also calculate the probabilities before and after a 10% increase in expected net income for all migration alternatives. For brevity, the results are not reported but are available from the corresponding author upon request.

Table 4. Simulated probabilities before and after a 10% increase in expected net income for the staying alternative

Alternative	Average individual	Age		Homeowner		Regional rate of unemployment	
		20 years	40 years	No	Yes	15%	25%
Before increase in income							
Staying	0.9724	0.9634	0.9811	0.9689	0.9754	0.9783	0.9671
Migrating to periphery	0.0135	0.0177	0.0097	0.0182	0.0085	0.0124	0.0141
Migrating to growth-centre	0.0141	0.0189	0.0092	0.0129	0.0161	0.0093	0.0188
After increase in income							
Staying	0.9927	0.9934	0.9931	0.9896	0.9966	0.9973	0.9896
Migrating to periphery	0.0036	0.0029	0.0035	0.0062	0.0009	0.0014	0.0043
Migrating to growth-centre	0.0037	0.0037	0.0034	0.0042	0.0025	0.0013	0.0061
Absolute change in probability							
Staying	0.0203	0.0300	0.0120	0.0207	0.0212	0.0190	0.0225
Migrating to periphery	-0.0099	-0.0149	-0.0061	-0.0120	-0.0076	-0.0110	-0.0098
Migrating to growth-centre	-0.0104	-0.0152	-0.0059	-0.0087	-0.0136	-0.0080	-0.0127
Percentage change in probability							
Staying	2.09%	3.12%	1.22%	2.13%	2.17%	1.94%	2.33%
Migrating to periphery	-73.61%	-83.73%	-63.41%	-65.95%	-89.02%	-88.68%	-69.47%
Migrating to growth-centre	-73.54%	-80.25%	-63.55%	-67.31%	-84.60%	-86.36%	-67.64%

Notes: The probabilities are simulated using estimates given in Table 2. They are calculated as averages over all observations. Replications for simulated probabilities: 1,000. The average predicted annual net income in the staying alternative is 8,674 euro.

The simulated probabilities yield the expected result that the younger one is, the larger will the effect of expected income changes on the probabilities of staying and moving. If the individual is 20 years old (40 years old), his/her probability of staying would on average increase by 3.12% (1.22%) and his/her probability of migration would on average fall by some 82% (63%). Similar conclusions can be drawn from the absolute changes in the probabilities. For example, for individuals aged 20, a 10% increase in net income in the region of origin would increase their average probability of staying by 0.03.

The elasticity of staying with respect to an increase in expected net income in the region of origin hardly changes with home-ownership. For homeowners, the probability of staying increases by 2.17%, and for those who do not own their home by 2.13%. However, the absolute probability of moving to a growth-centre (periphery) falls considerably more (less) for homeowners than for those who do not own their home. Note, however, that their initial migration probabilities are different. The elasticity of migration is considerably greater with home-ownership.

The elasticity of staying is greater in regions of high unemployment (2.33%) than in regions of low unemployment (1.94%). In absolute figures, the average probability of moving to a growth-centre region is reduced more for individuals living in regions of high unemployment than for individuals living in regions of low unemployment. This is a good outcome, if it is desired to retain more people in the peripheral regions.

6 Discussion of policy implications

Figure 5 shows percentage net migration into the Finnish subregions in 1999. We can see a geographical shift of population towards the growth-centre regions. In fact, the subregional concentration of population has strengthened in the recent past. Net migration into the growth-centre and peripheral regions was 8,459 and –5,194 individuals, respectively, in 1995 as against 17,374 and –14,596 individuals in 1999. Could a reduction in the personal taxation of the biggest net migration loser regions be an answer to the problem (see the eleven regions coloured white in Figure 5)?

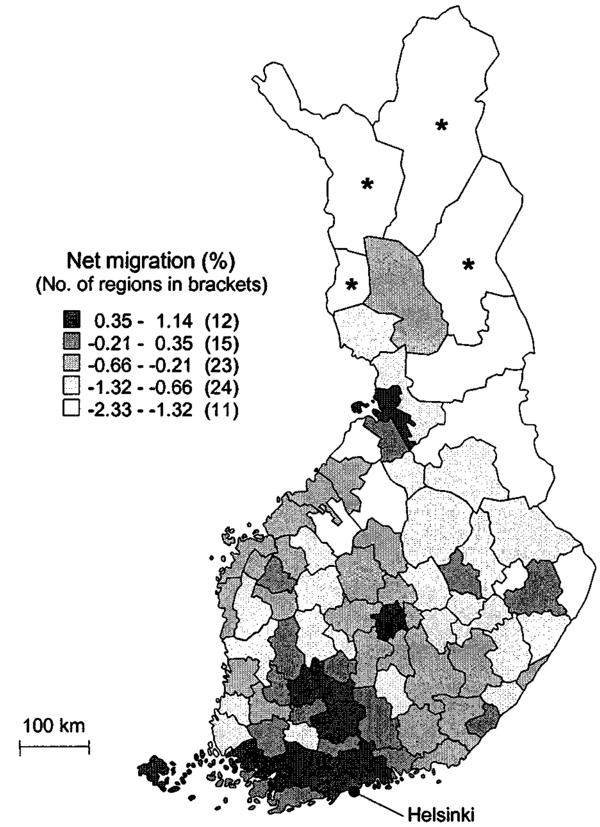


Figure 5. Net migration per population in 1999, % (*Source:* Statistics Finland's Kuntafakta), * indicates regions used in the policy analysis

Firstly, it would mean that fewer people would move from the lowered taxation regions and thus reduce out-migration. Secondly, it would probably increase in-migration to those regions. Therefore, the selected regions would lose fewer inhabitants. However, it is difficult to evaluate the aggregate affects of such policies. That is, how many more people would stay in the area and how many more people would move into an area of reduced taxation. We shall focus on the first problem.

To approach the problem, we have to decide how this tax reduction is implemented in practice. Because income tax is progressive in Finland, it may not be desirable to use it: for example, only individuals with earned income in excess of 11,000 euro would be affected by the policy in 2001. Instead, social security taxes and municipal tax seem more eligible candidates because they are proportional to earned income and are paid by everyone with earned income. In the latter case, however, the government would have to compensate the municipalities for these lost tax revenues so as not to throw their already poor economies even further out of balance.

Here we consider the implications of two regional taxation policies targeted at individuals living in the four northernmost subregions (see Figure 5). In the first policy their annual net income is increased by 10%, for example with the help of social security taxes. In the second policy their annual net income is increased by 25%. This latter net growth in income can be achieved, for example, by assuming that the individuals who are affected by the policy do not have to pay municipal tax.[70]

Table 5 illustrates the cost-effectiveness of such policies for 1999. We can see that there were 26,898 employed individuals with an average annual net income of approximately 9,137 euro in the four subregions. Therefore, the two policies would cost approximately 24.585 and 61.435 million euro to the government, respectively. Statistics also show that 3,284 (1,927) individuals migrated from (into) the four subregions in 1999, resulting in a net in-migration deficit of –1,357. Our simulations, which rely on the fact that the unemployment rate is approximately 25% in those regions, imply that on the average the out-migration probability would diminish by some 74% and 84% as a result of the first and second policies,

[70] Because the average annual income, municipal tax and taxes paid in total were approx. 13,453 euro, 18% and 32%, respectively, in those subregions in 1999, the policy would increase their annual net income by some 27%.

respectively.[71] Since approximately one third of the migrants are employed and are thus directly affected by the policy, the out-migration would fall to 2,474 and 2,365 individuals, respectively. Of course, the policy would also attract other than employed persons to stay in these and increase migration into them. Therefore, we estimate that the net out-migration would be significantly more balanced after both taxation policies. However, the 10% increase in annual net income appears to be a more sensible alternative than the 25% increase, since the latter, more expensive policy, does not reduce the gap much more than the cheaper one.

Table 5. Costs and effects of two taxation policies

	Before the taxation policy [1]	After 10% increase in annual net income	After 25% increase in annual net income
Costs			
Employed individuals	26,898	[2]	[2]
Annual income per individual, euro	13,453	[2]	[2]
Annual net income per individual, euro	9,137	10,051	11,421
Annual costs per individual, euro	-	914	2,284
Total annual costs, euro	-	24,584,772	61,435,032
Effects			
In-migration	1,927	[2]	[2]
Out-migration	3,284	2,474 [3]	2,365 [3]
Net in-migration	-1,442	-547	-438

Notes: The four subregions used in the illustration are given in Figure 5. [1] Figures are given for 1999 (*Sources*: Finnish Tax Administration & Statistics Finland's Kuntafakta). [2] Figure is assumed to be unchanged after the policy. [3] Figures are calculated using estimates in Table 2.

Yet, there are problems in the tax reduction policies. First problem is related to financing. Even though the tax reductions in the peripheral regions would probably slow down the concentration of the population into the growth-centre regions, it would also be very expensive compared to potential results. In addition, the equality of the individuals and the regions is at stake. The surplus from the tax reductions can easily accumulate on the highly educated and well-paid individuals. We have to take into consideration that a large number of the peripheral population consists of unemployed or low-income earners and therefore their benefit from the tax reductions may retain relatively small. Regional inequality may harm other policy purposes like networking of the regions as well.

Another important question is how effective such a regional policy is during an economic upturn. The used data set included only years of economic recession and therefore the results

[71] The simulated percentage changes are averages over all sample individuals living in the peripheral regions.

may not apply in general. According to Norwegian experience, the importance of the local labour markets is strengthened and the effectiveness of tax reductions is weakened during favourable state of employment, when there are plenty of job vacancies in the nearby areas. Another problem related to the employment is the influence of the tax reductions on incentives and misuse. For example, an individual may become reluctant to search for a job from other regions, even though it would be optimal from the point of view of the individual and the society. To summarise, individually focused tax reductions can be used in influencing the development of regions as long as the problems related to their use are sufficiently taken into account.

7 Conclusion

In this paper, we analyse migration choices in Finland focusing on whether migration decisions can be affected by income taxation policies. Our findings have important implications for public policy. First, we show that the decision to migrate is affected by net income expectations, as the human capital theory predicts. Second, we find that the size of the impact of expected net income on migration depends on age, home-ownership and regional unemployment rate. In addition, we consider the effectiveness of income taxation in reducing out-migration from stagnating regions. Our simulations imply that the effectiveness of such policy would be increased, if the reduction in taxation could be targeted at young individuals living in regions with high unemployment rates. Hence, we provide important evidence on where to target possible tax reductions.

Acknowledgements

This paper is part of Mika Haapanen's doctoral studies in the Finnish Postgraduate Programme in Economics (FPPE). Both authors would like to thank the Yrjö Jahnsson Foundation for financial support. An earlier version of this paper was presented at FPPE's research seminar in Labour Economics in Helsinki. We appreciate the valuable comments by Arnaud Chevalier and other participants. We would also like to thank Hannu Tervo for his helpful comments and suggestions on this paper.

Appendix

Table A1. Variable definitions and descriptive statistics

Variable	Scale	Operational definition	Mean
Sex	(0, 1)	1 = male; 0 = female	0.497
Age	Continuous	Age in years divided by 10	3.641
Age squared	Continuous	(Age/10) squared	14.427
Lower academic degree	(0, 1)	1 = lower academic degree; 0 = otherwise	0.097
Higher academic degree	(0, 1)	1 = higher academic degree; 0 = otherwise	0.069
Academic degree	(0, 1)	1 = academic degree; 0 = otherwise	0.166
Spouse employed	(0, 1)	1 = married or cohabiting and spouse's main activity is employment during the last week of 1993; 0 = otherwise	0.465
Under school-aged children only	(0, 1)	1 = under school-aged children only; 0 = otherwise	0.119
School-aged children	(0, 1)	1 = school-aged children; 0 = otherwise	0.327
Homeowner	(0, 1)	1 = homeowner; 0 = otherwise	0.422
Initial earnings	Continuous	Annual earnings in 1993 (10,000 euro) = annual income from labour plus self-employment income and work-related transfers, such as unemployment insurance and sick pay.	1.647
Months of employment	(0-12)	Months of employment in 1993	8.520
Work experience	Continuous	No. of months of employment during 1987–93 divided by 10	6.083
Work experience squared	Continuous	Work experience squared	44.469
Commuting	(0, 1)	1 = commuting from the municipality in the last week of 1993; 0 = otherwise	0.336
Living in region of birth	(0, 1)	1 = living in region of birth; 0 = otherwise	0.539
Living in growth-centre region	(0, 1)	1 = living in growth-centre region, i.e. in the region of Helsinki, Salo, Porvoo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio or Oulu; 0 = otherwise	0.476
Degree of urbanisation	(0-10)	Proportion of population living in built-up areas	7.749
Distance to the closest growth-centre	Continuous	Individual's distance to the closest growth-centre using distances by road (10 km)	5.679
Regional rate of unemployment	Continuous	Regional rate of unemployment, %	21.997
Ln(predicted annual income)	Continuous	Natural logarithm of predicted annual income for 1995 (1,000 euro). Calculated using the endogenous switching model (see Table 1).	2.091

Notes: All variables measured at the region of origin in 1993 if not otherwise stated.

References

Ben-Akiva, M. and Lerman, S. R. (1985) *Discrete Choice Analysis: Theory and Application to Travel Demand*, MIT Press, Cambridge.

Brownstone, D. and Train, K. (1999) Forecasting new product penetration with flexible substitution patterns, *Journal of Econometrics*, 89, 109–129.

Connolly, S. and Munro, A. (1999) *Economics of the Public Sector*, Prentice Hall Europe, London.

Daganzo, C. (1979) *Multinomial Probit: The Theory and Its Application to Demand Forecasting*, Academic Press, London.

Eikeland, S. (1999) Personal incentives in Norwegian regional policy, Nordregio working paper 5/1999.

Haapanen, M. (2000) Expected earnings and interregional migration, University of Jyväskylä, School of Business and Economics, Working paper No. 221.

Hensher, D. A. (2001) The sensitivity of the valuation of travel time savings to the specification of unobserved effects, *Transportation Research E*, 37, 129–142.

Islam, M. N. and Choudhury, S. A. (1990) Self-selection and intermunicipal migration in Canada, *Regional Science and Urban Economics*, 20, 459–472.

Jain, D. C., Vilcassim, N. J. and Chintagunta, P. K. (1994) A random-coefficients logit brand-choice model applied to panel data, *Journal of Business and Economic Statistics*, 12, 317–328.

Juarez, J. P. (2000) Analysis of interregional labor migration in Spain using gross flows, *Journal of Regional Science*, 40, 377–399.

Lucas, R. E. B (1997) Internal migration in developing countries, in: Rosenzweig, M. R. and Stark, O. (eds.) *Handbook of Population and Family Economics*, Volume 1B, 721–798.

Maddala, G. S. (1983) *Limited-dependent and Qualitative Variables in Econometrics*, Cambridge University Press, Cambridge.

Maddala, G. S. (1995) Specification tests in limited dependent variable models, in: Maddala, G. S., Phillips, Peter C. B. and Srinivasan, T. N. (eds.) *Advances in Econometrics and Quantitative Economics: Essays in Honor of Professor C. R. Rao* (Blackwell, Oxford), 1–49.

McFadden, D. and Train, K. (2000) Mixed MNL models for discrete response, *Journal of Applied Econometrics*, 15, 447–476.

Mincer, J. (1978) Family migration decisions, *Journal of Political Economy* 86, 749–773.

Nakosteen, R. A. and Zimmer, M. (1980) Migration and income: the question of self-selection, *Southern Economic Journal*, 46, 840–851.

Pekkala, S. (2000) Regional convergence and migration in Finland 1960–90, Doctoral Dissertation, Jyväskylä Studies in Business and Economics, University of Jyväskylä.

Poirier, D. J. and Ruud, P. A. (1981) On the appropriateness of endogenous switching, *Journal of Econometrics*, 16, 249–256.

Powers, D. A. (1993) Endogenous switching regression models with limited dependent variables, *Sociological Methods & Research*, 22, 248–273.

Pudney, S. (1989) *Modelling Individual Choice: The Econometrics of Corners, Kinks and Holes*, Blackwell, Cambridge.

Ritsilä, J. (2001) Studies on spatial concentration of human capital, Doctoral Dissertation, Jyväskylä Studies in Business and Economics, University of Jyväskylä.

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.

Robinson, C. and Tomes, N. (1982) Self-selection and interprovincial migration in Canada, *Canadian Journal of Economics*, 15, 474–502.

Schaeffer, P. (1985) Human capital accumulation and job mobility, *Journal of Regional Science*, 25, 103–114.

Seater, J. J. (1977) A unified model of consumption, labour supply, and job search, *Journal of Economic Theory*, 14, 349–372.

Sjaastad, L. A. (1962) The costs and returns of human migration, *Journal of Political Economy*, 70 (Supplement), 80–93.

Stern, S. (1997) Simulation-based estimation, *Journal of Economic Literature*, 35, 2006–2039.

Train, K. (1998) Recreation demand models with taste differences over people, *Land Economics*, 74, 230–239.

Tversky, A. (1972) Elimination by aspects: a theory of choice, *Psychological Review*, 79, 281–299.

United Nations (1999) World urbanization prospects: the 1999 revision, United Nations Population Division.

Weiss, Y. (1971) Learning by doing and occupational specialization, *Journal of Economic Theory*, 4, 189–198.