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Mika Haapanen

Studies on the Determinants of Migration and the Spatial Concentration of Labour

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UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 2003

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ABSTRACT

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This thesis consists of five empirical studies which seek to understand the processes behind the interregional migration decisions and the spatial concentration of labour. The thesis mainly utilises Finnish longitudinal population census file from 1993–1996. A good variety of advanced microeconometric methods are used in the modelling of the migration phenomenon to ensure robustness and reliability of the results. The empirical studies are preceded by an introductory chapter that, for example, discusses spatial concentration in Finland between 1980 and 2000, and surveys prior evidence on the determinants of migration. Chapter 2 examines the impact of labour market performance on the migration decisions. The results imply that person-specific productivity has hardly any impact on migration, apart from females living in peripheral regions: women with the poorest performance decide to move when their performance is compared with a reference group based on characteristics such as age, education and experience. In Chapter 3 the main interest is now on the expected performance after migration. It is found that expected earnings influence migration decision. Chapter 4 stresses the role of highly educated migrants in human capital redistribution. The results suggest that the highly educated are likely to move to urban municipalities, which offer better job opportunities, versatile possibilities for self-improvement and hobbies etc. Chapter 5 investigates unobserved variation in the migration behaviour and finds that a random parameters logit specification can provide a more realistic description of the migration behaviour than the standard logit model. Chapter 6 studies the migration-impact of income policy interventions. The findings on individuals living in the peripheral regions show that the decision to migrate is affected by net income expectations, as the human capital theory predicts. However, the costs of such income policy interventions can be very high.

Keywords: interregional migration, spatial concentration, labour markets, human capital, wages, discrete choice analysis, microeconometrics

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Jyväskylä, July 2003

Mika Haapanen

CONTENT

CHAPTER 1

INTRODUCTION*

Mika Haapanen

Abstract

This introductory chapter first discusses the spatial concentration in Finland. The focus of the discussion is on the population and migration figures between 1980 and 2000, such as the natural population growth (births - deaths), interregional and international migration, dependency ratio, and population density. Second, this chapter surveys the prior evidence from the empirical literature on the determinants of interregional migration. In the literature survey the emphasis is on the Finnish studies that use micro-data. Finally, it discusses the outline, methodological issues and main results of this thesis.

Keywords: migration, spatial concentration, labour, Finland

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* I wish to thank Robert E. B. Lucas, Hannu Tervo and Jaakko Pehkonen for their helpful comments on this Introduction.

1 Background

The migration research, both theoretical and applied, has concerned advanced industrial as well as less developed countries. It has dealt with interregional and international migration. Although valuable theoretical research has been focused on the migration phenomenon, most migration research has been empirically oriented (Plane and Bitter, 1997). Prior to 1975, virtually all empirical migration research was based on aggregate data (Greenwood and Hunt, 2003).[1] More recently, sophisticated computing capabilities in combination with the availability of micro and longitudinal data, as well as analytical tools for their analysis, have deepened our understanding of the migration phenomenon. Here, the thesis follows the empirical tradition where the interregional migration decisions are studied at the micro level.

Two main branches of migration literature can be distinguished, one dealing with the determinants of migration and one dealing with the consequences of migration. The determinants of migration are factors that affect the migration decision, including characteristics of an individual as well as their family and region of residence.[2] The consequences of migration usually refer to the performance of a migrant in their new location relative to the performance in their former place of residence had they not moved.[3] While this thesis concentrates on the determinants of migration, it acknowledges that the determinants and consequences of migration are interrelated. The reason for this is that the migration decision is likely to be dependent on the expected consequences of the migration, such as the expected income path; in the theoretical migration literature it is usually assumed a positive migration decision is reached if the expected utility gained from moving exceeds the direct costs of moving.[4]

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[1] Studies of aggregate migration have usually failed to account for differences in the underlying determinants of migration of various population groups, although stratification by age and race has been common.

[2] They include, for example, individual's level of education, presence of children, regional employment and wage opportunities, location-specific amenities and other qualitative and quantitative factors.

[3] The most common measures of performance are probably the unemployment/employment status and the wage level of an individual.

[4] The thesis discusses neither theoretical nor international migration literature in detail. See, however, the comprehensive surveys by Greenwood (1975; 1985; 1997), Shields and Shields (1989), Greenwood *et al*. (1991), Ghatak *et al*. (1996), LaLonde and Topel (1997) and Lucas (1997).

This introductory chapter first discusses the spatial concentration in Finland by focusing on the Finnish population and migration figures between 1980 and 2000. Then it surveys the prior evidence from the empirical literature on the determinants of interregional migration. Finally, this chapter discusses the outline, methodological issues and main results of the thesis.

2 Spatial concentration in Finland 1980 – 2000

Interregional migration flows in Finland experienced a sharp growth after 1993, compared to the 1980s and the beginning of the 1990s (Figure 1).[5] This has significantly strengthened the rate of urbanisation in Finland.[6] Currently, people are moving away from already sparsely populated areas to areas of economic growth. If this current trend continues, it will lead to the concentration of human capital in a few attractive regions, while the other regions diminish and struggle for survival in this urbanisation process (see e.g. Pekkala, 2000; Ritsilä, 2001; Nivalainen and Haapanen, 2002; Kauhanen and Tervo, 2002): more distant regions are losing important future human capital, as the young and educated move away from those regions.[7]

[5] At the same time, international migration has been modest but increasing in Finland. For example, in absolute numbers 10 465 people migrated to Finland and 7 739 exited the country, while in 2000 the corresponding figures were 16 895 and 14 311 (Statistics Finland, Demographic statistics).

[6] The trend towards urbanisation is an old global phenomenon (Lucas, 1997; United Nations, 1999). Hence, it is not surprising that the urbanisation has been a popular topic in regional science; see e.g. survey by Williamson (1988) and studies by Anas *et al.* (1998), Beeson *et al.* (2001) and Davis and Henderson (2003). In fact, it has been argued that the phenomenon most responsible for initial interest in migration as a field of scientific study appears to have been urbanisation; see Greenwood and Hunt (2003) for discussion of the early history of migration research, beginning with the work of Ravenstein in the 1880s and continuing through to the 1940s.

[7] See also Nivalainen (2003a) for analysis of the movements to rural areas in Finland.

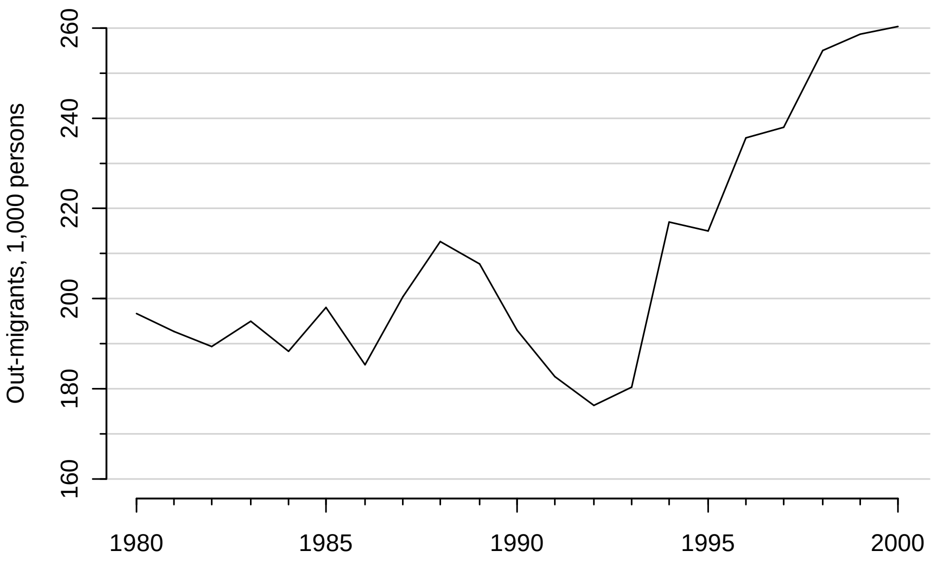

FIGURE 1 Out-migration between Finnish municipalities, 1980 – 2000

To describe and analyse migration, spatial concentration and regional development in Finland, this chapter and the empirical studies of the thesis exploit a classification of growth-centre regions and other peripheral regions (Figure 2).[8] The regional classification is formed using information on the net migration rates and population figures at the NUTS4 level ("*seutukunta*"), which, by and large, represent actual commuting and working areas: 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.[9] The resulting nine growth-centre regions are Helsinki, Porvoo, Salo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu, and are also characterised by high wage levels; see Chapter 3 of this thesis. The other 76 regions are mostly peripheral and stagnating regions, although, in Finnish terms, they include some of the bigger towns (Lappeenranta, Rovaniemi).

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[8] Chapter 4, however, uses a different classification of regions, which is directly related to the degree of urbanisation.

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

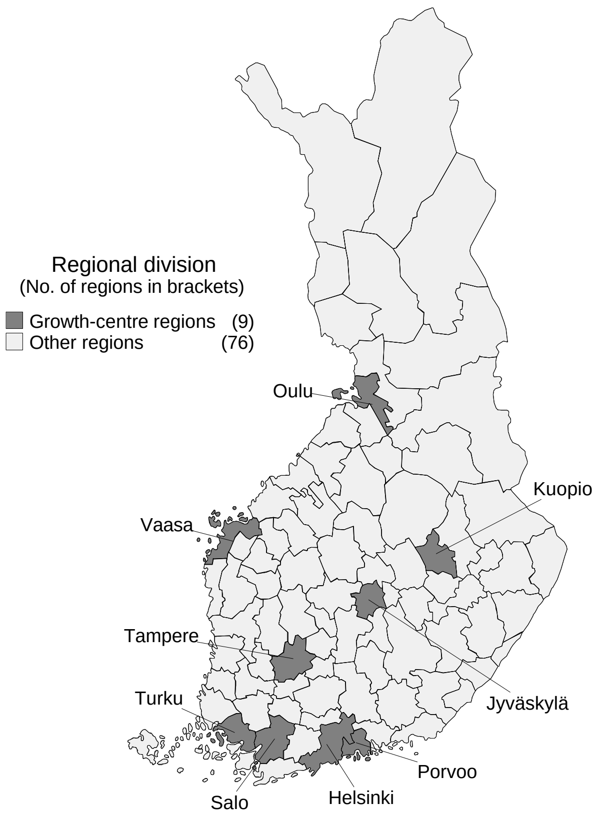

FIGURE 1 Regional division into growth-centre and other regions

Table 1 presents a comparison of the population size and population density between the two types of regions and the whole of Finland. Population in Finland has grown by 8.2 percent, from 4.8 million in 1980 close to 5.2 million, in 2000. As mentioned above, people have been moving to the growth-centre regions: the population of the growth-centre regions increased by 23.4 percent, while the population of the other regions decreased 2.2 percent between 1980 and 2000. The population densities have changed correspondingly. Table 1 shows that, for example, the population density of the growth-centre regions increased by 22 persons per square kilometre in 1980 - 2000. The initial levels of the population densities are also very different in the two types of regions. In 1980 the population density in growth-centre regions was approximately 95 persons per square kilometre, while the corresponding figure for the other regions was 9 persons per square kilometre.

TABLE 1 Regional population and regional population density in Finland, 1980 – 2000

	1980	1985	1990	1995	2000	Change 80-00	Change %
Population							
Growth-centre reg.	1 948 689	2 043 157	2 134 064	2 262 153	2 404 210	455 521	23.4
Other regions	2 839 089	2 867 507	2 864 414	2 854 673	2 776 971	-62 118	-2.2
All regions	4 787 778	4 910 664	4 998 478	5 116 826	5 181 181	393 403	8.2
Population density, km2							
Growth-centre reg.	94.776	99.371	103.792	110.022	116.931	22.155	23.4
Other regions	8.940	9.029	9.019	8.989	8.744	-0.196	-2.2
All regions	14.159	14.522	14.782	15.132	15.322	1.163	8.2

Notes: Population density is the number of persons per square kilometre. Source: Statistics Finland (Altika) and author's own calculations.

To further highlight the differences in the regional development, dependency ratios for the Finnish municipalities in 1980 - 2000 are presented in Table 2. Means and standard deviations of the dependency ratios are given first, followed by the percentage change between 1980 -2000. In general, the larger the dependency ratio, the greater the burden the local authorities have in providing basic consumption needs and welfare services for those people who are dependent; see the table notes for a more detailed definitions of the dependency ratios.

First, the table shows that, on average, the demographic dependence ratio did not weaken in the growth-centre regions between 1980 and 2000, while at the same time in the other regions it became worse every five-year period. However, the future development of a municipality depends greatly on the proportion of young and elderly. Therefore, the youth and elderly dependency ratios are presented next, which focus on people below 15 and above 64, respectively.

Table 2 shows that the changes in the youth dependency ratios have been modest between 1980 and 2000. The differences between the growth-centre and other peripheral regions have also been small in this respect. In contrast, the elderly dependency ratios have worsened substantially more in the peripheral regions than in the growth centre regions. The mean of the elderly dependency ratio for the peripheral regions has increased by almost 36 percent, from 0.226 in 1980 to 0.309 in 2000. At the same time, the corresponding figure for the growth-centre regions increased by some 13 percent.

TABLE 2 Means of the dependency ratios in Finland, 1980 – 2000 (standard deviation)

	1980	1985	1990	1995	2000	Change 80-00, %
Demographic dependency ratio						
Growth-centre regions	0.513	0.511	0.528	0.535	0.531	3.5
	(0.061)	(0.077)	(0.094)	(0.089)	(0.081)	
Other regions	0.519	0.531	0.573	0.596	0.596	14.8
	(0.061)	(0.064)	(0.072)	(0.075)	(0.073)	
Youth dependency ratio						
Growth-centre regions	0.317	0.313	0.321	0.319	0.309	-2.5
	(0.069)	(0.059)	(0.055)	(0.049)	(0.053)	
Other regions	0.293	0.294	0.311	0.310	0.289	-1.4
	(0.050)	(0.052)	(0.053)	(0.051)	(0.049)	
Elderly dependency ratio						
Growth-centre regions	0.196	0.198	0.207	0.216	0.222	13.3
	(0.088)	(0.093)	(0.098)	(0.096)	(0.092)	
Other regions	0.226	0.237	0.262	0.286	0.307	35.8
	(0.071)	(0.069)	(0.070)	(0.070)	(0.072)	
Economic dependency ratio						
Growth-centre regions	1.157	1.135	1.125	1.532	1.235	6.7
	(0.136)	(0.176)	(0.194)	(0.215)	(0.189)	
Other regions	1.301	1.353	1.394	1.941	1.636	25.7
	(0.156)	(0.186)	(0.209)	(0.340)	(0.304)	

Notes: Demographic dependency ratio is (population below age 15 and above 64) / (popul. aged between 15 and 64). Youth dependency ratio is (popul. below age 15) / (popul. aged between 15 and 64). Elderly dependency ratio is (popul. above 64) / (popul. aged between 15 and 64). Economic dependency ratio is (popul. – employed persons) / (employed persons). The ratios are calculated at the municipal level. Source: Statistics Finland (Altika) and author’s own calculations.

Table 2 also presents the economic dependency ratios for the two regions. The economic dependency ratio indicates more directly the economic responsibility of those economically active in providing services for those who are not, as it relates the employed persons to those who are not. Hence, the financing of the social infrastructure such as schools and health care becomes more difficult when the economic dependency ratio increases. Table 2 shows that, on average, the economic dependency ratios worsened in the growth-centre and other regions between 1990 and 1995 due to the deep recession. After the mid-1990s, the economic dependency ratios have improved in both regions due to increasing employment.

However, one should note that there is a lot of variation in the economic dependence ratios between the municipalities within the two types of regions: some municipalities are much worse off and some are much better off than the average municipality. In fact, it can be easily seen from Table 2 that the variation in the dependency ratios has almost doubled in the peripheral regions between 1980 and 2000 if measured with standard deviation.

To further shed light on the regional development, Figure 3 presents the factors that influence regional population at a given time period, namely natural population growth (births – deaths), interregional migration (in-migration – out-migration) and international migration (immigration – emigration). Theoretically, the interregional and international migration flows are seen as important mechanisms through which labour resources are redistributed geographically in response to changing economic and demographic forces. For example, the relocation of labour from low productivity to high productivity regions is regarded as an engine of economic growth and development; see e.g. Ghatak *et al.* (1996). Similarly, the natural population growth can have a major role in changing the demographic structure of population, for example through the aging process (see e.g. Weil, 1997).

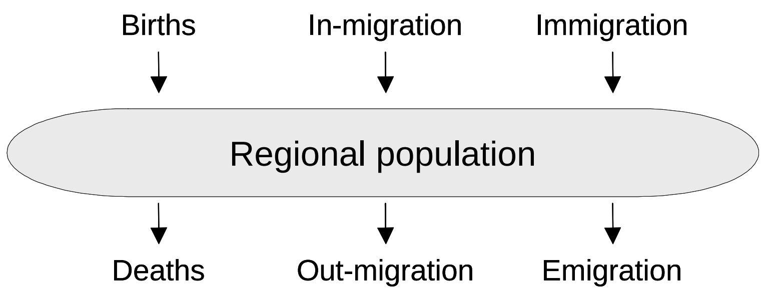

FIGURE 3 Natural population growth, interregional and international migration

Figure 4 shows the trends in these components of the regional population growth in Finland between 1980 and 2000. Clearly interregional migration has been the most significant factor that explains the regional population growth during the last twenty years. Especially since the mid-1990s, the interregional migration has increased the population of the growth-centre regions and at the same time it has swiftly diminished the population of the other peripheral regions.[10] A marked temporary increase in the net-immigration is also noticeable in the beginning of the 1990's.

[10] During this period the Finnish economy was starting to recover from recession, with the unemployment rate remaining exceptionally high (see e.g. Kangasharju *et al.*, 1999, and Pekkala, 2000).

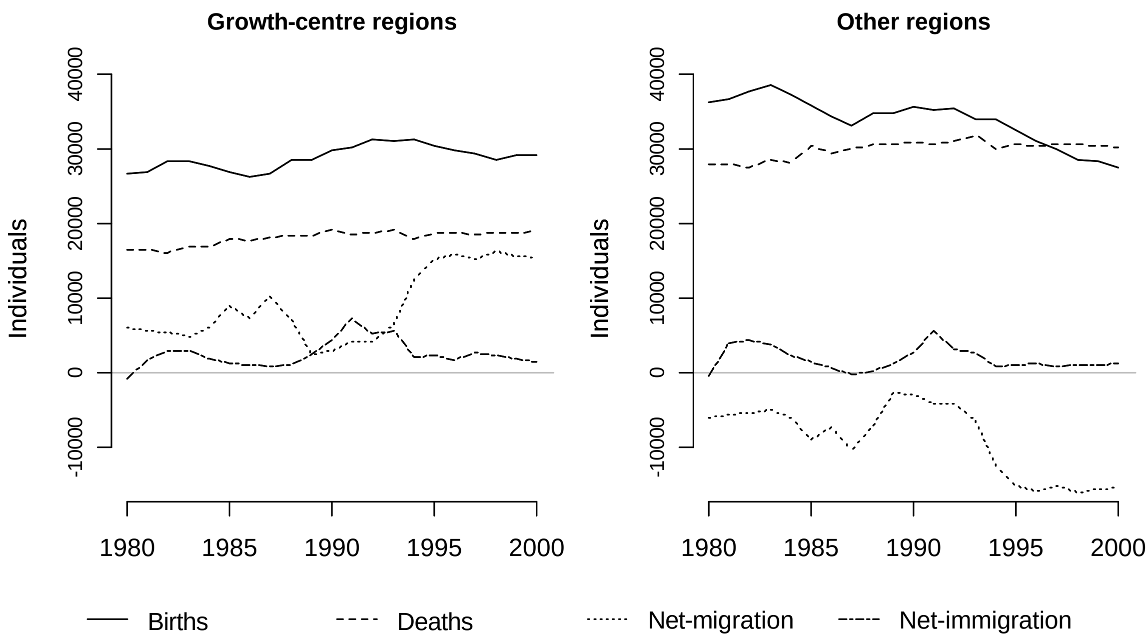

FIGURE 4 Regional population flows in Finland, 1980 – 2000

Trends in the natural population growth have been very different in the two regions (Figure 4). The natural population growth steadily increased the population of the growth-centre regions between 1980 and 2000. At the same time, the natural population growth declined sharply in the other peripheral regions, due to the number of births falling substantially and the number of deaths hardly changing. This has lead to a situation where currently in the peripheral regions less people are being born than dying, which will evidently worsen the future prospects of these regions.

The increase in the interregional migration flows and its direction towards areas of growth has given rise to numerous economic policy concerns. The rapid changes in the population structure of regions due to migration affect revenues, the cost of providing services and infrastructure needs. Moreover, economies of scale exist in the provision of public goods, which affect the unit costs imposed on society with the arrival of a new migrant.

Growth in the population of children can also exert significant pressures on schools because the local government sector may not only be faced with providing expanded services but also with the costs of expanding capacity, for example, in the forms of new school buildings. Similarly, the associated decline in school enrolment in another region can leave the region with excess capacity and very high unit costs associated with maintaining overstock of buildings. On the end of the life cycle, large number of retirees can have significant impacts on the public health care system. Thus, the interregional migration, together with the aging of the population, is challenging the social welfare state in Finland; see Nivalainen and Haapanen (2002) for more on the aging of the Finnish population in this context.

3 Prior evidence on the determinants of migration

To approach the above challenges and to offer reasonable policy recommendations, it is necessary to understand the determinants of the individual migration decision. Hence, empirical literature on the determinants of migration is reviewed.[11] Keeping the length of the review manageable requires selection in the studies surveyed. Following the scope of the thesis, this discussion concentrates on empirical studies that employ micro-data. In addition more emphasis is placed on studies published in the recent past and on those using Finnish data.[12]

In the micro-level studies, the movement of labour is usually modelled as a utility maximising the process of an individual, which is driven by personal, household, labour market and regional factors as well as by costs associated with the move.[13] Most of these factors are observable (such as age, levels of education and work experience), but some are unobservable (e.g. personal productivity and skill).[14] In this section evidence based on the observable characteristics is looked at. The modelling of the unobserved characteristics and other methodological issues are discussed in the next section.

[11] In addition to the determinant of migration, the micro-level studies have commonly been interested in analysis of linkages between income gains and migration and those between employment/unemployment states in relation to migration; see e.g. Herzog *et al.* (1993).

[12] Much empirical literature has concerned migration in less-developed countries; see Lucas (1997) for a survey. In many cases the orientation and the motivation are not necessarily very different from that concerned with interregional migration in Finland and in other advanced industrial countries. The rural-urban migration of less-developed countries can help us to understand the movement of labour from the peripheral regions to the growth areas in Finland. On the other hand, much of the international migration literature has a decidedly different orientation than interregional migration. For example, the issues concerning language abilities, assimilation and adaptation to new environment are much less important in the context of interregional than international migration; see LaLonde and Topel (1997) for a review of the literature on international migration; see also Dustmann (1999; 2000).

[13] Surveys by Greenwood (1985; 1997), Shields and Shields (1989) and Ghatak *et al*. (1996) discuss migration theories.

[14] There exists a number of other ways to group the factors affecting migration in the literature. Firstly, a distinction between benefits and costs associated with the migration has often been used. Secondly, a distinction has been made between the desire to migrate and the ability to undertake migration (Ghatak *et al.*, 1996).

3.1 Personal and household factors

The personal human capital factors, age and education are generally regarded as one of the most important determinants of migration behaviour.[15] The empirical evidence on migration suggests that, in general, the propensity to move diminishes with age. One explanation is that 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 (Shields and Shields, 1989). In addition, young adults may have fewer local family ties. However, at an early age, an individual may be dependent on his or her parent's decisions and thus the propensity to move may be reduced.[16]

The analysis of the effects of educational attainment on migratory behaviour is quite extensive; see e.g. Molho (1987), Owen and Green (1992), Antolin and Bover (1997) and Ritsilä and Ovaskainen (2001). The overall finding of these studies is that educational attainment increases the likelihood of migration.[17] On the other hand, micro-level analyses of destination choices of highly educated migrants are much scarcer (see, however, Kauhanen and Tervo, 2002).

While the migration decision has usually been formulated in the context of individual utility maximisation, in recent years increasing emphasis has been placed on the family or the household as the decision-making unit (e.g. Westerlund and Wyzan, 1995; Lin, 1997; Nivalainen, 2003b). An early example is Mincer (1978) who studies the influence of family ties on migration. Hence, besides affecting the direct costs of moving, being married and having children may indicate the existence of additional local household ties. Because family members may have different employment prospects and community ties, such ties result in negative personal externalities that usually tend to discourage migration. For example, Sandell (1977) concludes that an individual with an employed spouse has a lower probability of migrating.

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[15] Not surprisingly, the human capital framework (Sjaastad, 1962) has been a common theoretical background in the empirical studies (see e.g. Ritsilä, 2001; Ritsilä and Ovaskainen, 2001).

[16] Detailed empirical analyses of the effect of age on the migration are fairly rare. Though, it has been fairly common in micro-level studies to increase the homogeneity of a sample by concentrating on young adults (e.g. Molho, 1987; Falaris, 1988; Bailey, 1993) or more rarely on the elderly (Lin, 1997); or by splitting the sample into a few age groups (see e.g. Islam, 1989; Islam and Choudhury, 1990); see also a detailed study by Lundborg (1991) on international migration.

[17] Theoretically, education is considered as general human capital, which creates employment opportunities and which is easily transferable to different locations. Thus, higher levels of education may reduce risks associated with migration (Shields and Shields, 1989).

Empirical studies have shown that owning a house reduces the propensity to move (see e.g. Henley, 1998; Tervo, 2000; Ritsilä and Ovaskainen, 2001). The explanation is at least two-fold. Firstly, moving costs depend greatly on the size and type of the dwelling. Hence, it can be expected that renters have higher propensity to move than homeowners due to their lower cost of moving. Secondly, because owning a house is an indicator of the engagement to the region of residence and the economic welfare in that region, a homeowner can be expected to have a higher threshold to move.

3.2 Labour market factors

Pissarides and Wadsworth (1989) have argued that the unemployment affects migration on three different levels.[18] Firstly, at the personal level unemployed workers are more likely to migrate than employed workers because of their lower cost of movement, particularly if they have been the main source of income for the household. Empirical evidence from Finnish studies supports this view (Ritsilä and Tervo, 1999; Ritsilä and Ovaskainen, 2001; Kauhanen and Tervo, 2002).[19]

Secondly, regional unemployment differentials encourage migration: if the local unemployment rate is high, the propensity to move is likely to be high as well, since the probability of job placement in the home region is then low. Ritsilä and Tervo (1999), Tervo (2000) and Ritsilä and Ovaskainen (2001) find with Finnish data that a higher regional unemployment rate encourages migration. Hämäläinen (2002) studies the migration behaviour of unemployed workers and finds that the migration-impact of the regional unemployment seems to depend on the overall unemployment: in the era of low national unemployment, the regional unemployment rate significantly augments the likelihood of migration, while in the era of high unemployment, the regional unemployment disparities do not significantly influence the likelihood of migration. Kettunen (2002) studies re-employment of unemployed workers by moving. He finds that the probability of migration decreases with the demand for labour in the area of residence.[20] There is also a growing interest in interactions between interregional migration and job mobility in the literature; see e.g. Zax and Kain (1991), Zax (1994) and van Ommeren (1999).[21]

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[18] In this literature, migration is commonly considered as a spatial job-search (see e.g. Herzog *et at.*, 1993).

[19] Only Tervo (2000) found insignificant (but positive) impact of personal unemployment on migration.

[20] Kettunen (2002) has measured the demand for labour using the unemployment/vacancy ratios.

[21] See also van Ham (2002) and references there.

Thirdly, a higher national rate of unemployment deters migration. In a period of high unemployment, the potential migrant is faced with a greater uncertainty of getting a job at the destination and a lower rate of return from migration. Accordingly, migration flows move pro-cyclically and during recessions the equilibrating role of migration is reduced; see e.g. Milne (1993) and Pekkala (2000).[22]

Much of the research on the migration-impact of wages has been modelled in the context of human capital theory, which was originally introduced by Sjaastad (1962). In this literature migration is seen as a result of people attempting to maximise their discounted present value of lifetime utility. Hence, the workers in each region consist of those who, ceteris paribus, experience their highest wages in the chosen location. Therefore, the incentive to move is likely to be reduced the higher the level of wages in the region of origin and the smaller are the wage differentials between the regions or the smaller the expected wages in an alternative region.

The empirical evidence on the migration-impact of wages is fairly extensive internationally but is quite limited in regards to Finland.[23] The international studies provide support for the human capital hypothesis. Robinson and Tomes (1982) and Islam and Choudhury (1990) estimate positive and significant impact of expected income gain on migration for Canada. Falaris (1987; 1988) finds significant positive impact of expected wages on the migration decision for Venezuela and United States. Newbold (1996) studies the return and onward migration in Canada and concludes that a drop in expected wages decreases the propensity associated with making a return migration. Finnish studies have used observed wages.[24] Tervo (2000) and Ritsilä and Ovaskainen (2001) find that income does not effect migration. However, Hämäläinen (2002) and Kettunen (2002) find that the migration likelihood of unemployed workers decreases when their wealth increases.

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[22] In particular, see Milne (1993) for survey of literature on macroeconomic influences on migration.

[23] The international studies include Robinson and Tomes (1982), Falaris (1987; 1988), Islam and Choudhury (1990); Vijverberg (1993) and Newbold (1996).

[24] See, however, Chapters 3 and 6 of the thesis for studies on the migration-impact of expected wages in Finland.

3.3 Regional and other factors

Location-specific amenities and cost-of-living differentials have been shown to be significant factors in the migration decision of individuals (see e.g. Knapp *et al.*, 2001). Individuals living in rural areas have a higher likelihood of migration than individuals living in urban areas, due to the benefits of living in close proximity to others (Axelsson and Westerlund, 1998). Migration propensity seems to increase with the number of migration events in the recent past[25] or with the commuting status (Ritsilä and Ovaskainen, 2001; Nivalainen, 2003b). More specifically, Van Ommeren *et al.* (1999) find the commuting distance positively influences the decision to move.[26]

The analysis of the influence of the public sector on migration decision is problematic, because public expenditures reflect both the quality and cost of providing public services. Therefore, empirical examination of the public sector and migration requires both taxes and measures of public services together with the rents paid and wages received (Charney, 1993; see also Westerlund and Wyzan, 1995). Fairly little emphasis has been placed on these issues in the migration literature, especially at the micro-level. [27] Islam (1979) finds that individuals prefer to locate in the low-taxed and high-welfare-spending municipalities, with their marginal propensity to move varying with age. Fox *et al.* (1989) conclude that tax rates significantly reduce the probability of migration. Moffitt (1992) concludes in his review that welfare has a positive and significant influence on the geographical mobility of certain population subgroups, in particular, of female heads of households; see also Cebula (1979).

[25] Repeat and return migration has also been modelled directly to emphasise the recurring nature of migration; see e.g. Newbold (1996) and Avikainen et al. (2001).

[26] Commuting can be seen as an alternative to migration; see e.g. van Ham (2002).

[27] At the aggregate level, Schachter and Althous (1989) conclude that high taxes tend to deter in-migration and to encourage out-migration. Similarly, Day (1992) finds that the type of government spending matters, e.g. higher per capita spending on health and education induces in-migration.

4 Outline of the study, methodological issues and main results

4.1 Outline of the study

As seen in this introduction, the concentration of population into the growth-centre regions arises from individual migration decisions. The purpose of this thesis is to understand the processes behind these migration decisions. The thesis consists of five empirical studies, each of which analyses different aspects of migration decisions. To shed light on these aspects, the empirical studies address several important interrelated questions:

- How does labour market performance influence migration decision? (Chapter 2)
- What factors determine the decision to move to the growth-centre regions and to the other peripheral regions? (Chapters 3, 4 and 6)
- Is migration from the peripheral regions affected by higher expected earnings in the growth-centre regions? (Chapters 3 and 6)
- What is the role which migration of highly educated labour plays in human capital reallocation? (Chapter 4)
- How can we control for and study the unobservable factors that affect decision to move? (Chapter 5)
- Is it possible through income policy interventions to influence where people choose to live? (Chapter 6)

Summary of the empirical studies is presented in Table 3. For each study, the focus, sample, model specification and main results are listed. Methodological issues regarding the empirical studies and findings are discussed in the following.

TABLE 3 Summary of the empirical studies and main results (Chapters 2 - 6)

Chapter	Focus	Sample	Model Specification	Main Results
2	• Impact of labour market performance on migration decision	• Individuals in labour force (employed or unemployed) • Aged 16-65 • Subsamples by gender and region of origin (growth-centre region vs. other regions)	• (Bivariate) probit models for each subsample • Controlling for self-selection	• Results depend on the gender and region of origin • Actual wages has no significant effect on migration, apart from females living in peripheral regions (negative) • In all samples wage norm has insignificant effect on migration • For females living in peripheral regions, those with the relatively poorest local prospects decide to move, i.e. personal productivity matters
3	• Impact of expected earnings on migration decision	• Young adults in peripheral regions • Aged 18-55	• Multinomial and nested logit models • Destination choice: stay, periphery migration or growth-centre migration • Controlling for self-selection	• Expected earnings has significant positive impact on migration decisions • The magnitude of the impact may depend on individual's age and distance from growth-centre region • Initial earnings have insignificant impact on migration decisions
4	• Where do highly educated migrate?	• Only actual migrants • Aged 17 - 64	• Homoskedastic and Heteroskedastic ordered probit models	• Highly educated prefer to move to urban areas • Rural as well as densely populated regions lose their highly educated labour to urban regions. • It is necessary to control for heteroskedasticity
5	• Empirical investigation of unobserved variation in migration behaviour of individuals	• Random sample • Aged 18 - 65	• Random parameters and standard logit models • Normal, triangular and uniform random parameters • Controlling for unobserved heterogeneity	• RPL model can provide more realistic description of migration behaviour than standard logit • Random parameters can give additional information on the migration phenomenon and enhance reliability of the results • Standard logit model may underestimate the migration-impact of education
6	• Can migration decisions be affected by income policy interventions?	• Individuals living in peripheral regions • Aged 16-60	• Random parameters logit • Controlling for self-selection & unobserved heterogeneity • Destination choice as in Chapter 3.	• Decision to move is influenced by expected net income and can be affected by income policy interventions • However, the costs of the interventions can be very high and thus they should be targeted carefully (cost affectivity is higher if targeted on young)

4.2 Methodological issues

The present study seeks to apply newly developed modelling methods to gain further understanding on the determinants of migration and the spatial concentration in Finland. The samples used in the empirical papers are taken from the Finnish longitudinal population census file that is combined with longitudinal employment data. The micro-data comprise years 1987-1995. The present study mainly utilises data from the years 1993–1995, where information on variables is more complete and recent.

In this study variety of advanced microeconometric methods are used to ensure robustness and reliability of the results. We emphasise the importance of taking account of the heterogeneity in the population of potential migrants. The heterogeneity can be classified into observed and unobserved heterogeneity. Let us begin with a discussion of the observed heterogeneity.

The observed heterogeneity is considered at many levels of model specification. Firstly, the micro-data allow us to control for and study observed differences in human capital, location, labour market status and costs of migration. That is, the decision to move is modelled as a function of personal and family characteristics and regional variables, such as age, education, children, home-ownership, spouse's labour market status and regional unemployment rate. Secondly, the micro-data include information on the region of residence. Hence, we are able to control for differences in the destination choices between the migrants (Chapters 3, 4 and 6). We follow the pioneering work on estimating discrete choice models by McFadden (1974) and the empirical work since.[28] Finally, the homogeneity of samples is increased by concentrating on a sub-population. For example, Chapter 2 focuses separately on males and females living in the growth-centre and peripheral regions.[29]

The unobserved heterogeneity is captured by the error terms of the model. We think it is important to control for possibility of differences in the error variances between individuals (heteroskedasticity). The reason for this is that Godfrey (1988) has shown that uncorrected departures from homoskedasticity can bias the estimated parameters and standard errors in non-linear models that the present study are using; see e.g. Chapters 2 and 4 of this thesis.

Recently, development of random parameters logit (RPL, "mixed" logit) models has provided an alternative way to study and control for the unobserved heterogeneity structure (McFadden and Train, 2000). The RPL

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[28] Destination choices of migrants are modelled at the micro level in international studies by Linneman and Graves (1983), Falaris (1987), Maier and Weiss (1991), Hughes and McCormick (1994) and Knapp *et al*. (2001); see Haapanen (1998), Häkkinen (2000) and Kauhanen and Tervo (2002) for studies using Finnish data.

[29] However, splitting the data into subsamples is only innocent as long as it is ensured that the subsamples do not suffer from self-selection problem; see the discussion below.

models allow us to control for unobserved heterogeneity in a more complicated choice situations fairly easily, for example, when the decisions are made over multiple alternatives. The RPL models have been used in various applications, e.g. in marketing, consumer and transportation research (Jain *et al.*, 1994; Brownstone and Train, 1999; Hensher, 2001), but, to our knowledge, they have not been applied to migration problems; see, however, Chapters 5 and 6 of this thesis.

As mentioned above, in the migration literature individuals select their chosen region of residence because they believe that it will yield a higher return than their other options. For instance, migrants with higher levels of educational attainment will choose to reside in the region where job matches value such ability relatively more. Consequently, those individuals who decide to move are not randomly drawn from the population as a whole. The resulting selectivity bias poses potentially serious problems in many econometric models of migration behaviour.[30] Hence, the selectivity issues need to be considered for example when performance is measured and income predictions are calculated for the potential migrants (see Chapters 2, 3 and 6).

4.3 Main results

Chapter 2 examines the impact of labour market performance in the region of origin on interregional migration decisions. To increase the homogeneity of the migration model, the model is estimated separately for men and females living in the growth-centre and peripheral regions. The results are analysed in a comparison with the human capital migration model developed by Vijverberg (1993). Following Vijverberg, the paper uses a sample selection model to decompose observed annual income from labour into two components: a wage norm, which represents market-determined average productivity, and a wage residual, which represents person specific productivity driven by talent and personality features.

Results from Chapter 2 suggest, firstly, that an increase in the actual wages in the region of origin does not seem to have any effect on the likelihood of migration,[31] apart from females living in the peripheral regions whose propensity to move is decreased. Secondly, wage norm does not have a significant impact on the likelihood of migration in any of the subsamples. Finally, person-specific productivity has hardly any impact on the likelihood of

[30] Most migration studies have used Heckman method (Heckman, 1979) for correcting for the possibility of self-selection; see e.g. Islam (1979) and Islam and Choudhury (1990). Though, for example, Falaris (1987) uses Lee's (1983) method and Hämäläinen (2002) uses the heteroskedastic bivariate probit model. Vijverberg (1995) has built a complicated model for the analysis of migration, work status and wages that control for multiple selection criteria.

[31] This is inline with the results in Tervo (2000) and Ritsilä and Ovaskainen (2001).

migration, except for females living in the peripheral regions: women with the relatively poorest local prospects decide to move. Hence, the results imply that peripheral regions are not necessarily losing their more productive workers after controlling for age, education, work experience etc.[32] 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 the desired effect on the economy as a whole, since a migrant's productivity often increases only when they have moved to a more prosperous region.

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 on the expected performance after migration, not on the performance before migration, on the decision to move. The results show that expected earnings influence migration. A policy, which would increase expected earnings in the 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 seems smaller, the further away from the growth-centre regions individual lives and the younger he is. On the other hand, a decrease in expected earnings in the growth-centre regions has hardly any impact on migration.

Chapter 4 analyses the role which high education plays in migration decision and in human capital reallocation. The study focuses on actual migrants, examining the direct effect of educational attainment on destination choices. The modelling results, which are based on the findings of previous theoretical and empirical research, indicated that highly educated migrants are likely to move to urban municipalities, which offer better job opportunities as well as more versatile possibilities for self improvement, hobbies, etc. At the same time, rural regions, as well as densely populated regions, tend to lose a remarkable part of their highly educated labour to urban regions. As a result, the reallocation of highly educated labour, and thereby also the redistribution of human capital, seems to be taking place in Finland.

Chapter 5 investigates empirically unobserved variation in the interregional migration behaviour of individuals. So far little research has been devoted to this issue, despite the fact that recent work on the random parameters logit (RPL) models provides the means for such an analysis. This paper contributes to the migration literature (i) by testing whether the RPL specification has any significance in terms of mean impacts when compared to the standard logit model, (ii) by testing whether and how much the migration determinants vary within the sample population, and (iii) by studying the

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

robustness of the results with respect to the specification of the random parameters.

The results from Chapter 5 suggest that the RPL specification can provide a more realistic description of the migration behaviour of individuals than the standard logit model. The RPL models provided evidence in favour of unobserved variation in the parameters that describe an individual's region of origin, employment status and marriage status. In some cases, marginal effects in the RPL specifications were estimated to some extent differently from those in the standard logit model. For example, while all the models showed a clear positive relationship between an individual's length of education and migration, the results from the RPL models implied that the standard logit model may underestimate the effect of education. In addition, the RPL models produced larger (smaller) estimates for the effects of commuting or children (being married) on migration than the standard logit model. At the same time, the results were fairly robust with respect to the specification of the random parameters logit model.

Chapter 6 studies the migration-impact of income policy interventions. The findings on individuals living in the peripheral regions show that the decision to migrate is affected by net income expectations, as the human capital theory predicts. For example, an income policy intervention that increases an individual's expected net income by 10 percent, if (s)he will not move to a growth-centre region, would decrease their probability of growth-centre migration by around 12 percent. The results are in accordance with the results from Chapter 3, where the impact of expected (gross) earnings on migration is examined.

However, the policy simulations in Chapter 6 suggest that the costs of such income policy interventions are very high. Therefore, they have to be targeted carefully. We think that a policy would be more cost-effective, if it could be targeted at young individuals because they are more likely to move than older people and their levels of income are on average smaller. In addition, it is important to improve the level of services and infrastructure in the peripheral regions, so that people are willing to stay there after the policy intervention is no longer operative. For example, it might be sensible to invest in people working in (nursery) schools and public health care.

In sum, we believe that the description of the migration phenomenon and the sophisticated micro-level analyses of the determinants of migration in this thesis can provide explanations for the observed spatial concentration in Finland and provide a solid background for the discussion of the appropriate policy tools. However, it is worth remembering that between 1993–1995, when our sample data was mostly measured, the Finnish economy was in deep recession and the migration flows were significantly smaller than at current (see e.g. the figures above). Hence, the results of the thesis may not apply in general and it would be sensible to replicate the analyses with more recent data when they become available.

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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. The analysis is conducted separately by gender and region of origin. The results suggest that person-specific productivity has hardly any impact on the likelihood of migration, apart from females living in peripheral regions: women with the poorest performance decide to move when their performance is compared with a reference group based on characteristics such as age, education and experience.

Keywords: migration, productivity, wages, selectivity

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1 Introduction

During recent decades interregional 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 peripheral regions and the concentration of economic activity in growth-centre regions (see e.g. Pekkala, 2000; Ritsilä and Ovaskainen, 2001). How harmful this trend is depends on the kind of people who migrate from peripheral regions to growth-centre regions. In this paper, we consider the migration-impact of labour market performance by focusing on the unobserved productivity factors.[1]

Roy's (1951) model of selectivity is usually employed to study the role of unobservable productivity factors.[2] However, the Roy model does not allow a direct estimate of the correlation between the unobservable productivity factors in the origin and destination regions.[3] A viable alternative is Vijverberg's (1993) human capital model of migration, which allows us to compare performance of migrants with a reference group based on characteristics such as age, education and experience. The model demonstrates that more productive workers in the region of origin migrate only if a positive correlation exists between the person-specific productivity in the origin and destination regions.

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 in Finland? If so, this would mean that peripheral regions are losing their productive workers, which has obvious negative implications for the development of such regions. Particularly, since Ritsilä and Haapanen (2003) have demonstrated that the reallocation of human capital is taking place in Finland: rural regions, as well as densely populated regions, tend to lose a remarkable part of their highly educated labour to urban regions.

To shed light on the above questions, we first briefly review Vijverberg's (1993) human capital model of migration in Section 2. Then Section 3 introduces our register-based data on Finland and presents our empirical model specifications. Herein, the Vijverberg's model is extended by estimating it separately for both sexes and for people living in the peripheral and growth-centre regions. Section 4 discusses estimation results and draws a comparison

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[1] See e.g. Pekkala (2002) for observed performance comparisons for Finland.

[2] Empirical 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).

[3] This is important because the origin productivity may differ substantially from destination productivity, for reasons of occupational specification and regional job separation (e.g. growth-centre versus periphery).

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 examines on the effect of labour market performance on migration by focusing on the certain and uncertain components of the wage rate. The model assumes that there are two locations, $l = a$ and $l = b$, and that an individual resides currently ($t = 0$) at the present location ($l = a$). At the end of the current time period, he decides whether to move to an alternative location ($l = b$).

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

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

where

$$V_0(l) = E_0\left\lfloor \sum_{t=1}^{T} (1+r)^{-t} U_t(l) \right\rfloor, \tag{2}$$

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, $W_t(l)$, and a set of other personal, household and regional factors, $X_t(l)$, at that moment and place: $U_t(l) = U(W_t(l), X(l))$. The expectation E_0 is taken with respect to information available at $t = 0$ with the rate of time preference, r.

Hence, 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 a dummy variable I, which takes value 1 (migrate), if $I^* > 0$ and, 0 (stay) otherwise. While the costs of migration are not explicitly mentioned in the model, they can be part of $X(l)$.

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

$$W_t(l) = m_t(l) + h_t(l) + e_t(l). \tag{4}$$

The wage norm $m_t(l)$ 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. Thus, it can be viewed as the typical population-

averaged wage of workers with a particular set of personal characteristics. $e_t(l)$ 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. $e_t(l)$ obscures the value of $h_t(l)$, which is a person-specific productivity factor driven by talent and personality features. $h_t(l)$ may drift over time depending on local labour market conditions as the demand for such qualities shifts.
The model assumes that an individual bases his prediction of $h_t(a)$, denoted by $\hat{h}_t(a)$, on the past observations of his personal productivity.[4] For the new location, he has no such observations. However, it is assumed that his prediction of $h_t(b)$, denoted by $\hat{h}_t(b)$, is formed on the basis of a correlation with $h_t(a)$. For illustration, suppose that $h_t(a)$ and $h_t(b)$ are jointly normally distributed with mean 0, variance s_l^2 (l = a, b) and correlation coefficient r_{ab}. Then the prediction $\hat{h}_t(b)$ equals (see also e.g. Johnston and DiNardo, 1997):

$$\hat{h}(b) = r_{ab}(s_b / s_a)\hat{h}(a)\,. \tag{5}$$

By differentiating (3), we can see that a change in $\hat{h}_t(a)$ induces a change in $\hat{h}_t(b)$, which together affect the utility gain from migration by the amount:

$$\frac{¶ I^*}{¶\hat{h}(a)} = \frac{¶ V_0(W(b), X(b))}{¶ m(b)}\frac{¶\hat{h}(b)}{¶\hat{h}(a)} - \frac{¶ V_0(W(a), X(a))}{¶ m(a)}\,, \tag{6}$$

where $\partial\hat{h}(b)/\partial\hat{h}(a) = r_{ab}(s_b / s_a)$ in our example.

Suppose that we can estimate the impact of person-specific productivity on migration, $¶ I^*/¶\hat{h}(a)$, from our data, and that we are willing to make realistic assumptions that the standard deviations, s_a and s_b, and the marginal utilities, $¶ V_0(a)/¶m(a)$ and $¶ V_0(b)/¶m(b)$, are positive. What can we then say about the correlation between origin and destination productivity, r_{ab}?

First, suppose that we were to observe that an increase in the person-specific productivity reduces propensity to move ($¶ I^*/¶\hat{h}(a) < 0$). In this case the Equation (6) implies that r_{ab} is smaller than (s_a / s_b) $[¶ V_0(a)/¶m(a)]$ / $[¶ V_0(b)/¶m(b)]$. Hence, we can deduce that the correlation between the person-specific productivity in the origin and destination can be either positive, zero or even negative (i.e. undetermined).[5] Second, suppose that we were to find that $¶ I^*/¶\hat{h}(a) = 0$, that is, a deviation from the norm does not influence migration decision. Then the correlation r_{ab} is equal to (s_a / s_b) $[¶ V_0(a)/¶m(a)]$ / $[¶ V_0(b)/¶m(b)]$ and we can conclude that the correlation between the personal-

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[4] See Vijverberg (1993) for more details on the prediction.

[5] However, if we were to know more about the marginal utilities and standard deviations, we could say more about the correlation between origin and destination productivity (cf. Vijverberg, 1993).

specific productivity in the origin and destination regions must be positive. Finally, suppose that we were to find that $\partial I^*/\partial\hat{\eta}(a) > 0$. Then the ρ_{ab} is greater than $(\sigma_a/\sigma_b)\,[\partial V_0(a)/\partial\mu(a)]\;/\;[\partial V_0(b)/\partial\mu(b)]$. Thus, the correlation between the personal-specific productivity in the origin and destination regions must be positive (and is likely to be strongly positive).[6] In sum, the three cases imply that a necessary condition for an increase in the local $\eta_t(a)$ to lead into a greater likelihood of migration is that a positive correlation exists between the personal-specific productivity in the origin and destination regions. If a positive correlation exists, also an increase in $\eta_t(b)$ makes migration more attractive, everything else being equal.

Let us finish with a discussion of 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. For example, if education raises the productivity of labour in growth-centre regions more than in peripheral regions, then highly skilled and educated people may find it difficult to accept jobs in peripheral regions and migration becomes more likely. Though, an individual may not be able to take advantage of the improved wage norm of another region due to family ties (Mincer, 1978). 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). Thus, the wage norm may have a negative or positive effect on migration; Vijverberg found a negative association. Based on the Vijverberg's results, it is also expected that the total wage, as the sum of the norm and deviation, has an indeterminate impact on the migration behaviour (see also Tervo, 2000; Ritsilä and Ovaskainen, 2001).

3 Data and empirical model

The impact of labour market performance on interregional migration is examined 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, past

[6] This final case corresponds to Vijverberg's (1993) empirical observations on Côte d'Ivoire.

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 16 and 65 who belonged to the labour force in 1994 (i.e. were employed or unemployed). 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 sample. After these restrictions and omitting observations with missing information we are left with 18,945 individuals, of whom 499 persons (2.63 percent) migrated in 1995. Here, the definition of migration involves a change of residence from one subregion to another at the NUTS4 level.[9]

However, labour market behaviour is not likely to be the same for all members of the sample. Therefore, the analysis is conducted separately for males and females living in the peripheral and 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 the results between different groups of people.[10]

The operational classification of growth-centre 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.[11] The growth-centre regions - Helsinki, Porvoo, Salo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu - are also characterised by high wage levels.[12] The other 75 subregions are mostly peripheral and stagnating regions, although, in Finnish terms, they include some bigger towns (Lappeenranta, Rovaniemi).

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[7] One limitation of the data set is that it does not allow us to use households as the unit of analysis. However, we do have wide range of household variables, which should adequately control for dependencies in the 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 considerably lower compared to situation at present (see e.g. Pekkala, 2000, p. 18).

[9] We used data from 84 subregions (see also Figure 1). 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] Approximate likelihood ratio tests (Ben-Akiva and Lerman, 1985) for this labour market segmentation were employed and they lend support to the sample split (see also Appendix, Table A1).

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

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

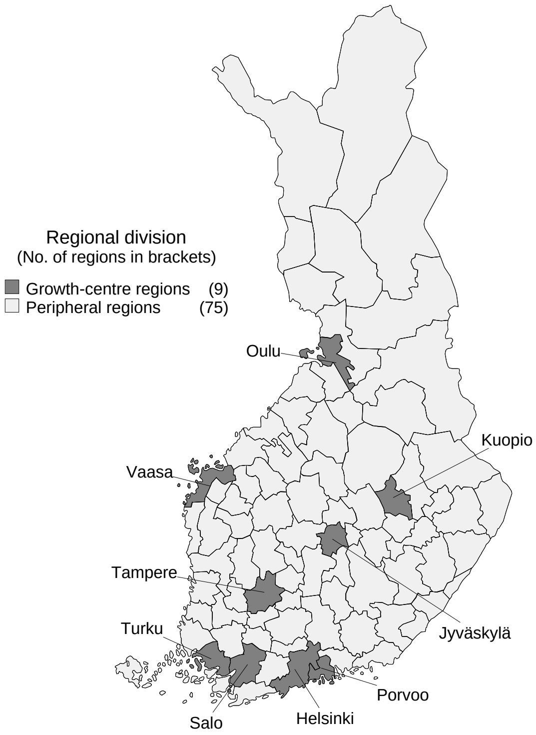

FIGURE 1 Regional division into growth-centre and peripheral regions

In this paper, the labour market performance is measured with the annual wage income from labour. In our sample, 16,842 individuals (88.90 percent) had positive wages. Of these wage earners, 2.38 percent migrated in 1995, which is less than the average of the whole sample.[13] 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 held 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 for each subsample is specified as:

$$\ln W = d\,'X_w + e_w, \tag{7}$$

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

$$J^* = g\,'X_a + e_a. \tag{8}$$

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

[13] 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).

corrected log-wage regression is estimated with maximum likelihood (Appendix, Table A2; see also Heckman, 1979; Heckman and Honoré, 1990; Puhani, 2000). The explanatory variables in the log-wage equations include, for example, age, education and work experience. The explanatory variables in the activity choice equations include also additional household variables, such as marital status and spouse's months of employment. The non-linear specification and these exclusion restrictions operate in favour of the model identification.[14] Further details on the explanatory variables are presented in Appendix (see Table A1).

The estimation results of the selectivity-corrected log-wage regressions are given in Appendix (Table A2). Likelihood ratio tests indicate that the estimated negative correlation between the disturbances of wage equation and activity choice equation is significantly different from zero in all subsamples.[15] 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]

$$\textit{wage-p} = \exp(\hat{d}\,'X_w + \hat{s}^{\,2}/2) \tag{9}$$

$$\textit{wage-r} = (\ln W - \hat{d}\,'X_w)\,/\,\hat{s}\ , \tag{10}$$

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

Figure 2 illustrates the distributions of these labour market performance measures, together with the actual wage income, for each subsample.[17] They are calculated for those engaged in wage employment in 1994, because only for them we can calculate the deviation from the wage norm. The earnings densities of males and females are clearly different: the wage income of males is larger and more dispersed than that of females in both growth-centre and peripheral regions. The densities for the growth-centre and peripheral residents also exhibit some dissimilarity. In the distributions of predicted wages the general patterns resemble the figures for actual wage income. As expected, the densities for the standardised residual terms appear similar.

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[14] The model is identified by the exclusion restrictions so long as X_a contain at least one independent variable, not in X_w, that affects the activity choice but not the wage determination (see e.g. Maddala, 1983).

[15] The selectivity parameter is estimated to be negative in all samples (see Appendix, Table A2). However, the precise interpretation of its sign 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, p. 117).

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

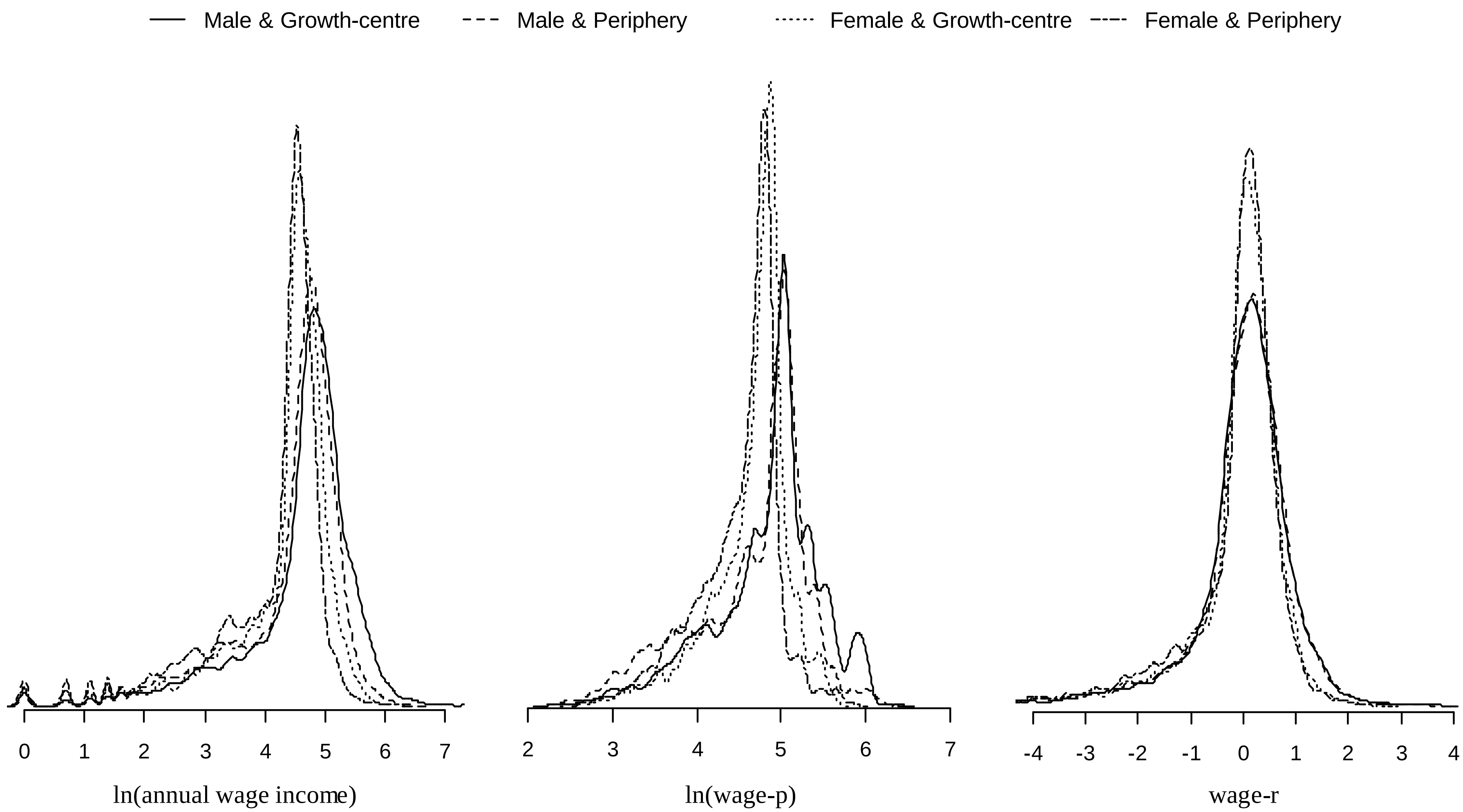

FIGURE 2 Density estimates by gender and region of origin

Table 1 presents a comparison between migrants and stayers for the labour market performance measures. The table shows that the migrants earned significantly lower wages than the stayers in all subsamples; see, for example, the very low wages of females in the peripheral regions. The results hold for predicted wages. Note, however, that the average wage norm exceeds the average wage by a substantial margin in every subsample (see also Figure 2). This is because *wage-p* is calculated from $\hat{d}'X_w$ through a transformation, and because the selectivity parameter (so called lambda) is negative in all subsamples, being smallest (largest) in absolute value for females (males) living in the peripheral regions (see Appendix, Table A2).[18] The table also clearly shows gender differences in the *wage-r*. The deviations from the wage norm are, on average, larger for women than for men.

TABLE 1 Descriptive statistics by gender and region of origin - mean (std. dev.)

Variable	Periphery				Growth-centre			
	Stayers		Migrants		Stayers		Migrants	
Males	N = 4,195		N = 138		N = 3,933		N = 83	
wage	106.134	(66.350)	86.833	(67.375)	132.706	(97.546)	89.675	(64.722)
wage-p	126.408	(70.498)	90.677	(71.626)	150.066	(83.041)	100.828	(62.374)
wage-r	-0.020	(0.994)	0.128	(1.152)	-0.020	(0.998)	-0.001	(1.018)
Females	N = 3,947		N = 111		N = 4,367		N = 68	
wage	79.299	(45.195)	53.757	(47.283)	94.683	(51.471)	71.279	(52.288)
wage-p	101.743	(41.899)	74.259	(53.377)	115.187	(43.372)	86.270	(42.125)
wage-r	-0.143	(0.926)	-0.400	(1.057)	-0.104	(0.939)	-0.404	(1.240)

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 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 1,000 Finnish Marks.

Finally, the migration decision is specified with an index variable, I^*:

$$I^* = b'X_m + e_m, \qquad (11)$$

where an individual migrates in 1995, if $I^* \geq 0$, and stays, if $I^* < 0$. X_m is a vector of explanatory variables that have previously been found to affect migration (see e.g. Greenwood, 1997; and Equation (3)). That is, the migration decision is modelled as a function of personal and family characteristics, such as age, education, children and spouse’s labour market status, and the labour market performance measures discussed above.

[18] 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).

To control for a possible self-selection, the migration decision is also estimated together with the activity choice of engaging in wage employment in 1994; see 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, e_m is integrated out for non-participants by estimating a bivariate probit model with sample selection (see e.g. van de Ven and van Praag, 1981). Furthermore, a multiplicative heteroskedasticity is introduced to the error variances, because uncorrected departures from homoskedasticity can bias the estimated parameters and standard errors in non-linear models (see e.g. Godfrey, 1988).

4 Estimates of the determinants of migration

The parameter estimates of the migration equation are given for males in Table 2 and for females in Table 3. In both tables, columns 1 and 2 and columns 3 and 4 show the results for individuals living in the peripheral and the growth-centre regions, respectively. First a simple wage specification is given, where the migration decision is influenced by the annual wage prior to migration; see columns 1 and 3. Components of the labour market performance measures were then added; see columns 2 and 4. Only the preferred model specification is reported.

The significance of the heteroskedasticity correction term, based on age of the individual, was tested with the likelihood ratio (LR) statistics (Tables 2 and 3). The results imply that we did not find much heteroskedasticity in the migration equations: only for males living in the peripheral regions did an inclusion of the variable error variance term improve the fit of the model (see Table 2). Normality of the error terms was tested in the reported models. Our results from the RESET tests suggest that the assumption of the normal distribution of the error terms cannot be rejected at the 5% significance level, expect for males living in the growth-centre regions. Finally, Wald tests were conducted in order to test for self-selection.[19] The reported statistics show that, at the 5% significance level, no evidence in favour of self-selection was found. Hence, for simplicity, we have only reported results of the univariate probit models.

[19] The Wald test examines the significance of the error correlation in a bivariate probit model of migration and activity choice (see Section 4). The migration equation was specified as in the Tables 2 and 3 (including heteroskedasticity), while the activity choice (selection) equation was specified as in Table A2, Appendix (homoskedastic).

TABLE 2 Determinants of migration for *males* by region of origin

	Periphery				Growth-centre			
Variable	(1)		(2)		(3)		(4)	
Constant	0.396	(0.883)	0.448	(0.975)	-1.025**	(0.366)	-1.138**	(0.390)
Age/10	-1.538**	(0.535)	-1.562**	(0.57)	-0.235**	(0.064)	-0.210**	(0.068)
Lower secondary education	0.110	(0.262)	0.104	(0.265)	-0.120	(0.143)	-0.107	(0.144)
Upper secondary education	0.612*	(0.288)	0.615*	(0.291)	-0.025	(0.143)	0.006	(0.146)
Lower academic degree	0.728	(0.381)	0.738	(0.384)	0.013	(0.187)	0.053	(0.192)
Higher academic degree	1.188*	(0.518)	1.241*	(0.521)	0.013	(0.200)	0.121	(0.225)
# Children under age 7	-0.203	(0.158)	-0.205	(0.162)	-0.117	(0.087)	-0.100	(0.088)
School-aged children	-1.548**	(0.468)	-1.552**	(0.482)	-0.204	(0.143)	-0.193	(0.144)
Married	-0.420	(0.279)	-0.419	(0.283)	0.109	(0.141)	0.091	(0.141)
Spouse is working	0.326	(0.374)	0.344	(0.383)	-0.580**	(0.170)	-0.584**	(0.171)
Spouse's income	-0.112*	(0.054)	-0.117*	(0.058)	0.033*	(0.014)	0.037*	(0.015)
Spouse has higher academic degree	0.456	(0.420)	0.477	(0.425)	-0.089	(0.175)	-0.087	(0.175)
Homeowner	-0.550*	(0.215)	-0.558*	(0.221)	-0.101	(0.106)	-0.099	(0.106)
Employed during the last week of 1994	0.895**	(0.330)	0.886**	(0.336)	0.000	(0.192)	-0.044	(0.196)
(·)*Commuting	1.172**	(0.290)	1.187**	(0.299)	0.238	(0.164)	0.235	(0.164)
# Migrat. events in 90-94	0.715**	(0.178)	0.736**	(0.184)	0.364**	(0.082)	0.352**	(0.082)
# Months of employment	-0.044	(0.036)	-0.041	(0.038)	-0.003	(0.023)	0.008	(0.025)
(Annual wage income)*10^{-4}	0.288	(0.215)			-0.043	(0.086)		
(*wage-p*)/10			0.175	(0.234)			-0.128	(0.118)
wage-r			0.114	(0.092)			0.046	(0.049)
Reg. of origin is Helsinki					-0.164	(0.103)	-0.152	(0.104)
Variance function								
Age/10	0.235**	(0.054)	0.240**	(0.055)				
Diagnostics:								
Log-likelihood	-480.77		-480.76		-352.83		-351.76	
LR test for heteroskedasticity	11.173**		10.940**		0.296		0.567	
RESET test for normality	5.136		5.835		7.002*		6.534*	
Wald test for select. bias	0.035		0.124		0.397		2.927	
Number of observations	4,333				4,016			

Notes: See also notes in Table A1. First the parameter estimates of univariate probit models are given, followed by the asymptotic standard errors in parentheses. Dependent variable is *migrate in 1995*. In the LR test for heteroskedasticity the variance of the error term is a function of age. In columns 3 and 4 the preferred model is homoskedastic. The RESET test for normality of error terms tests the joint significance of two expansion terms (see Pagan and Vella, 1989, p. 43). * (**) = statistically significant at the 0.05 (0.01) level.

TABLE 3 Determinants of migration for *females* by region of origin

	Periphery				Growth-centre			
Variable	(1)		(2)		(3)		(4)	
Constant	-0.507	(0.303)	-0.419	(0.331)	-1.090**	(0.372)	-1.290**	(0.408)
Age/10	-0.288**	(0.064)	-0.341**	(0.075)	-0.219**	(0.064)	-0.190*	(0.078)
Lower secondary education	-0.319*	(0.159)	-0.348*	(0.161)	-0.150	(0.157)	-0.136	(0.158)
Upper secondary education	-0.006	(0.152)	-0.047	(0.155)	-0.183	(0.156)	-0.163	(0.158)
Lower academic degree	0.301	(0.174)	0.223	(0.183)	-0.020	(0.185)	0.031	(0.197)
Higher academic degree	0.649**	(0.236)	0.428	(0.286)	0.101	(0.218)	0.200	(0.263)
# Children under age 7	-0.138	(0.096)	-0.134	(0.096)	-0.068	(0.102)	-0.082	(0.104)
School-aged children	-0.348*	(0.138)	-0.361**	(0.139)	-0.234	(0.147)	-0.230	(0.148)
Married	-0.121	(0.143)	-0.120	(0.144)	-0.082	(0.152)	-0.081	(0.152)
Spouse is working	-0.126	(0.173)	-0.116	(0.173)	-0.234	(0.188)	-0.223	(0.189)
Spouse's income	-0.027*	(0.014)	-0.029*	(0.014)	0.005	(0.011)	0.005	(0.011)
Spouse has higher academic degree	0.646**	(0.181)	0.654**	(0.181)	-0.170	(0.210)	-0.180	(0.211)
Homeowner	-0.215*	(0.106)	-0.229*	(0.107)	-0.139	(0.113)	-0.135	(0.113)
Employed during the last week of 1994	0.453**	(0.171)	0.437*	(0.171)	0.311	(0.238)	0.389	(0.240)
(·)*Commuting	0.341*	(0.139)	0.346*	(0.138)	0.402*	(0.191)	0.404*	(0.191)
# Migrat. events in 90-94	0.311**	(0.075)	0.314**	(0.075)	0.260**	(0.093)	0.251**	(0.094)
# Months of employment	-0.030	(0.017)	-0.041*	(0.02)	-0.012	(0.020)	-0.002	(0.025)
(Annual wage income)*10^{-4}	-0.316*	(0.147)			-0.062	(0.142)		
(*wage-p*)/10			0.023	(0.195)			-0.182	(0.248)
wage-r			-0.109*	(0.048)			-0.062	(0.049)
Reg. of origin is Helsinki					-0.307**	(0.111)	-0.290*	(0.114)
Variance function								
Age/10								
Diagnostics:								
Log-likelihood	-371.99		-371.83		-307.28		-306.37	
LR test for heteroskedasticity	0.882		0.104		0.760		0.156	
RESET test for normality	1.623		0.853		1.186		1.405	
Wald test for select. bias	0.129		0.291		0.327		1.889	
Number of observations	4,058				4,435			

Notes: See notes in Table A1. First the parameter estimates of univariate probit models are given, followed by the asymptotic standard errors in parentheses. Dependent variable is *migrate in 1995*. In the LR test for heteroskedasticity the variance of the error term is a function of age. In all columns (1-4) the preferred model is homoskedastic. The RESET test for normality of error terms tests the joint significance of two expansion terms (see Pagan and Vella, 1989, p. 43). * (**) = statistically significant at the 0.05 (0.01) level.

Before considering the impact of labour market performance on the migration decision, we briefly present the results for the other significant explanatory variables. As expected, age has strong negative effect on the propensity to move in all subsamples. For people living in the peripheral regions, 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 the peripheral regions. Likelihood of migration is also increased significantly if the individual has previous migration experience.

The presence of school-aged children or owning a house reduces individual's willingness to migrate for those living in the peripheral regions (Tables 2 and 3). Commuters show high propensity to move, except for males living in the growth-centre regions. The effect of commuting is greatest for males living in the peripheral regions. This is plausible since most migrants in Finland move from peripheral regions to growth-centre regions, where the employment situation is better. Hence, commuting can be seen as a state preceding migration.

Turning to the labour market performance measures, first, a decrease in observed wages in the region of origin does not seem to have any effect on the probability of migration (see columns 1 and 3, Tables 2 and 3). This result is in line with previous studies done with Finnish data (see e.g. Tervo, 2000; Ritsilä and Ovaskainen, 2001) and our prior expectations based on the Vijverberg's (1993) theoretical model and empirical findings. Females living in the peripheral regions are an exception: an increase in wages significantly reduces their propensity to move. Thus, it indicates that economic welfare influences their migration decisions.

Second, a wage norm does not have a significant impact on the likelihood of migration in any of the four subsamples (see columns 2 and 4, Tables 2 and 3).[20] This result is contrary to Vijverberg's findings on a developing country, which suggested a significant negative effect. Though, support for this result can be found from the discussion in Section 2.

Finally, for males, a positive deviation from the wage norm does not significantly enhance the likelihood of migration (Table 2). For females living in the growth-centre regions, the parameter estimate of the person-specific productivity factor is also insignificant, but now negative (Table 3). However, for females living in the peripheral regions, the parameter estimate is significantly negative: a negative (positive) deviation from the wage norm significantly increases (decreases) the likelihood of migration (Table 3).

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

What do these results tell us about the correlation between the person-specific productivity in the origin and destination locations? The theoretical discussion in Section 2 implies that for males and for females living in the growth-centre regions the correlation is positive. On the other hand, for females living in the peripheral regions, the correlation is left undetermined: it can be either positive, zero or even negative. Hence, the results suggest that, in the peripheral regions, female migrants are less origin-productive than non-migrants in their reference group, but the results do not reveal what is their productivity relative to the wage norm at the destination.

5 Conclusions

This paper examined the impact of labour market performance on interregional migration decisions in Finland. The starting point of the analysis was Vijverberg's (1993) human capital migration model, where an individual's performance is compared with a reference group based on characteristics such as age, education and experience. In our empirical application, the model was estimated separately for males and females originally living in peripheral and growth-centre regions.

Our results show, firstly, that an increase in the actual wages in the region of origin does not seem to have any effect on the likelihood of migration, apart from females living in peripheral regions whose propensity to move is decreased. Secondly, the wage norm does not have a significant impact on the likelihood of migration in any of the subsamples. Finally, person-specific productivity has hardly any impact on the likelihood of migration, apart from females living in the peripheral regions: women with the poorest performance, relative to a reference group, decide to move. Hence, our results imply that peripheral regions are not necessarily losing their more productive workers then the performance is compared with a reference group. This is 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 activity have been concentrating into the growth-centre regions in Finland. Policies are planned to slow down migration from the peripheral and stagnating regions into the central and prosperous regions. Our results suggest that such policies may not have a desired effect on the economy as a whole since the labour market performance of an individual can improve due to migration.

Appendix

TABLE A1 Descriptive statistics by migration and activity status - mean (std.dev.)

	Men				Women			
Variable	Periphery		Growth-centre		Periphery		Growth-centre	
Annual wage > 0 in 1994	0.864	(0.342)	0.890	(0.313)	0.882	(0.322)	0.920	(0.271)
Migrate in 1995	0.036	(0.185)	0.020	(0.141)	0.032	(0.175)	0.017	(0.131)
Annual wage (1,000)	9.121	(7.158)	11.730	(10.052)	6.935	(4.963)	8.679	(5.576)
Age	38.388	(10.713)	38.106	(10.528)	39.714	(10.722)	39.121	(10.856)
(Age/10) squared	15.884	(8.310)	15.628	(8.261)	16.922	(8.529)	16.483	(8.555)
Primary school education	0.329	(0.470)	0.265	(0.442)	0.294	(0.456)	0.287	(0.452)
Lower secondary education	0.390	(0.488)	0.285	(0.452)	0.366	(0.482)	0.246	(0.431)
Upper secondary education	0.172	(0.378)	0.231	(0.421)	0.221	(0.415)	0.260	(0.439)
Lower academic degree	0.070	(0.256)	0.101	(0.302)	0.090	(0.286)	0.126	(0.331)
Higher academic degree	0.038	(0.192)	0.117	(0.322)	0.030	(0.169)	0.081	(0.273)
# Children under age 7	0.289	(0.658)	0.309	(0.657)	0.255	(0.574)	0.262	(0.593)
School-aged children	0.306	(0.461)	0.264	(0.441)	0.377	(0.485)	0.297	(0.457)
Married	0.657	(0.475)	0.688	(0.464)	0.806	(0.396)	0.750	(0.433)
Spouse's wage (10,000)	3.727	(4.931)	4.991	(6.014)	6.192	(7.770)	7.251	(9.729)
Spouse is working	0.420	(0.494)	0.476	(0.499)	0.511	(0.500)	0.491	(0.500)
# Spouse's months of employment	4.607	(5.498)	5.414	(5.633)	5.886	(5.659)	5.673	(5.727)
Spouse has higher academic degree	0.077	(0.266)	0.153	(0.360)	0.085	(0.279)	0.138	(0.344)
Homeowner	0.736	(0.441)	0.645	(0.478)	0.747	(0.435)	0.666	(0.472)
# Months of employment	11.142	(2.242)	11.386	(1.881)	10.860	(2.601)	11.072	(2.432)
Employed during the last week of 1994	0.713	(0.452)	0.774	(0.418)	0.744	(0.437)	0.833	(0.373)
(·)*Commuting	0.418	(0.493)	0.289	(0.453)	0.335	(0.472)	0.204	(0.403)
# Migration events in 90-94	0.133	(0.439)	0.130	(0.411)	0.139	(0.435)	0.127	(0.399)
Work experience	6.220	(2.589)	6.452	(2.387)	5.986	(2.683)	6.356	(2.454)
Work experience squared	45.392	(25.745)	47.317	(24.527)	43.028	(26.406)	46.417	(24.809)
Reg. of origin is Helsinki	n/a		0.507	(0.500)	n/a		0.529	(0.499)
Number of observations	5,013		4,513		4,599		4,820	

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. Wage measures are in Finnish Marks (FIM). (·) = Employed in the last week of 1994.

TABLE A2 Maximum likelihood estimates (Heckman selection model)

Variable	Men: Periphery		Men: Growth-centre		Women: Periphery		Women: Growth-centre	
Wage equation:								
Constant	2.323**	(0.171)	2.021**	(0.166)	0.061**	(0.009)	1.473**	(0.147)
Age	-0.019	(0.010)	-0.007	(0.009)	-0.068**	(0.011)	0.061**	(0.008)
(Age/10) squared	0.017	(0.012)	0.012	(0.011)	0.078*	(0.032)	-0.066**	(0.010)
Lower secondary education	0.099**	(0.029)	0.100**	(0.031)	0.178**	(0.037)	0.054	(0.031)
Upper secondary education	0.322**	(0.036)	0.323**	(0.033)	0.460**	(0.048)	0.120**	(0.031)
Lower academic degree	0.528**	(0.048)	0.524**	(0.041)	0.885**	(0.074)	0.317**	(0.038)
Higher academic degree	0.930**	(0.062)	0.899**	(0.040)	0.057**	(0.005)	0.649**	(0.045)
# Months of employment	0.076**	(0.007)	0.103**	(0.007)	0.074**	(0.023)	0.069**	(0.005)
Work experience	0.070**	(0.027)	0.062*	(0.026)	0.005*	(0.002)	0.093**	(0.023)
Work experience squared	0.018**	(0.002)	0.014**	(0.002)	-0.041	(0.023)	0.001	(0.002)
# Children under age 7	-0.007	(0.018)	0.010	(0.017)	0.005**	(0.002)	-0.106**	(0.020)
Spouse's income	0.015**	(0.003)	0.008**	(0.002)	1.437**	(0.165)	0.003*	(0.001)
Reg. of origin is Helsinki			0.050*	(0.022)			0.077**	(0.022)
Selection equation:								
Constant	0.911**	(0.283)	2.087**	(0.339)	1.161**	(0.290)	1.070**	(0.300)
Age	-0.045*	(0.017)	-0.107**	(0.020)	-0.048**	(0.017)	-0.042*	(0.018)
(Age/10) squared	0.014	(0.022)	0.081**	(0.026)	0.041*	(0.021)	0.034	(0.022)
Lower secondary education	0.129*	(0.062)	0.197*	(0.077)	0.287**	(0.062)	0.357**	(0.072)
Upper secondary education	0.437**	(0.085)	0.461**	(0.083)	0.427**	(0.077)	0.490**	(0.077)
Lower academic degree	0.628**	(0.132)	0.790**	(0.135)	0.996**	(0.123)	0.924**	(0.117)
Higher academic degree	1.163**	(0.241)	1.431**	(0.189)	1.349**	(0.277)	1.384**	(0.176)
Work experience	0.089*	(0.043)	0.002	(0.051)	0.126**	(0.038)	0.139**	(0.042)
Work experience squared	0.025**	(0.005)	0.037**	(0.005)	0.004	(0.004)	0.003	(0.005)
Married	0.013	(0.076)	0.349**	(0.094)	-0.032	(0.068)	-0.072	(0.069)
# Children under age 7	0.101	(0.059)	0.049	(0.071)	-0.038	(0.046)	-0.070	(0.046)
Spouse's income	0.042**	(0.013)	0.009	(0.012)	0.017**	(0.005)	-0.003	(0.004)
# Spouse's months of employment	0.003	(0.011)	0.003	(0.012)	0.003	(0.006)	0.025**	(0.007)
Region of origin is Helsinki			-0.061	(0.063)			0.069	(0.055)
Diagnostics:								
Correlation coefficient	-0.087*	(0.047)	-0.142**	(0.061)	-0.841**	(0.027)	-0.874**	(0.021)
Lambda	-0.067*	(0.036)	-0.099**	(0.043)	-0.668**	(0.027)	-0.644**	(0.020)
Log-likelihood	-6,413.52		-5,274.93		-5,754.40		-5,612.31	
Number of observations	5,013		4,513		4,599		4,820	

Notes: Dependent variable in the wage equation is ln(*annual wage*). Dependent variable in the selection equation is *annual wage > 0 in 1994*. See notes in Table A1. * (**) = statistically significant at the 0.05 (0.01) level. Parentheses contain asymptotic standard errors.

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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 seems smaller, the further away from a growth region an individual lives and the younger he is. On the other hand, a fall in expected earnings in the growth regions would have hardly any impact on migration probabilities.

Keywords: migration, expected earnings, nested logit

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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.[1] 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.[2] 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.

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

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

[2] 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.

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).[3] 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, a 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.

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: 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*

[3] 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.

McFadden, 1973; 1981; 1984; Ben-Akiva and Lehman, 1985).[4] 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:

$$U_j = a'_j w_j + b'_j x_j + e_j, \quad j = 1, 2, 3 \tag{1}$$

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 a and b'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.[5]

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 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 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:

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

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

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[4] 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, p. 122). See Ben-Akiva and Lehman (1985, pp. 35–38) and Pudney for other examples.

[5] 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, pp. 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.

equations is equal to the number of migration alternatives. We will assume that the marginal distributions of v_j are normal, $N(0, s^2)$.

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:

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

where y_j are the explanatory variables from z and x_j with estimated parameters w_j. P_j denote the probability of choosing alternative j. The model assumes that e_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).[6]

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

$$\ln w_j = g_j' z - s_j r_j [f(J(P_j))/P_j] + x_j \tag{4}$$

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

We use the estimates of the MNL model to calculate choice probabilities and to form the sample selection correction variables $f(J(P_j))/P_j$ for each observation. Then we estimate equation (4) by OLS. This last step gives us consistent estimates of g_j and $s_j r_j$. Non-zero estimates of $s_j r_j$'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 migration choice model by nested logit. Hence, we obtain estimates of a_j and b_j.

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

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

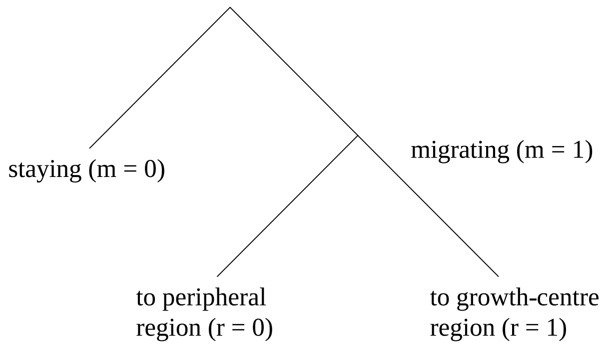

FIGURE 1 The structure of the nested logit migration model

We formulate the 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 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 and Wen, 1998, for discussion). To simplify the notation let the utility of alternative *r* in nest *m* be

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

where $V_{rm} = a'_{rm} w_{rm} + b'_{rm} x_{rm}$ denotes the deterministic component of utility and e_{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 e_{rm} has the GEV distribution, we obtain the nested logit model:

$$P_{r|m} = \frac{\exp(V_{rm}/m_m)}{\sum_{j \in R_m} \exp(V_{jm}/m_m)} = \frac{\exp(V_{rm}/m_m)}{\exp(I_m)}, \tag{6}$$

$$P_m = \frac{\exp(m_m I_m)}{\sum_k \exp(m_k I_k)}, \text{ and } I_m = \ln\left(\sum_{j \in R_m} \exp(V_{jm}/m_m)\right)$$

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.[7] I_m is termed the inclusive value of alternative *m* at level 1 and its parameter m_m is termed the inclusive value parameter. Thus, V_m, the utility of nest *m*, is equal to $m_m I_m$. If $m_m = 1$ 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 m_0 has to be normalised equal to one.

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 nested logit migration model with predicted earnings entering as additional explanatory variables.[8]

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.[9] 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' region of residence at the NUTS4 subregion level is especially useful for this study.[10] The place-of-residence data allow us to determine the individual's subregion of

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

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

[9] 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.

[10] We used data from 84 subregions. The estimation sample individuals from the subregion of Åland have been excluded, as they have many distinctive characteristics (for example self-regulation, isolated geographical location, a Swedish-speaking majority).

origin and the region to where he migrates. Here, the definition of migration involves a change of residence from one subregion to another at the NUTS4 level.

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 that only few regions experienced positive net migration in 1995. Comparison of Figures 2 and 3 indicate that the destination choices of migrants have often been the already more populated areas of Finland. Hence, 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 - Helsinki, Porvoo, Salo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu - are also characterised by high wage levels and generally lower unemployment rates (see Figures 4 and 5). The other 75 subregions are mostly peripheral and stagnating regions, although, in Finnish terms, they include some bigger towns (Lappeenranta, Rovaniemi).

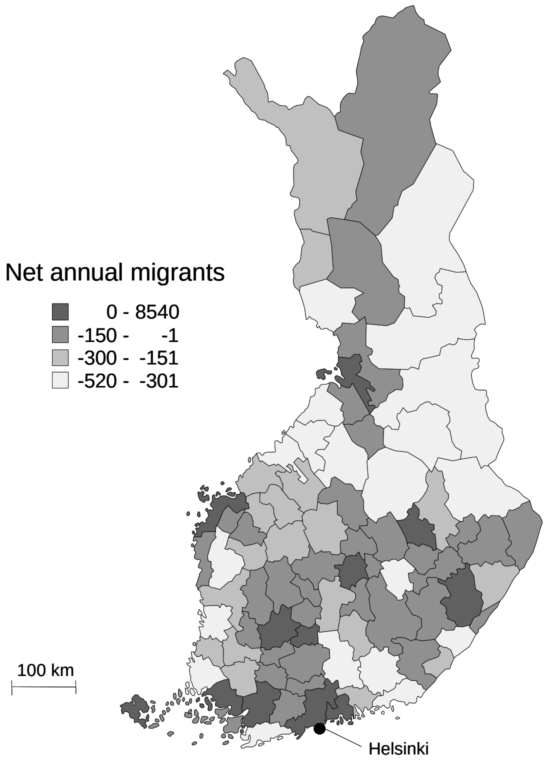

FIGURE 2 Net annual migrants, 1995

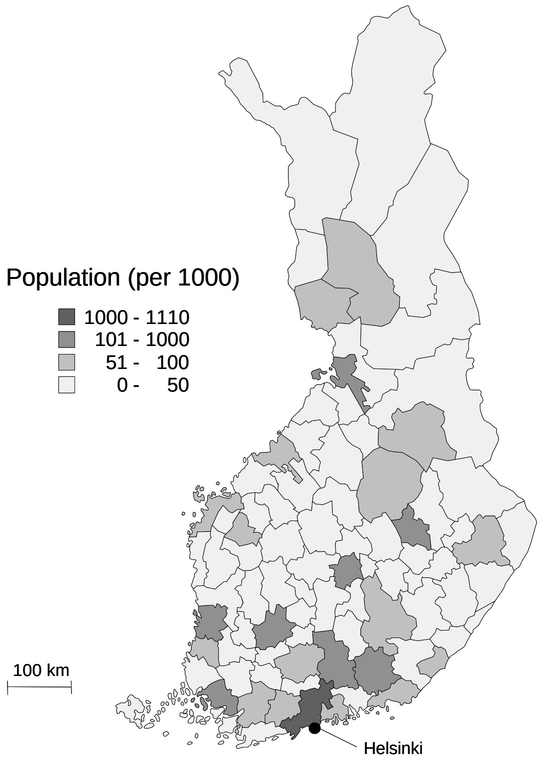

FIGURE 3 Population, 1995

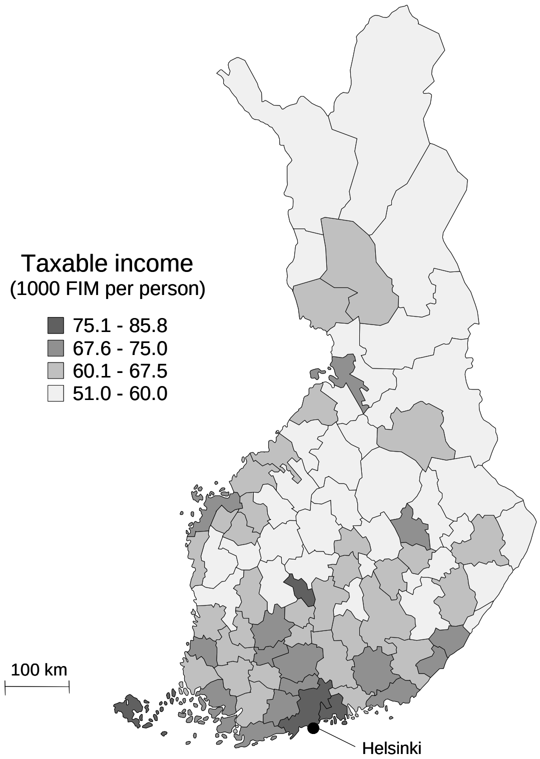

FIGURE 4 Annual household income

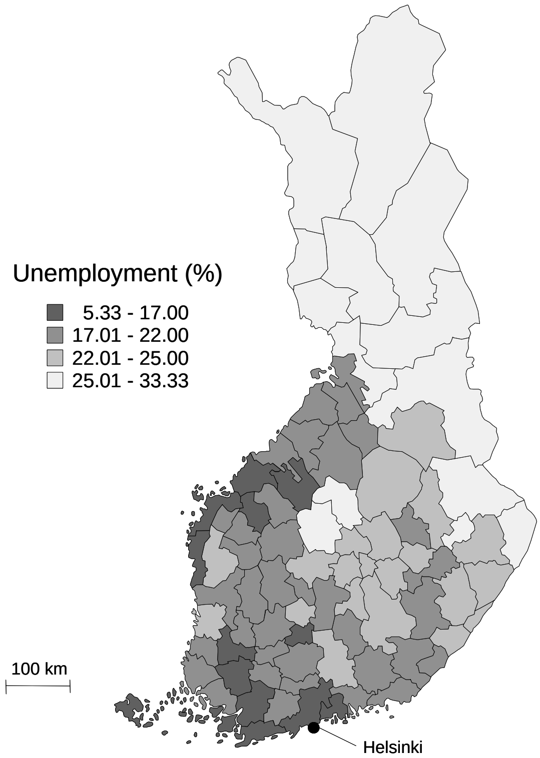

FIGURE 5 Unemployment rate, 1995

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 labour force (see Vijverberg, 1993).[11]

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 counterparts (see e.g. Linneman and Graves, 1983; Schaeffer, 1985; Kettunen,

[11] 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 very complicated model (see Vijverberg, 1995). Instead, we decided to concentrate on individuals with positive earnings.

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.[12] 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.[13] A similar pattern holds for individuals who have obtained their last educational qualification during 1993–1994.

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)
# 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 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.

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

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

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. 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.[14] 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).

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.[15] The distribution of the earnings for migrants is more dispersed, while the autocorrelation in 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.

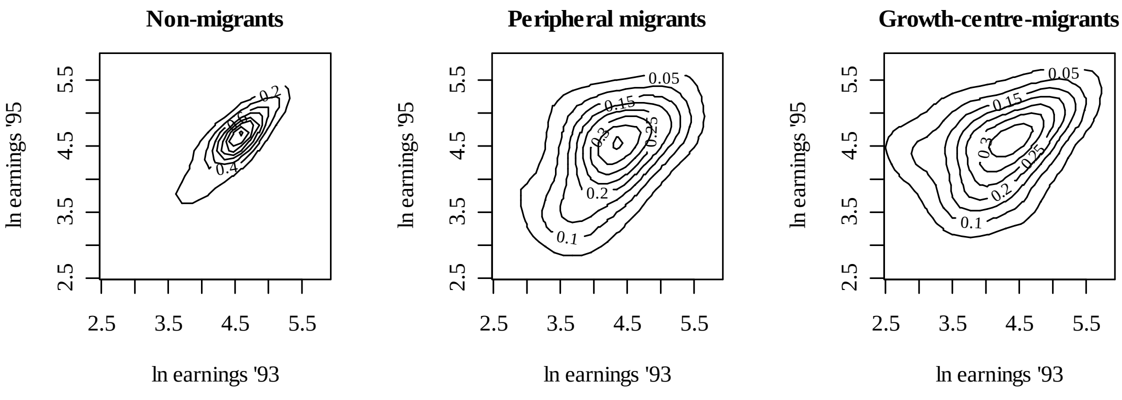

FIGURE 6 Bivariate density of earnings for 18–40-year-olds originally living in the peripheral regions at the end of 1993

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

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

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. The main explanatory variables in the log-earnings equations include sex, age, education and work experience[16]. Thus we assumed that each individual can adequately predict his expected earnings in 1995, conditional on his characteristics at the moment of migration choice. Estimation results of the log-earnings equations are given in Appendix (see Table A1).[17]

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 of other regression coefficients can be ensured. The estimated coefficients for the stayers and growth-centre migrants were negative ($-s_j r_j < 0$, $j = 1, 3$), and for the peripheral migrants positive ($-s_j r_j > 0$, $j = 2$). 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.[18]

The estimated utility function parameters specified in equations (1) and (5), estimated by the multinomial and nested logit models with full information maximum likelihood, are reported in Table 2.[19] 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 a_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. In addition, 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

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

[17] Due to the small number of observations in the migration categories, the selectivity-corrected earnings equations were not estimated for men and women separately.

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

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

likelihood values) and that its independence of irrelevant alternatives - assumption is not rejected.[20]

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, which helps to explain why migration diminishes with age. In addition, younger individuals are expected to have lower psychic 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 parsimonious specification 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.[21] The results 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) and Shields and Shields (1989).

[20] 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).

[21] 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.

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	4,360		85		101		4,360		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.

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 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.

Table 3 reports the elasticities of the estimated probabilities with respect to changes in expected earnings for all three alternatives.[22] 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, p. 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.[23]

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

[23] 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.

To interpret the elasticities, suppose a decision maker in a peripheral region expects, *ceteris paribus*, his expected earnings to increase by 10% in his present region of residence. This would increase the propensity to stay by 1.11% (0.59%) in the nested (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 he were to select the other periphery-region alternative. This would ultimately reduce incentives to stay in the present region. It would increase his 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 he were to migrate to a growth-centre. This would increase his 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 the 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.[24]

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.[25] 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.

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[24] An additional distance variable is also introduced to the model, namely distance to Helsinki.

[25] The test values are $c^2(4) = 9.06$ (p = 0.06) and $c^2(4) = 10.00$ (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 (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 (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	4,360		85		101		4,360		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.[26] 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).

[26] The results for the multinomial logit model are given in the Appendix (Table A2).

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 significantly, but only to a small extent, influenced by expected earnings. For example, an 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 he is. On the other hand, a decrease in expected earnings in growth-centre regions has hardly any impact on migration.

Appendix

TABLE A1 Parameter estimates of the log-earnings equations

Variable	Stayers		Periphery migrants		Growth-centre migrant	
	Sample in the estimation of earnings equation					
Constant	3.856	(0.051)	3.344	(0.424)	4.405	(0.291)
Sex (1 = male)	0.195	(0.014)	-0.140	(0.117)	0.070	(0.092)
Age (10 years)	0.010	(0.013)	-0.043	(0.101)	0.113	(0.129)
Primary school	-0.237	(0.020)	-0.282	(0.174)	-0.301	(0.222)
Lower secondary school	-0.145	(0.017)	-0.445	(0.158)	-0.122	(0.131)
Lower academic degree	0.227	(0.025)	0.241	(0.189)	0.404	(0.130)
Higher academic degree	0.633	(0.033)	0.717	(0.214)	0.293	(0.142)
Work experience	0.024	(0.011)	0.102	(0.030)	0.060	(0.032)
Work experience squared	0.003	(0.001)				
# Children under 7	0.013	(0.009)	0.190	(0.075)	-0.059	(0.075)
Married	0.111	(0.015)	-0.210	(0.142)	-0.053	(0.113)
# Months of employment	0.030	(0.002)	-0.024	(0.015)	0.031	(0.014)
Lambda	-0.623	(0.088)	0.473	(0.212)	-0.396	(0.140)
Number of observations	4,360		85		101	

Notes: First the estimated parameter is given, followed by the asymptotic standard errors in parenthesis. The lambda is computed from a reduced form MNL model discussed in the main text.

TABLE A2 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.

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CHAPTER 4

WHERE DO THE HIGHLY EDUCATED MIGRATE? MICRO-LEVEL EVIDENCE FROM FINLAND*

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Abstract

This paper analyses the role which migration of highly educated labour plays in human capital reallocation. The study focuses on actual migrants, examining the direct effect of educational attainment on destination choices. The paper uses the ordered probability model and a micro-level data set in econometric analyses. Individual level investigations of migrants show that highly educated migrants are likely to move to urban regions. As a result, the reallocation of highly educated labour, and thereby also the redistribution of human capital, seems to be taking place in Finland.

Keywords: human capital, migration, educational attainment, regional development

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1 Introduction

According to migration theories, a number of different forces may affect the movements of labour, and thus, human capital. The individual decision to migrate can be seen as a utility maximising process, which is driven by personal, household and regional factors. One important factor is certainly education. The analysis of the effects of educational attainment on migratory behaviour is quite extensive (see e.g. Molho, 1987; Owen and Green, 1992; Levine, 1996; Antolin and Bover, 1997; Ritsilä and Ovaskainen, 2001). The overall finding of these studies is that educational attainment increases the likelihood of migration. On the other hand, micro-level analyses of destination choices of highly educated migrants are much scarcer and related themes have remained rather untouched (see, however, Kauhanen and Tervo, 2002).

From the viewpoint of human capital allocation, the role of educational attainment on destination choices of migrants is of special interest. As mentioned above, it is generally accepted that educational attainment increases the likelihood of migration. Similarly, it is empirically shown that population tends to concentrate spatially. This study accepts these results, but will show that the impression they give is incomplete because it neglects the possibility that divergent destination choices of highly educated migrants may even strengthen the concentration process. Qualified individuals choosing residential location expect a supply of relevant jobs, as well as interesting educational, cultural and recreational opportunities for themselves and their families. Thus, the location decisions of skilled labour are connected to the infrastructure and production of regions. In a coherent way, the settling of enterprises, services and skilled labour support each other (see e.g. Myrdal, 1957; Hansen, 1992; Camagni, 1995; Ritsilä, 1999).

The aim of this paper is to investigate the extensive role which migration of the highly educated plays in human capital reallocation. For simplicity, this paper assumes that the human capital acquired from schooling is the main factor in the formation of the human capital stock of a person. The empirical analysis focuses on migrants, examining the direct effect of educational attainment on destination choices. Consequently, the approach of this paper is different compared with a number of other studies dealing with the relationship between migration and educational attainment. These studies usually aim to define the effects of educational attainment on the likelihood of migration, without considering the destination of this movement.

The empirical analysis of the paper is based on data from the Finnish Longitudinal Census File. The data set used herein is a sample of inter-municipal migrants in the period from 1994 to 1995, and it includes information on population characteristics such as mobility, economic activity, dwelling conditions, family and district of residence. The analysis focuses on persons of working age. The econometric estimations of the paper are based on the ordered probability model.

The paper is organised as follows. The theoretical background of the paper is outlined in Section 2. Section 3 describes our data and the framework of analysis. The results are presented and discussed in Section 4. Finally, the paper ends with concluding remarks.

2 Migration decisions and human capital redistribution

2.1 Migration as utility maximisation

The analytical setting of this paper is related to human capital framework. The framework is based on the modelling work of Sjaastad (1962), Weiss (1971), Seater (1977) and Schaeffer (1985). Herein, heterogeneous individuals possess different utility functions, and consequently encounter differences in the net benefits of living in a specific location. Migration is supposed to result from variations in individual economic utility in different locations.

An important factor that affects economic utility, and hence the decision making of an individual, is her or his personal human capital reserve. Human capital can be considered as a heterogeneous asset, resulting from formal schooling, training and experience, etc. In addition, human capital can be defined as being of general use, or valuable only in specific tasks. For simplicity, we assume that there are only two types of human capital: one acquired by education (vector *E*), and one gained from other sources (vector *O*).

Formally, an individual *i* is assumed to decide to migrate from location *j* to location *k* under the following utility maximisation process at a present date 0:

$$\mathrm{E}(R_i) = \max_{(E,O)} \left[\int_0^T e^{-rt} \{ U_{ikt}(E_{it}, O_{it}) - U_{ijt}(E_{it}, O_{it}) \} dt - CM_{ijk} \right] \tag{1}$$

under the precondition

$$\int_0^T e^{-rt} (U_{ikt} - U_{ijt}) dt - CM_{ijk} \geq 0,$$

where $\mathrm{E}(R_i)$ is the net present value of expected economic utility of an individual *i*, U_{kt} is the expected utility level achieved in the alternative location *k* at time *t*, U_{jt} is the expected utility achieved by living in the present location *j* at time *t*, and CM_{jk} are the direct costs involved in moving from location *j* to location *k*. The expected utilities U_{kt} and U_{jt}, 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, the positive migration decision is reached when the expected utility gained from moving exceeds the direct costs of moving.

2.2 Reallocation of human capital

The new theories of economic growth emphasise the role of human capital as a prerequisite for economic growth processes (e.g. Lucas, 1988; Romer, 1990; Krugman, 1991; Barro and Sala-i-Martin, 1995). The know-how of population acts as a non-material input for the producers of goods and services, institutes of research and education, trade organisations and local services. Research and development personnel, as well as skilled operative personnel, can be considered as necessary labour input in the process of innovation (see e.g. Davelaar and Nijkamp, 1997; Ritsilä, 2001). As a result, the corporal and mental endowments of regions affect the location decisions of enterprises. Economic activity tends to concentrate geographically, because it generates sizable returns to producers in form of greater productivity (see e.g. Lucas, 1988; Krugman, 1991; Wheeler, 2001).

Usually the geographical concentration of economic activities also implies the concentration of population, as agglomerating firms require large labour pools (Richardson, 1995); Considering potential migrants, qualified personnel choosing residential location expect a supply of relevant positions/posts, as well as interesting educational, cultural and recreational opportunities for themselves and their families. Thus, the accumulation of enterprises, skilled personnel and services support each other, which can create a self-feeding agglomeration process (see e.g. Myrdal, 1957; Hansen, 1992).

As a result of agglomeration benefits, human capital often migrates from where it is scarce to where it is abundant, rather than vice versa (Lucas, 1988). This is in line with the rational decision making process, according to which labour is assumed to move from declining regions of high unemployment to expanding regions with modern and well-paid jobs. From the regional perspective, especially in the case of educated persons, there are significant dynamic gains from inward migration. Highly educated migrants raise the educational level of the region, provide new ideas and encourage investment that embodies new technologies, and so on (see e.g. Nijkamp and Poot, 1997). Hence, migration can lead to regional concentration of human capital, which may have a diverging rather than converging effect on the development of local economies (see e.g. Myrdal, 1957; Nijkamp and Poot, 1997).

3 Data and framework of analysis

The empirical analysis is based on a sample of inter-municipal migrants registered in the Finnish Longitudinal Census data. The sample covers the period from 1994 to 1995, and it contains information, for example, on economic activity, dwelling conditions and the families of individuals. This analysis focuses on persons that were of working age in 1994 (aged 17 to 64). The sample size is 24 904 individuals. The analysis focuses on the destination choices of migrants, and stresses the role of educational attainment in the decision making process.

The use of the unusual framework of analysis (using the data set of actual movers instead of modelling the destination choice of potential migrants) in this study can be rationalised by at least three arguments. First, the simultaneous modelling of moving decisions and choices of destination usually involves a pitfall in estimating the effects of aggregate variables on micro units, i.e. integrating regional and individual level factors into the same econometric models (Moulton and Randholph, 1989; Moulton, 1990).

Second, the procedure used herein makes it possible to treat the destinations as ordered choices of the municipality class. This characteristic is not reached by using, for example, the multinomial logit model in the case of potential migrants. Our model can also yield very interesting and relevant information from the viewpoint of spatial concentration. Third, the analysis of potential migrants often involves the difficulty that the proportion of migrants in the whole population is minor, for which reason the econometric analysis may be problematic.

The dependent variable (*municipality class*) of this analysis has three different ordered classes based on the amount of population and degree of urbanisation of the municipalities of destination:

Y = 2 (Urban)	if the number of population > 50 000 and the level of urbanisation ≥ 90% (N = 10 332)
Y = 1 (Densely populated)	if the number of population > 15 000 or the level of urbanisation ≥ 70%, and the condition of Y = 2 is not valid (N = 9 802)
Y = 0 (Rural)	otherwise (N = 4 770)

This classification of spatial concentration applies the same elements as the Communal Classification of Statistics Finland (1996).

The regional division of classification is presented in Figure 1. Exploiting the municipal moves enables a larger sample size, but the problem of the municipal level sample is that the migrations of the sample include a number of moves that are not labour market based. However, this problem is reduced to some extent by forming a relevant data set (e.g. an individual being of working age) and by using the explanatory variables that control the relevant labour market characteristics (e.g. an individual being a student) of an individual.

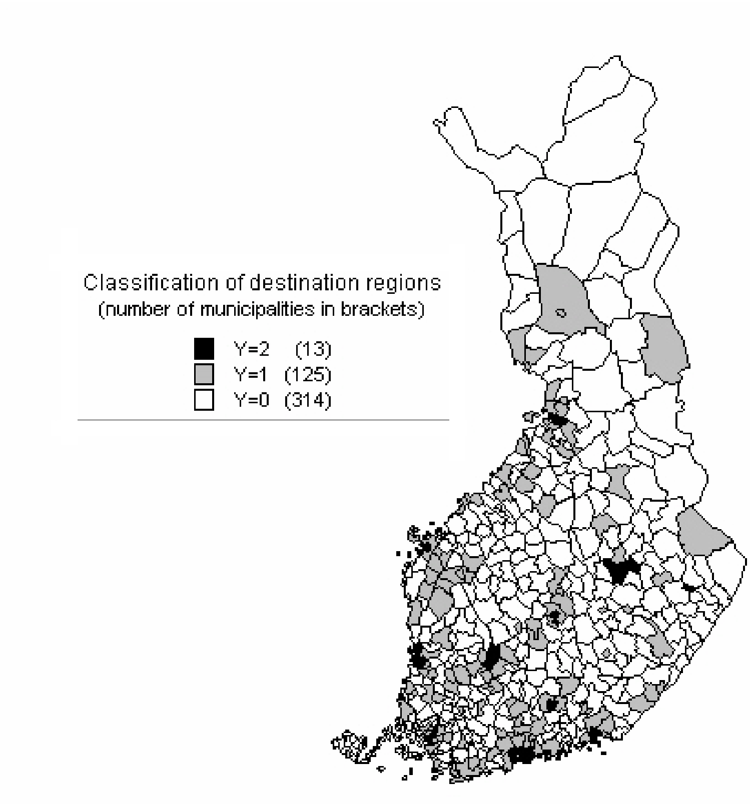

FIGURE 1 Classification of municipalities used in the analysis

The construction of the dependent variable as ordered levels of spatial concentration suggests a use of an ordered probit model (see e.g. Hausman *et al.*, 1992; Greene, 1997; Long, 1997). Thereby, we assume that a migrant *i* chooses her or his destination region y_i (*municipality class*) according to a latent variable y_i^*, which describes the regional level of human capital concentration in the destination region:

$$y_i^* = b' x_i + e_i , \qquad e_i \sim N(0, s_i^2) \tag{2}$$

$$y_i = j \quad \text{if} \quad m_{j-1} < y^* \leq m_j , \qquad j = 0, 1, 2 \tag{3}$$

where xi is a set of explanatory variables, b is a parameter vector and m's are unknown threshold parameters ($m_{-1} = -\infty$ and $m_2 = \infty$). The variance of the error term e_i is assumed to depend on a set of explanatory variables, zj (see e.g. Davidson and MacKinnon, 1984): s_i^2 = [exp(g 'zi)]^2, where g is an additional parameter vector to be estimated with b and m's. This multiplicative heteroskedasticity is introduced into the model, because uncorrected departures from homoskedasticity can bias the estimated parameters and standard errors in non-linear models (Godfrey, 1988).

Given these assumptions, the probability of alternative *j* is

$$\Pr(y_i = j) = \Phi\big((m_j - b'x_i)/\exp(g'z_i)\big) - \Phi\big((m_{j-1} - b'x_i)/\exp(g'z_i)\big), \qquad (4)$$

where $\Phi(.)$ denotes the cumulative distribution function of standard normal. Hence, the appropriate log-likelihood function for the heteroskedastic ordered probit model can be expressed as

$$\log L = \sum_{i=1}^{N}\sum_{j=0}^{2} y_{ij} \log\big[\Phi\big((m_j - ß'x_i)/\exp(g'z_i)\big) - \Phi\big((m_{j-1} - ß'x_i)/\exp(g'z_i)\big)\big], \qquad (5)$$

where y_{ij} = 1 if $y_i = j$ and 0 otherwise (dummy variable). Since the full set of m's is not identified if vector *x* contains a constant, normalisation m_0 = 0 is adopted.

Maximisation of the Equation (5) gives maximum-likelihood estimates of b, g and m_1. The procedure employed to determine the terms included in the heteroskedastic function follows O'Higgins (1994). First, the heteroskedastic ordered probit model was estimated with vector *z* containing all variables in *x* save the constant. Second, the vector *z* was subsequently reduced so as to have the simplest form which, at the same time, was not rejected in a comparison with the more general model. Likelihood ratio tests are used for the analyses (see e.g. Godfrey, 1988; Greene, 1997). Note that a homoskedastic ordered probit can be estimated by setting the variance of the error term to one (s_i^2 = 1). Thus, the presence of heteroskedasticity can be tested easily.

As stated above, this analysis focuses on the effect of educational attainment on the destination choices of migrants. The dummy variable (*highly educated*), which is used for educational attainment, is 1 if an individual has at least the lowest level of tertiary education, the whole length of education being about 13-14 years. The definition of the variable follows the Finnish Standard Classification of Education (31.12.1994). Row percentages in Table 1 suggest that an individual is more likely to move to urban regions if she or he is highly educated. This result is strongest for individuals living in the rural area of Finland.

TABLE 1 Crosstabulation of municipal class in 1994 and 1995 by the educational attainment

Municipality class in 1994 (origin)	Municipality class in 1995			
Not highly educated	Rural (y = 0)	Dens. pop. (y = 1)	Urban (y = 2)	Total
Rural	1419 (26.1%)	2415 (44.4%)	1604 (29.5%)	5438 (100%)
Densely pop.	1957 (20.8%)	3618 (38.5%)	3816 (40.6%)	9391 (100%)
Urban	856 (12.8%)	2449 (36.7%)	3375 (50.5%)	6680 (100%)
Total	4232 (19.7%)	8482 (39.4%)	8795 (40.9%)	21509 (100%)
Highly educated	Rural (y = 0)	Dens. pop. (y = 1)	Urban (y = 2)	Total
Rural	154 (24.0%)	270 (42.1%)	217 (33.9%)	641 (100%)
Densely pop.	234 (18.6%)	481 (38.1%)	546 (43.3%)	1261 (100%)
Urban	150 (10.0%)	569 (38.1%)	774 (51.8%)	1493 (100%)
Total	538 (15.8%)	1320 (38.9%)	1537 (45.3%)	3395 (100%)

Notes: Sample frequencies are given first. Row percentages are in brackets.

Control variables used in the analysis measure an individual's personal characteristics, household and region of origin. Further details on the variables are presented in Table 2.

TABLE 2 The explanatory variables of the ordered probit models

Explanatory variable (Year 1994)	Definition	Mean
Highly educated	1 if an individual has at least the lowest level of tertiary education; 0 otherwise	0.136
Female	1 if an individual is female; 0, otherwise	0.504
Age	Age of an individual (continuous)	29.186
Unemployed	1 if a person has been unemployed at least two weeks in the observation year; 0 otherwise	0.394
Student	1 if an individual is reported as a student on the basis of the main type of activity in the last week of the observation year; 0 otherwise	0.222
Commuter	1 if the location of an individual's job is different from her or his municipality of residence at the end of the observation year; 0 otherwise	0.192
Fragmented work experience	1 if a person has experienced terminated spell of employment at least twice in the observation year; 0 otherwise	0.131
House owner	1 if an individual has her/his own house; 0 otherwise	0.265
Flat owner	1 if an individual has her/his own flat; 0 otherwise	0.204
Size of household	Size of the household unit an individual belongs to (continuous)	3.167
Urban (origin)	1 if the number of population > 50 000 and level of urbanisation ≥ 90% at the region of origin; 0 otherwise	0.328
Densely populated (origin)	1 if the number of population > 15 000 or level of urbanisation ≥ 70% and region of origin is not urban; 0 otherwise	0.428

4 Empirical results

Table 3 presents the results of the homoskedastic and heteroskedastic ordered probit models for destination choices of migration. All the coefficients, except for the size of household in the homoskedastic model, reach statistical significance at the 5% level. Looking at the diagnostics reported in the table, we can see that the Likelihood ratio test for heteroskedasticity is highly significant (58.4 against the 1% critical c^2 value 16.8), so that the null hypothesis of homoskedasticity is rejected. On the other hand, a more general form of heteroskedasticity is rejected (6.37 against the 5% critical c^2 value 12.6).

TABLE 3 Estimated models for destination choices of migration, 1994-1995

	Homoskedastic model		Heteroskedastic model	
Variable	Coefficient	St. Err.	Coefficient	St. Err.
Constant	0.817**	0.038	0.966**	0.053
Highly educated	0.115**	0.022	0.137**	0.026
Female	-0.032*	0.015	-0.044*	0.018
Age	-0.014**	0.008	-0.016**	0.001
Unemployed	-0.058**	0.016	-0.054**	0.020
Student	0.246**	0.021	0.335**	0.030
Commuter	0.185**	0.020	0.218**	0.025
Fragmented work experience	0.107**	0.022	0.156**	0.030
House owner	0.271**	0.019	0.314**	0.026
Flat owner	0.195**	0.019	0.234**	0.025
Size of household	-0.008	0.004	-0.010*	0.005
Urban (origin)	0.631**	0.021	0.759**	0.035
Densely populated (origin)	0.285**	0.018	0.357**	0.026
Threshold parameter, m_1	1.142**	0.010	1.382**	0.047
Correction for heteroskedasticity				
Age	—		0.040**	0.009
Unemployed	—		0.061**	0.018
Student	—		0.121**	0.024
Fragmented work experience	—		0.075**	0.026
House owner	—		-0.042*	0.019
Densely populated (origin)	—		0.058**	0.017
Diagnostics				
Log-likelihood	-25167.95		-25138.76	
LR-test for heteroskedasticity	58.4** (d.f. = 6)		—	
LR-test for more general heteroskedasticity	—		6.37 (d.f. = 6)	

Notes: Dependent variable: Municipality class (0, 1, 2). Number of observations: 24 904. * (**) = Statistically significant at the 5% (1%) level. The first test for heteroskedasticity compares the homoskedastic model with the heteroskedastic model reported in the table. The test for more general heteroskedasticity compares the latter model with a model including all the independent variables save the constant term in the heteroskedastic function (d.f. = degrees of freedom).

The dependent variable exploited herein involves ordered classification of destination municipalities, and hence, direct interpretation of coefficients is not advisable (see e.g. Long, 1997). Therefore, we look at the marginal effects of changes in the regressors. These effects are calculated as partial derivatives and are presented in Table 4.

TABLE 4 Marginal effects on the probability of destination choices for migrants, 1994-1995

	Homoskedastic model			Heteroskedastic model		
Variable	Rural	Dens. pop.	Urban	Rural	Dens. pop.	Urban
Highly educated	-0.030**	-0.015**	0.045**	-0.030**	-0.014**	0.044**
Female	0.008*	0.004*	-0.012*	0.010*	0.005*	-0.014*
Age	0.004**	0.002**	-0.005**	0.004**	0.001	-0.005**
Unemployed	0.015**	0.007**	-0.022**	0.026**	-0.014*	-0.012
Student	-0.064**	-0.031**	0.096**	-0.043**	-0.075**	0.118**
Commuter	-0.049**	-0.023**	0.072**	-0.047**	-0.023**	0.070**
Fragmented work experience	-0.028**	-0.014**	0.042**	-0.016*	-0.041**	0.057**
House owner	-0.071**	-0.034**	0.106**	-0.078**	-0.019**	0.097**
Flat owner	-0.051**	-0.025**	0.076**	-0.051**	-0.024**	0.075**
Size of household	0.002	0.001	-0.003	0.002*	0.001*	-0.003*
Urban (origin)	-0.166**	-0.080**	0.245**	-0.165**	-0.079**	0.244**
Densely populated (origin)	-0.075**	-0.036**	0.111**	-0.063**	-0.056**	0.120**

Notes: Marginal effects are partial derivatives that are computed on overall means of the data. The reported effect for the heteroskedastic model is the total effect from a variable in x and from a possible heteroskedastic term in z. * (**) = Statistically significant at the 5% (1%) level.

Let us first consider the outcomes of control variables. The following interpretations of the results are based on the preferred heteroskedastic model, if not otherwise stated. According to the results, if an individual is a student (*student*) at the beginning of the observation period, her or his likelihood of moving to urban regions increases by some 11.8 percentage points. Urban regions possess more job opportunities, and hence, a greater likelihood of finding new employment compared to remote districts. Availability of job vacancies is even more important in the case of newcomers to labour markets, since finding a first job without any work experience is usually tricky. On the other hand, the first job is very important for the work résumé.

The results imply that commuting (*commuter*) and short-term employment (*fragmented work experience*) increase the propensity for moving to urban regions by some 7 and 5.7 percentage points, respectively. Again, these outcomes are connected to the ability of urban municipalities to offer more job opportunities. In contrast, it seems that personal unemployment (*unemployed*) does not encourage individuals to move to urban municipalities. Note also that the introduction of the heteroskedastic terms alters the marginal effects of the *unemployed* to some degree.

House (*house owner*) or flat owners (*flat owner*) seem to be more likely to migrate to urban regions. This might partly be explained by welfare factors. If migrants have their own accommodation therein, or they have the capital to buy housing, they are more able to move to urban municipalities that normally have a lack of housing. *Size of household* has only a minor effect on the destination choices of migrants. The effects of *age* and *female* are also slight. However, the outcomes of these variables show that large households, aged individuals and females are less likely to move to urban municipalities. These results are logical from the viewpoint of opportunity costs and labour market reasons.

Furthermore, the dummies of *urban* and *densely populated regions* were used in the estimations to control the effect of origin on destination choices of migrants. The estimates of these dummies indicate that individuals living in urban municipalities or in densely populated regions are more likely to move to urban regions compared to the reference group of persons living in remote districts.

Next let us proceed to the main explanatory variable, educational attainment. The results presented in Table 4 suggest that, regardless of the model specification, highly educated individuals are more likely to migrate to urban municipalities. In fact, the sign of the marginal effects of the *highly educated* dummy is positive only for urban regions. Furthermore, if the assumption of the highly educated being more likely to move in the first place is considered, the outcomes of the dummies of *urban* and *densely populated regions* also seem to strengthen the effect. However, since the partial derivatives for a dummy variable is in principal inaccurate (see e.g. Greene, 1997), Table 5 below displays the predicted probabilities that result when the dummy of educational attainment takes two different values (i.e. 0 and 1) while other variables are held at their sample means. From the predicted probabilities *ceteris paribus* highly educated versus not highly educated difference in probability is calculated.

TABLE 5 Effect of the highly educated dummy variable on the probabilities of moving

	Homoskedastic model			Heteroskedastic model		
	Rural Pr[y=0]	Dens. pop. Pr[y=1]	Urban Pr[y=2]	Rural Pr[y=0]	Dens. pop. Pr[y=1]	Urban Pr[y=2]
Not highly educated	0.184	0.411	0.404	0.184	0.411	0.404
Highly educated	0.155	0.395	0.449	0.156	0.396	0.449
Change	-0.029**	-0.016**	0.045**	-0.028**	-0.016**	0.044**
Change %	-15.7%	-3.9%	11.1%	-15.5%	-3.8%	10.9%

Notes: * (**) = Statistically significant change at the 5% (1%) level.

The outcomes for the homoskedastic and heteroskedastic models are very close to the marginal effects presented in Table 4. According to the heteroskedastic model, the probability of moving to rural or densely populated regions decreases by 15.5% and 3.8%, respectively, if an individual is highly educated. In contrast, the probability of moving to urban municipalities increases by 10.9% if an individual is highly educated. To sum up the outcomes of this analysis, we may say that the highly educated prefer to move to urban municipalities, even if other personal factors are controlled and potential bias arising from heteroskedasticity is taken into account.

5 Concluding remarks

This paper examined the influence of educational attainment on destination choices of migrants. The modelling results, which were based on the findings of previous theoretical and empirical research, indicated that highly educated migrants are likely to move to urban municipalities, which offer better job opportunities as well as more versatile possibilities for self-improvement, hobbies, etc. At the same time, rural regions, as well as densely populated regions, tend to lose a remarkable part of their highly educated labour to urban regions. As a result, the destination choices of highly educated migrants seem to strengthen the human capital concentration in Finland.

The results are not very promising as regards the regional equality of human capital redistribution. It seems that the ongoing process of centralisation might even become set, and divergence between lagging regions and central areas deepen in the future. From a political point of view the phenomenon is interesting. A number of regional policy measures aim at developing the human capital endowments of lagging regions. However, it seems that simultaneously human capital flows at an increasing speed to central regions. Thus, future orientated regional policy should find new tools to enable more equal human capital allocation. Otherwise, the implementation made might remain as a decelerator of an unavoidable evolutionary process.

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CHAPTER 5

UNOBSERVED VARIATION IN MIGRATION BEHAVIOUR *

Mika Haapanen

Abstract

The purpose of this study is to investigate empirically unobserved variation in the interregional migration behaviour of individuals. So far little research has been devoted to this issue, despite the fact that recent work on random parameters logit (RPL) models provides the means for such an analysis. The RPL models are estimated on Finnish micro-data and the robustness of the results with respect to different distributional specifications is studied. The results suggest that the RPL specification can provide a more realistic description of the migration behaviour of individuals than the standard logit model.

Keywords: migration, decision making, random parameters, simulation estimation

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1 Introduction

Statistical formulations in migration analysis are very often estimated under assumptions of "parametric stability" or "invariance". Although such formulations have widened our understanding of the migration phenomenon, they also impose a notable restriction: the parameters that enter the migration model are assumed to be non-stochastic (fixed).[1] This implies that different individuals with the same observed characteristics have the same value for each factor that enters the migration model.

There are at least three reasons why this assumption of parametric invariance may not hold in reality. Firstly, individuals may have different tastes or valuations regarding goods, leisure time, region of residence, *etc*. This means that, for example, the effect of labour income on the migration behaviour may be different across individuals. Secondly, in addition to the observed characteristics that are included in the model, unobserved characteristics may also influence migration decisions. If the unobserved effects are not modelled, they may be captured by the parameters that are estimated and bias the results. Suppose, for example, that the researcher is able to observe whether an individual is married but not whether that individual's spouse is commuting or not. Since being married is likely to decrease and commuting is likely to increase the propensity to migrate, it can be expected that the negative marginal effect of marriage on the propensity to migrate will be smaller (or may even be positive) for an individual whose spouse is commuting than for an individual whose spouse is not commuting. Hence, randomness in the parameters across individuals may be an indicator of a missing variable in the fixed parameter model. Estimating random parameters can provide a way to control for this. Finally, it may be the case that the explanatory variables have been measured with systematic or random errors. For example, there may not be a direct measure corresponding to the explanatory variable, such as permanent income and expected income.

In this paper a random parameters logit (RPL) model is employed in order to control for and analyse the unobserved effects (McFadden and Train, 2000).[2] The RPL model generalises the standard logit specification by allowing

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[1] Instead of modelling the stochastic component of the migration model, these models has been extended, for example, by estimating the migration decision and wage determination as a joint decision; see e.g. Axelsson and Westerlund (1998) and Tunali (2000); or the migration and employment decisions have been modelled jointly; see e.g. Zax (1991). In addition, the migration decision has been formulated with several destination alternatives; see e.g. Falaris (1987) and Vijverberg (1995).

[2] Random parameters logit ("mixed" logit) models have been used in various applications, e.g. in marketing, consumer and transportation research (Jain *et al.*, 1994; Brownstone and Train, 1999; Hensher, 2001), but, to our knowledge, they have not been applied to migration problems.

parameters to have random unobserved variation.[3] By specifying the distribution of the random parameters to be normal, triangular or uniform, variation in the random parameters is generated. In each specification the mean and the spread of each parameter distribution is estimated. Thus the models allow us (i) to test whether the RPL specification has any significance in terms of mean impacts when compared to the standard logit model, (ii) to test whether and how much the migration determinants vary within the sample population, and (iii) to study the robustness of the results with respect to the specification of the random parameters.

These objectives are approached using Finnish micro-data. The data set is a one percent random sample drawn from the Finnish longitudinal census. The primary finding is that the RPL model can be a useful way of studying the unobserved variation in the parameter estimates. The RPL specification improves the statistical fit compared to the standard logit model and it gives additional information on the estimated parameters.

The remainder of this paper is organised as follows. Section 2 specifies the random parameters migration model. Section 3 introduces the data. Section 4 presents the estimation results of the standard logit and random parameters logit models, and Section 5 concludes the study.

2 Econometric Model

Traditionally, migration decisions have been estimated with logit or probit models, as for example, because their likelihood functions can be maximised easily due to their closed-form solutions and their results are simple to interpret. However, to ensure efficient and accurate estimates of the parameters one should also study the unobserved heterogeneity structure of the model: the presence of unobserved heterogeneity can alter marginal effects and marginal rates of substitution between choices. To tackle this issue, we set out a random parameters logit (RPL) model that incorporates the unobserved effects.[4]

We assume that the choice of individual i is 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 stochastic component. However, to derive the

[3] An alternative way to study the variation in the parameters would be interact the variables with other *observed* variables (interactive dummy modelling), but *unobserved* factors could still influence the migration decisions.

[4] RPL models have taken different forms in different applications but what they have in common is the integration of the logit formula over the distribution of unobserved random parameters; see e.g. Train (1998), McFadden and Train (2000) and Hensher (2001).

random parameters logit model the stochastic component is further decomposed into a stochastic subcomponent that is, perhaps, heteroskedastic over people, and another stochastic subcomponent that is independently, identically distributed (i.i.d.) over alternatives and individuals (see Equation 1).[5]

To be more specific, the utility, $U(i,j)$, that individual i receives given a choice of alternative j is

$$U(i,j) = \underbrace{a_j + b_j' x_{ji}}_{\text{fixed}} + \underbrace{h_{ji}' z_{ji}}_{\text{random}} + \underbrace{e_{ji}}_{\text{i.i.d.}}, \tag{1}$$

where x_{ji} and z_{ji} are observed explanatory variables that may relate to the alternative (e.g. expected income) and to the individual (e.g. age and education). a_j is a fixed alternative specific constant, b_j is a fixed parameter vector and h_{ji} is a parameter vector randomly distributed across individuals (with normalisations: $a_j = \mathbf{0}$, $b_1 = \mathbf{0}$ and $h_{1i} = \mathbf{0}$). The random term e_{ji} is the i.i.d. extreme value. In sum, the individuals possess heterogeneous utility functions and consequently encounter differences in the benefits of living in specific locations.[6]

Furthermore, we assume that the individual knows the value of his own a_j, b_j, h_{ji} and e_{ji}'s for all j and maximises his economic utility. That is, the individual chooses alternative k if and only if $U_{ki} > U_{ji}$ for all $k \neq j$. However, in the model used an individual can only either stay in the region of origin (j = 1) or move to a new region (j = 2).

If it were possible to observe the random parameters h_{ji}, then for each individual the migration choice probability would be standard logit:

$$P(j \mid h) = \frac{\exp(U(i,j))}{\sum_{j=1}^{2} \exp(U(i,j))}, \ i = 1, \ldots, N; \ j = 1, 2. \tag{2}$$

However, we only observe the explanatory variables, x_{ji} and z_{ji} and the chosen alternative, but not the a_j, b_j, h_{ji} and e_{ji}'s. Therefore, we cannot condition on the h_{ji}'s. Instead, the unconditional choice probabilities for each individual in (2) must be integrated over all the possible values of h weighted by the density of h:

[5] McFadden and Train (2000) show that any random-utility model can be approximated to any desired degree of accuracy with a RPL model through appropriate choice of explanatory variables and distributions for the random parameters.

[6] The setting resembles the human capital framework of migration (Sjaastad, 1962); see Greenwood (1985; 1997), Shields and Shields (1989) and Ghatak *et al*. (1996) for reviews of migration theory.

$$P(j) = \int_h \frac{\exp(U(i,j))}{\sum_{j=1}^{2} \exp(U(i,j))} g(h \mid \Omega)\, dh \,, \qquad (3)$$

where it is assumed that the random parameters h follow a general distribution $g(h \mid \Omega)$.

Thus, the estimation of the RPL model involves specifying the distribution $g(h \mid \Omega)$ and estimating the parameters of that distribution in addition to the fixed parameters as in the standard logit model. In most applications, such as Revelt and Train (1998) and Brownstone and Train (1999), $g(h \mid \Omega)$ has been specified to be normal or log-normal. Revelt and Train (2000) and Hensher and Greene (2002) used triangular and uniform distributions. We follow these studies and specify the distribution of the random parameters to be independent (log-) normal, triangular or uniform.[7] The mean and the standard deviations of the distributions are estimated.

Note that the integrals in the choice probabilities (Equation 3) cannot be evaluated analytically since it does not have a closed-form solution. Therefore, the integrals are approximated through simulation and the resulting simulated log-likelihood function is maximised; see e.g. Stern (1997) for a discussion of simulation methods in estimation. In this study, the simulations are based on Halton draws to reduce simulation error (Train, 2000).

3 Data and Variables

The data set used for empirical analysis is 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 individuals and their spouses in the sample is well documented: the data includes information on personal and family status, past labour market record and regional characteristics. Information on the individuals' home regions allows us to divide Finland into 85 regions (NUTS4, "seutukunnat"), which, by and large, represent actual commuting and working areas. Therefore, in the empirical analysis the dependent variable, *migrate in 1996*, involves a change of region of residence.[8]

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[7] A number of other error covariance structures can be specified in the random parameters logit models (see e.g. Hensher, 2001). Identification is always an issue in estimating the random parameters. As it gets harder with an increasing number of random parameters and the dependencies between them, the models are kept fairly simple in this study.

[8] Information on the home region is recorded on the last day of each year. Hence, we know whether person migrated during a calendar year.

The only restrictions placed on individuals for inclusion in the working sample are that they were between 18 and 65 years of age in 1995 and that information on all the variables of interest is complete.[9] After omitting all those with missing information we are left with 32,394 individuals, of whom 980 persons (3.02 percent) migrated in 1996.

TABLE 1 Variables and descriptive statistics

	Mean (std. dev.)		
Variable	Full sample	Only stayers	Only migrants
Human capital			
Age/10	4.055 (1.291)	4.087 (1.284)	3.034 (1.113)
Upper secondary education†	0.219 (0.414)	0.215 (0.411)	0.339 (0.474)
Lower academic education†	0.086 (0.280)	0.085 (0.279)	0.096 (0.295)
Higher academic education†	0.057 (0.232)	0.057 (0.232)	0.066 (0.249)
Location			
Municipal semi-urban†	0.153 (0.360)	0.153 (0.360)	0.159 (0.366)
Municipal rural†	0.243 (0.429)	0.242 (0.428)	0.288 (0.453)
Growth-centre region†	0.447 (0.497)	0.450 (0.497)	0.348 (0.477)
Labour market characteristics			
Travel-to-work unemployment rate/10	1.982 (0.403)	1.980 (0.403)	2.040 (0.399)
Employed in the last week of 1995†	0.592 (0.491)	0.597 (0.491)	0.432 (0.496)
Commuting†	0.053 (0.225)	0.051 (0.220)	0.133 (0.339)
Farmer†	0.033 (0.178)	0.034 (0.181)	0.004 (0.064)
Migration costs			
Annual wage*10^{-5}	0.667 (0.776)	0.674 (0.780)	0.433 (0.589)
Under school-aged children only†	0.105 (0.307)	0.105 (0.307)	0.100 (0.300)
School-aged children†	0.250 (0.433)	0.255 (0.436)	0.096 (0.295)
Homeowner†	0.403 (0.491)	0.407 (0.491)	0.293 (0.455)
Living in region of birth†	0.523 (0.499)	0.528 (0.499)	0.387 (0.487)
Number of migration events in 1990–95	0.168 (0.485)	0.155 (0.463)	0.580 (0.848)
Married†	0.684 (0.465)	0.692 (0.461)	0.430 (0.495)
Spouse employed†	0.424 (0.494)	0.430 (0.495)	0.212 (0.409)
Number of observations	32,394	31,414	980

Notes: All variables are measures of the situation in 1995 if not otherwise stated. †Indicator variable (= 1 if the definition applies, = 0 else). The reference education (municipal; children) is primary school or lower secondary education (urban; no children). Growth-centre regions are Helsinki, Porvoo, Salo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu (as in Haapanen, 2002). Working experience is defined as number of months at work in 1987 – 1995 divided by 10. Annual wage is in Finnish Marks (FIM). The education variable is defined using the Finnish Standard Classification of Education (31.12.1994).

[9] No distinction is made between different reasons for migration, such as those related to family, work and or studies.

Table 1 presents the means and standard deviations by migration status of the explanatory variables in our empirical migration model. The explanatory variables include factors that have been found typically to affect migration behaviour (see e.g. Greenwood, 1985; 1997; Tunali, 2000; Ritsilä, 2001). They control for differences in human capital, location, labour market status and the costs of migration. All measurements of the explanatory variables relate to 1995, year before the migration decision was taken, so that the consequences of migration are not confused with causes of migration (see also Antolin and Bover, 1997). Moreover, because information about the situation immediately prior to migration is likely to carry more weight in the individual's prediction of the future than that related to the distant past.

Notable differences can be seen in the mean values of the explanatory variables between the samples of migrants and stayers. Personal human capital (age, education etc.) is an important factor that influences the decision to move (e.g. Ritsilä and Ovaskainen, 2001). Age is generally viewed as one of the key personal characteristics in explaining migration. 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. Education is also a very important personal characteristic in explaining migration. Education is general human capital, which creates employment opportunities and which is easily transferable to different locations. Higher levels of education may thus reduce the risks associated with migration (Shields and Shields, 1989).

The location variables suggest that individuals living in rural areas have a higher likelihood of migration than individuals living in urban areas (see also Axelsson and Westerlund, 1998), and that the incentives to move from the central areas are low. The labour market characteristics of the individual and of the region can also affect migration decisions. If the local unemployment rate is high, the propensity to move is likely to be high as well, since the probability of job placement in the home area is then low (Tervo, 2000). A recent spell of employment may also lower the propensity to move, whereas commuting is expected to increase it.[10]

The cost of migration may depend, for example, on family and housing characteristics, and prior migration experience. Besides affecting the direct costs of moving, being married and having children may indicate the existence of additional local household ties (Mincer, 1978). An individual may also be tied to a house, which is turn may reduce the propensity to move (see e.g. Henley, 1998). The cost of moving is likely to increase if the individual’s spouse is employed or the individual lives in the region of his or her birth. Migration

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[10] Commuting status is measured at the municipal level while migration status is measured at the regional level.

propensity is also expected to increase with the number of migration events in the recent past (Ritsilä and Ovaskainen, 2001). The cost of migration may also be dependent on the individual's economic wealth. A priori expectation is that the likelihood of migration will decrease as the experienced wealth increases (see e.g. Kettunen, 2002). Our measure of wealth is personal annual wage subject to state taxation in Finnish Marks.

4 Estimation Results

The estimation results from the standard logit and random parameters logit models are presented in Table 2. The maximum likelihood estimates and their standard errors are reported; see also Equations (1) and (3). The random parameters were selected on the bases of sequential model comparisons, starting from a general model and then dropping insignificant standard deviations at the 5 percent level. During this step the number of Halton sequences (simulations) was kept low in order to speed up the selection process. Ultimately, the variables *growth-centre region*, *employed in the last week of 1995* and *married* were modelled with random parameters and their means and standard deviations were estimated. Finally, this parsimonious model was estimated with a higher number of simulations in order to gain accurate parameter estimates. It turned out that the required number of simulations was larger in the RPL model with (unbounded) normal distributed parameters (1,000 simulations) than in the RPL model with the (bounded) triangular or uniform distributed parameters (500 simulations).

Before interpreting the results, the standard logit model was tested against the RPL models with approximate likelihood ratio (LR) tests.[11] With a $c^2(3)$ test statistic of 17.2, the LR test rejects the standard logit model against the normal RPL model at the 1 percent significance level. Similarly, the LR tests reject the standard logit model against the triangular and uniform RPL models at the 1 percent significance level with $c^2(3)$ test statistics of 19.7 and 23.2, respectively. Hence, the comparison of the RPL models with the standard logit model indicates that a less restrictive specification of the unobserved effects brings a significant contribution to the overall statistical fit.

[11] The test statistics are approximate only, since they are based on the simulated log-likelihoods.

TABLE 2 Parameter estimates of logit and RPL models (standard error)

Variable	Logit	Normal RPL	Triang. RPL	Uniform RPL
Fixed parameters				
Constant	-1.021 (0.245)	-0.872 (0.277)	-0.868 (0.280)	-0.875 (0.281)
Human capital				
Age/10	-0.563 (0.033)	-0.646 (0.046)	-0.656 (0.047)	-0.661 (0.046)
Upper secondary education	0.230 (0.078)	0.289 (0.091)	0.297 (0.092)	0.296 (0.093)
Lower academic education	0.399 (0.123)	0.523 (0.150)	0.549 (0.154)	0.569 (0.157)
Higher academic education	0.685 (0.152)	0.862 (0.197)	0.898 (0.205)	0.926 (0.210)
Location				
Municipal semi-urban	0.235 (0.105)	0.255 (0.119)	0.258 (0.120)	0.257 (0.121)
Municipal rural	0.334 (0.094)	0.362 (0.105)	0.367 (0.107)	0.368 (0.108)
Growth-centre region	-0.432 (0.090)			
Labour market characteristics				
Travel-to-work unempl. rate/10	0.173 (0.093)	0.192 (0.104)	0.195 (0.105)	0.198 (0.106)
Empl. in the last week of 1995	-0.322 (0.095)			
Commuting	1.114 (0.116)	1.388 (0.171)	1.445 (0.182)	1.499 (0.189)
Farmer	-1.179 (0.513)	-1.210 (0.541)	-1.214 (0.540)	-1.212 (0.538)
Migration costs				
Annual wage*10^{-5}	-0.314 (0.084)	-0.392 (0.101)	-0.406 (0.104)	-0.415 (0.104)
Under school-aged childr. only	-0.477 (0.129)	-0.598 (0.167)	-0.620 (0.173)	-0.639 (0.177)
School-aged children	-0.453 (0.128)	-0.620 (0.162)	-0.653 (0.166)	-0.674 (0.165)
Homeowner	-0.299 (0.083)	-0.321 (0.093)	-0.326 (0.094)	-0.325 (0.094)
Living in region of birth	-0.708 (0.074)	-0.789 (0.088)	-0.798 (0.089)	-0.803 (0.089)
No. of migr. events in 1990–95	0.536 (0.045)	0.672 (0.065)	0.695 (0.068)	0.712 (0.069)
Married	-0.190 (0.101)			
Spouse employed	-0.484 (0.103)	-0.614 (0.134)	-0.632 (0.137)	-0.646 (0.139)
Random parameters				
Growth-centre region – Mean		-1.293 (0.415)	-1.406 (0.490)	-1.556 (0.661)
– Sd. dev. of param. distrib.		1.518 (0.402)	1.652 (0.471)	1.833 (0.640)
Empl. in the last week of 95 – Mean		-0.607 (0.270)	-0.714 (0.317)	-0.852 (0.376)
– Sd. dev. of param. distrib.		0.830 (0.421)	1.011 (0.437)	1.209 (0.469)
Married – Mean		-1.102 (0.343)	-1.477 (0.466)	-2.252 (0.863)
– Sd. dev. of param. distrib.		1.676 (0.323)	2.056 (0.405)	2.794 (0.713)
Diagnostics				
(Simulated) log-likelihood	-3673.81	-3665.20	-3663.94	-3662.20
Likelihood ratio index	0.1638	0.1657	0.1660	0.1664
Replications for simul. prob.		1,000	500	500
Appr. LR-test against logit		17.28 (p=0.001)	19.75 (p=0.000)	23.212(p=0.000)

Notes: Dependent variable: *migrate in 1996*. See Table 1 for descriptive statistics. Sample size: 32,394. The likelihood ratio index is defined as 1 – SLL/SLL(0), where SLL is the value of the (simulated) log-likelihood at the estimated parameters and SLL(0) is the maximum value of the (simulated) log-likelihood subjected to the constraint that all the parameters except the constant term are zeros; see e.g. Maddala (1983).

The signs of the parameter estimates are in line with our prior expectations in all the models (Table 2; see also Section 3). In the logit model all the explanatory variables enter at 5 percent significance level, except for the variables *travel-to-work unemployment rate* and *married* ($p < 0.065$). In the RPL models all the explanatory variables are significant at the 5 percent level, except for the *travel-to-work unemployment rate*. Note also that the parameter estimates are generally much larger in magnitude in the RPL models than in the standard logit models. This is expected, as the scale of the utility is determined by the normalisation of the error term (Equation 1; see also Revelt and Train, 1998; Brownstone and Train, 1999). In a standard logit model, all the stochastic terms are absorbed into this one error term. In the RPL model some of the variance in the stochastic portion of the utility is captured in the random parameters. This is why the comparison between the models has to be based on measures that are independent of the scale of the utility, namely on measures such as probability and marginal effect.

The standard deviations of the random parameters suggest two clear patterns in Table 2.[12] Firstly, in all of the RPL models the largest estimate of the standard deviation of the random parameter is obtained for the *married* variable. Secondly, the normal RPL specification yields the smallest and the uniform RPL specification the largest standard deviation, that of the triangular specification lying in between the two. In addition, the standard deviation of the parameter of *employed in the last week of 1995* variable is estimated more significantly in the triangular and uniform RPL models than in the normal RPL model. A reason for this could be that in reality the distribution is bounded (normal is not) and/or is more evenly spread than the normal estimates. Hence, the triangular distribution appears to be useful alternative of the normal distribution.

To illustrate the estimated random parameters, their densities are shown in Figure 1 below. The vertical dashed line indicates the mean value of the distribution and the shaded area shows the positive proportion of the density. The figure shows that in all of the RPL models the random parameters are positive for some individuals. That is, the impact of an explanatory variable is unexpected (contrary to the predictions of economic theory) for some individuals in the sample. For example, the parameter densities of the *married* variable suggest that for a significant proportion of the individuals in the sample marriage actually increases their probability to migrate. One reason for this may be that the models lack certain unobserved factors relating to

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[12] The standard deviation provides a comparable measure of deviance between the RPL models, but the spread of the distribution is also commonly used in describing the triangular and uniform distributions. The spreads of the triangular and uniform distributions can be calculated by multiplying their standard deviations by $\sqrt{6}$ and $\sqrt{3}$, respectively (see e.g. Hensher and Greene, 2002).

household or spouse (e.g. commuting of spouse) as explanatory variables that would correlate with the *married* variable.

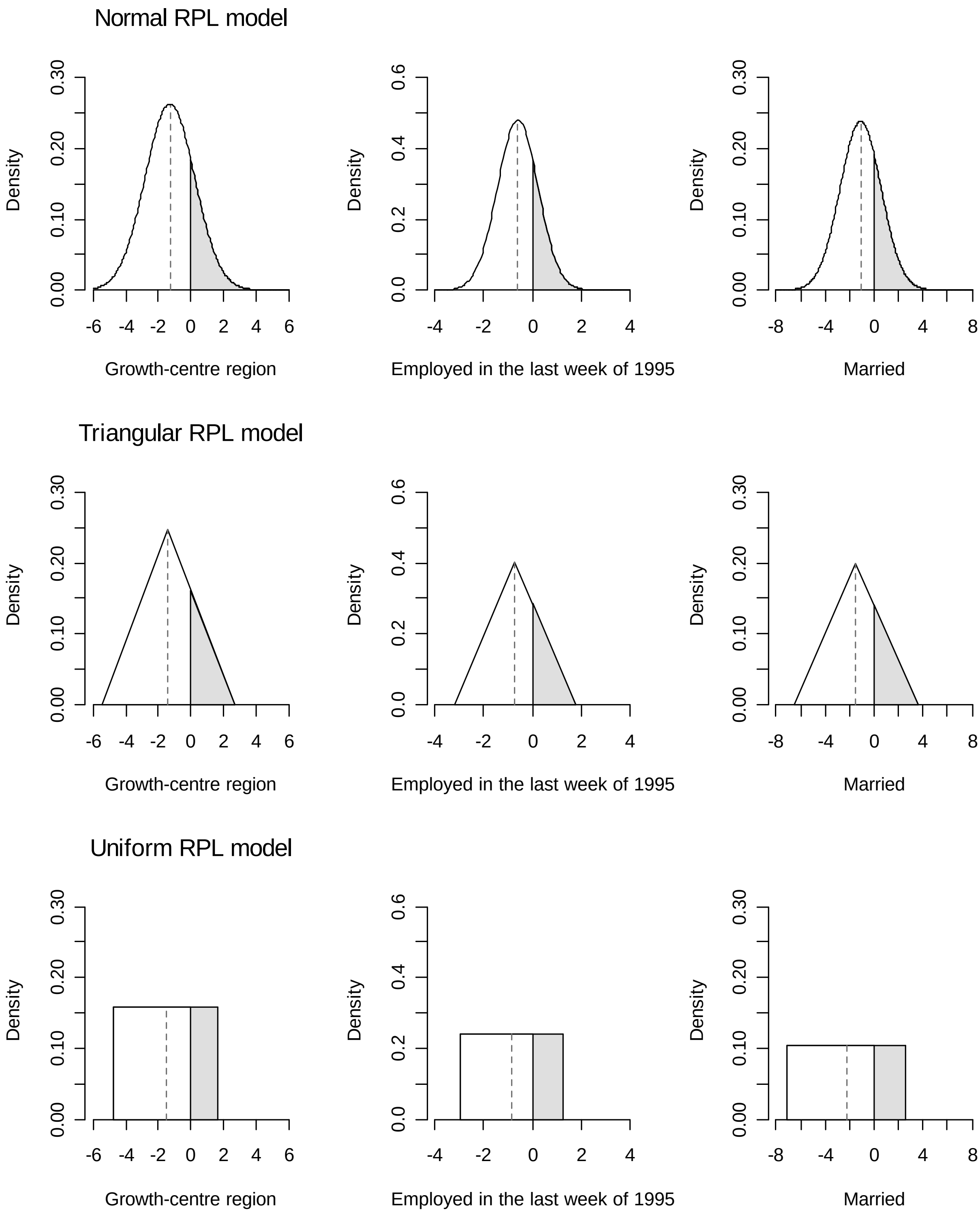

FIGURE 1 The densities of the random parameters in Table 2

This type of model behaviour is a consequence of the distributional assumptions made about the random parameters. In some cases the researcher may wish to restrict the density so that it is strictly positive on one side of the zero[13], but in the models reported in Table 2, it is credible for the random parameters to have an unexpected sign for some individuals (see e.g. the spouse/commuting example in the Introduction).

Table 3 presents the probabilities of a parameter being positive for a randomly drawn individual in each model. These probabilities would be especially important if for the individual the cost of the opposite effect is high. For the *married* variable these probabilities are very similar in all the RPL models, whereas for *growth-centre region* and *employed in the last week of 1995* the differences between the RPL models are noteworthy. In the normal RPL model the probability of an unexpected sign is the largest for the *married* variable, while in the triangular and uniform RPL models it is the largest for *employed in the last week of 1995*.

TABLE 3 Probability of a parameter being positive for a randomly drawn individual

Random parameter	Logit	Normal RPL	Triang. RPL	Uniform RPL
Growth-centre region	0	0.197	0.213	0.255
Empl. in the last week of 1995	0	0.232	0.253	0.297
Married	0	0.255	0.250	0.267

Notes: The calculations are based on the models reported in Table 2.

To study the differences in the mean effects between the RPL models, the simulated effects of the explanatory variables on migration probability are calculated in Table 4. These figures show how the migration probabilities change when various explanatory variables change. For the indicator variables the simulated effect can be interpreted as a marginal effect; for the categorical and continuous variables, see the notes to Table 4.

[13] For example, a log-normal distribution can be used to restrict the density to only one side of the zero. We found the parameters of the log-normal distribution to be hard to estimate and identify (see also McFadden and Train, 2000). Therefore, we conclude that the log-normal distribution is too restrictive for our random parameters.

TABLE 4 Simulated effects on migration probability (%)

Variable	Logit	Normal RPL	Triang. RPL	Uniform RPL
Human capital				
Age/10 [i]	-0.150	-0.149	-0.148	-0.149
Upper secondary education	0.615	0.672	0.667	0.670
Lower academic education	1.146	1.320	1.405	1.329
Higher academic education	2.221	2.443	2.566	2.458
Location				
Municipal semi-urban	0.639	0.596	0.581	0.594
Municipal rural	0.947	0.878	0.862	0.875
Growth-centre region	-1.145	-1.179	-1.190	-1.181
Labour market characteristics				
Travel-to-work unempl. rate/10 [ii]	0.047	0.045	0.046	0.045
Empl. in the last week of 1995	-0.874	-0.874	-0.890	-0.869
Commuting	4.514	4.900	5.163	4.958
Farmer	-2.038	-1.924	-1.898	-1.959
Migration costs				
Annual wage*10^{-5} [iii]	-0.037	-0.039	-0.040	-0.040
Under school-aged children only	-1.183	-1.267	-1.305	-1.262
School-aged children	-1.134	-1.304	-1.362	-1.298
Homeowner	-0.783	-0.736	-0.725	-0.741
Living in region of birth	-1.947	-1.908	-1.895	-1.906
No. of migr. events in 90–95 [iv]	1.563	1.751	1.832	1.747
Married	-0.518	-0.388	-0.358	-0.385
Spouse employed	-1.210	-1.304	-1.323	-1.314

Notes: Dependent variable: *migrate in 1996*. The simulations are based on the models reported in Table 2. See Table 1 for the descriptive statistics. [i)] The effect of one year increase in age. [ii)] The effect of a one percentage point increase in the unemployment rate. [iii)] The effect of a 10% increase in the annual wage. [iv)] The effect of one migration event when compared to no migration events. For the other variables, the comparison is made with respect to the base category (see notes in Table 1). The simulated effects are calculated as averages over all observations.

The results show that the effect of age is robust with respect to the specification of the model: the effect of a one year increase in age lowers the probability of migration by some 0.5 percentage points in all of the models. On the other hand, while the models show a clear positive relationship between an individual's length of education and migration, the results imply that the standard logit model may underestimate the effect of education. In the standard logit model, for example, an individual with higher academic education has 2.22 percentage points higher probability of migration than an individual with primary school or lower secondary education. In the RPL models the same figure varies between 2.44 and 2.57.

The results for the location variables are quite robust with respect to the specification of the logit models. *Ceteris paribus*, individuals living in the rural areas are more likely to move than individuals in the urban areas and, *ceteris paribus*, individuals living in growth-centre regions are less likely to move than individuals in other regions. Importantly, these results imply that individuals who live in the rural areas outside the growth-centre regions are very likely to move.[14] This can be seen in the aggregate regional statistics from Statistics Finland as well.

Turning to the labour market characteristics, a one percentage point increase in the travel-to-work unemployment rate has a small positive, insignificant effect on an individual's probability to migrate. The effect of being employed is more significant. Regardless of the model, employed individuals are less likely to migrate than other individuals (by some 0.87 percentage points). Commuting has a very strong impact on migration probability. The positive effect is even stronger with the random parameters logit specifications than with the standard logit specification.

Family status influences migration decisions through its cost effect (Mincer, 1978). The married individuals are less likely to move than singles. The effect is stronger in the standard logit model than in the random parameters logit models. An individual's propensity to move is diminished even more in the presence of children or if the spouse is working. In fact, the results imply that the standard logit model may underestimate the effect of children. Our results also support the standard result that owning a house reduces the individual's probability of migration. No gender differences were found in migration, which is not surprising given that various household characteristics were controlled for (Shields and Shields, 1989).

The effect of previous migration events was studied by comparing an individual with one migration event to an individual with no migration events during the past five years.[15] The results show that the standard logit underestimates the magnitude of the positive effect of previous migration events on the current propensity to migrate. Finally, the effect of an increase in the annual wage has small, but significant negative effect on migration propensity in all the models.

[14] That is, everything else being equal, an individual living in a rural area outside the growth-centre regions is approximately 2 percentage points more likely to move than an individual living in an urban area of a growth-centre region.

[15] These are the typical values of the variable: 87.1% of the individuals had no migration events in 1990–95, while 9.8% had one event.

5 Conclusion

In this paper random parameters logit (RPL) models were employed in order to control for and analyse the unobserved effects on migration. By specifying the distribution of the random parameters to be normal, triangular or uniform, variation in the random parameters was generated. In each specification the mean and the spread of each parameter distribution was estimated. A standard logit model was used as a model of comparison. The models were estimated using register-based micro data from Finland.

The estimation results suggested that the RPL specifications improved the statistical fit compared to the standard logit model and they gave additional information on the estimated parameters: the RPL models provided evidence in favour of unobserved variation in the parameters that describe an individual's region of origin, employment status and marriage status. In some cases, marginal effects in the RPL specifications were estimated to some extent differently from those in the standard logit model. For example, while all the models showed a clear positive relationship between an individual's length of education and migration, the results implied that the standard logit model may underestimate the effect of education. In addition, the RPL models produced larger (smaller) estimates for the effects of commuting or children (being married) than the standard logit model. At the same time, the results were fairly robust with respect to the specification of the random parameters logit model.

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CHAPTER 6

CAN MIGRATION DECISIONS BE AFFECTED BY INCOME POLICY INTERVENTIONS? EVIDENCE FROM FINLAND*

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Abstract

The question of individually focused policy measures is currently at the centre of public debate in Finland. Is it possible through income policy interventions to influence where people choose to live? This paper contributes to the debate by studying the migration decisions of individuals who are living in peripheral regions. Our micro-level analysis shows that the decision to move is influenced by expected net income. Results are illustrated with simulations of changes in the expected net income. For example, a policy that increases an individual's expected net income by 10 percent, if he will not move to a growth-centre region, would decrease his probability of moving to growth-centre region by around 12 percent. We also find that the costs of the income policy interventions can be very high and therefore they should be targeted carefully.

Keywords: migration, expected net income, policy interventions, destination

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1 Introduction

In recent years the direction of migration has been towards the areas of economic growth in Finland (Pekkala, 2000).[1] At the same time, more distant regions have been losing important future human capital, as the young and educated move away from them (Ritsilä, 2001; and Ritsilä and Haapanen, 2003). If this current trend continues it will lead to the concentration of human capital in a few attractive regions. The public debate in Finland has suggested that income policy interventions could be used to combat out-migration and help the survival of distant regions. So far no such individually focused policy measures have been applied in Finland. However, regionally differentiated taxation schedules are applied in Norway, including a reduction in personal income tax and an exemption from payroll tax for employers in Northern Norway (see, for example, Eikeland, 1999).

The aim of this study is to contribute to this public debate by assessing whether migration decisions can be affected by income policy interventions. The analysis is undertaken with Finnish micro-data for 1993–95 and it focuses on individuals living in peripheral regions. Here, it is assumed that the income policy interventions operate through changes in net income received by the individuals. Hence, the effect of expected net income on the migration decision is modelled.[2] Results are illustrated with simulations of changes in the expected net income. Policy implications are discussed using an example in the north of Finland.

[1] See Williamson, 1988, Lucas, 1997, and United Nations, 1999, for discussion of urbanization in general.

[2] For prior evidence on the migration-impact of expected earnings, see Falaris, 1987, for Venezuela and Islam, and Choudhury, 1990, for Canada. Evidence for Finland is very limited; see, however, Haapanen, 2002. They all find positive and significant impact of expected income gain on migration. Newbold, 1996, studies the return and onward migration in Canada and concludes that a drop in expected wages decreases the propensity associated with making a return migration. See also the literature on the migration-impact of taxation and the public sector (for example, Islam, 1989; Moffitt, 1992; Charney, 1993; and Westerlund and Wyzan, 1995).

2 Modelling framework

Here, the modelling framework for examining the impact of income policy interventions on migration is established. It is assumed that the income policy interventions operate through changes in expected net income and that they are targeted at individuals living in the peripheral regions. Thus, the focus is on the migration behaviour of individuals living in the peripheral regions. In our framework it is assumed that each individual may select between three mutually exclusive alternatives: he or she can either stay in the current peripheral region (j = 0), move to another peripheral region (j = 1), or move to a growth-centre region (j = 2).

Given these migration alternatives, suppose that the stochastic utility, $U(i,j)$, that individual i receives from the choice of alternative j is defined as:

$$U(i,j) = q_j' g_i + h_i' \ln w_{ij} + e_{ij}, \quad (1)$$

where g_i is a set of attributes that influence migration decision such as age and education, including a constant term. q_j is a vector of fixed coefficients with normalisations q_0 = 0 and $\ln w_{ij}$ is the natural logarithm of the expected net income with a random coefficient h_i (see discussion below). e_{ij} is an i.i.d. extreme value distributed error term. For a given individual the criterion for choosing alternative k is: $U_k > \max U_j$, for all $k \neq j$. That is, we follow the standard assumption in the literature that each individual will select the migration alternative with the highest utility (see, *inter alia*, Sjaastad, 1962; McFadden, 1984; and Ben-Akiva and Lehman, 1985).

However, we cannot observe an individual's expected net income and thus it has to be estimated for the alternatives j = 0, 1 and 2. To determine the expected net income, we define semi-log income equations:

$$\ln w_{ij} = b_j x_i + v_{ij}, \quad j = 0, 1, 2, \quad (2)$$

where b_j is the parameter vector associated with income-determining attributes x_i such as the education and work experience (see Mincer, 1978), and v_{ji} is a normally distributed error term. This is a censored regression in that for a given individual we have only information on w_j, if the migration alternative j is chosen. If there are unobserved preferences that influence the migration decision (selection process) as well as income determination, then ordinary least squares (OLS) estimation of the above equations will not provide unbiased estimates of income parameters (see, for example, Maddala, 1983).

To control for this self-selection, we follow the approach developed by Lee, 1983 (see also Falaris, 1987). First, we estimate a reduced form multinomial logit (MNL) model, where the migration decision is estimated as a function of attributes in g_i and x_i. Then, the net income equation is estimated for each migration alternative with a selectivity correction term calculated from the reduced form MNL model. Finally, the expected net incomes are calculated as linear predictions $\ln \hat{w}_{ij} = \hat{b}_j ' x_i$, where ^ denotes estimated values, and are inserted into equation (1).[3]

Another potentially important problem remains, namely the above procedure can lead to measurement errors in the prediction of the expected net income. To attempt to control for this, the parameter of the expected net income, h_i, is assumed randomly distributed across individuals and migration choices. Thus, the additional disturbance in h_i can pick unexplained variation and hence ensures more efficient and accurate parameter estimates. In the empirical application below, the distribution of h_i is specified as normal with mean g and standard deviation s to be estimated. Thus, our model falls into the class of random parameters logit (RPL) models that can incorporate unobserved effects (see McFadden and Train, 2000).[4]

In the estimation of equation (1) we only have information on the explanatory variables and chosen alternative, but not the estimated parameters or random errors. Thus, we cannot condition on the h_i and the migration choice probabilities must be integrated over all possible values of h:

$$P(j) = \int_h \frac{\exp(U(i,j))}{\sum_{j=0}^{2} \exp(U(i,j))} g(h \mid g, s)\, dh, \tag{3}$$

where $g(h \mid g, s)$ is the density of h (McFadden and Train, 2000). The integral in the choice probability (3) cannot be evaluated analytically since it does not have a closed-form solution. Instead, it is approximated through simulation and the resulting simulated log-likelihood function is maximised (see, for example, Stern, 1997, for a discussion of simulation methods in estimation). In this study, the simulations are based on Halton draws to reduce simulation error (Train, 2000).

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[3] Similarly, the expected net income can be predicted as $w_{ij} = \exp(b_j x_i + w_j / 2)$, where w_j is the estimated standard deviation of the error term v_{ij} in equation (2). The result follows from the expected value properties of log-normal distributions (see, for example, Mood et al., 1974, p. 117).

[4] Random parameters ("mixed") logit models have been used, for example, in marketing, consumer and transportation research (Jain *et al.*, 1994; Brownstone and Train, 1999; and Hensher, 2001), but, to our knowledge, they have not been applied to migration problems.

3 Data and variables

The main data set used in the empirical study is a one-percent random sample from the Finnish Longitudinal Census File. Statistics Finland has combined the population census with various employment registers maintained by labour administration. This study mainly utilises data from the years 1993–1995. The socioeconomic status of the sample individuals and their spouses is well documented in the data set. It includes detailed information on personal and family status, labour market record and regional characteristics, including individual's region of residence at the NUTS4 subregion level.[5] One limitation of the data set is that it does not allow us to use households as the unit of analysis, because we do not know which individuals belong to the same households. However, we do have wide range of household variables, which should control for the dependencies in the migration decision-making.

Importantly, the place-of-residence data allows us to focus on the individuals who were living in the peripheral regions of Finland in 1993. In this study the peripheral regions include all other regions, except for Helsinki, Porvoo, Salo, Tampere, Turku, Vaasa, Jyväskylä, Kuopio and Oulu. Herein, these nine regions are referred as growth-centre regions.[6] This regional division is also utilised in the dependent variable of the analysis. Namely, an individual is classified as a growth-centre migrant (j = 2), if he moves in 1994 and the destination is one of the growth-centre regions. An individual is classified as a periphery migrant (j = 1), if he moves in 1994 and the destination is one of the peripheral regions. Finally, an individual is classified as a stayer (j = 0), if no movement takes place in 1994.

In the estimation only individuals aged between 16 and 60 with a positive annual income in 1995 were included because we are interested in the effects of net income on migration.[7] After these restrictions and omitting observations with missing information we are left with 9,221 individuals. Of these, 8,948 individuals (97.0%) stayed in the region of origin, 127 individuals (1.4%) moved to another peripheral region and 146 individuals (1.6%) moved to a growth-centre region in 1994. As regards to their labour market status during the last

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[5] We used data from 84 subregions. The subregion of Åland was excluded, as it has many distinctive characteristics (for example self-regulation, isolated geographical location and a Swedish-speaking majority).

[6] The regional classification into growth-centre regions and peripheral regions was formed using information on the net migration rates and population figures: 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 in 1995. The division is not sensitive to the population size.

[7] An annual income greater than 1,000 euro was considered positive. 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 population. In addition, those who were students in 1995 were excluded from the working sample.

week of 1993, most of them were employed (76.8%) or unemployed (16.3%).

Table 1 presents the explanatory variables used in our empirical migration model. The variables include factors that have been found typically to affect migration behaviour (see, for example, Greenwood, 1985; and 1997). They control for the differences in the human capital, location, labour market status and costs of migration. All the explanatory variables, except for net expected income, are measured at the region of origin in 1993, that is, before the migration period (Figure 1).

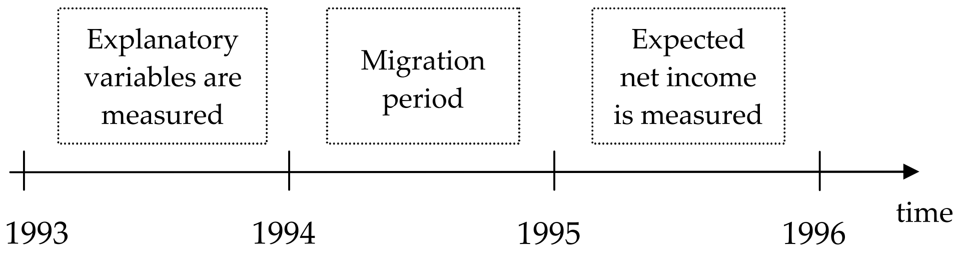

FIGURE 1 Composition of the data

To compute the primary variable of interest, the expected net income in 1995, we first merged our place-of-residence micro-data with taxation information on Finnish municipalities from the Finnish Tax Administration and calculated a proxy for the net income (see Appendix for details). This was necessary, as our micro-data does not include a direct measure of the net income earned by the individuals in 1995. Then we estimated net income equations that included selectivity correction terms calculated from a reduced form MNL model, as discussed in the text above.[8] Standard convention of specifying the income equations with education and experience as central explanatory variables was followed (see Appendix, Table A1, for the variables). However, the outcome was that we did not find evidence of self-selection in the income equation: the null hypothesis of no self-selection could not be rejected at the 0.05 level with t-test values of –1.478, 1.353 and –1.921 in the samples of stayers, peripheral migrants and growth-centre migrants, respectively.

[8] The selection model relies on the independence of irrelevant alternatives (IIA) assumption of the MNL model, which means that the probability ratio of any two alternatives is independent of any other alternatives (Hausman and McFadden, 1984). We tested the assumption in our reduced form MNL model with Hausman and McFadden, 1984, and Small and Hsiao, 1985, tests. Both tests could not reject the IIA assumption. In addition, appropriateness of the distinction between the periphery and growth-centre migration was checked with a pooling test (Cramer and Ridder, 1991). The test indicated significantly that these two migration alternatives cannot be pooled.

TABLE 1 Variable definitions and descriptive statistics

Variable	Scale	Definition	Mean
Sex	(0, 1)	1 = male; 0 = female	0.515
Age	Continuous	Age in years divided by 10	3.805
Age squared	Continuous	(Age in years divided by 10) squared	15.459
Lower secondary degr.	(0, 1)	1 = lower secondary degree; 0 = otherwise	0.377
Upper secondary degr.	(0, 1)	1 = upper secondary degree; 0 = otherwise	0.202
Lower academic degr.	(0, 1)	1 = lower academic degree; 0 = otherwise	0.089
Higher academic degr.	(0, 1)	1 = higher academic degree; 0 = otherwise	0.044
Married or cohabiting	(0, 1)	1 = married or cohabiting; 0 = otherwise	0.759
Spouse employed	(0, 1)	1 = married or cohabiting and spouse's main activity is employment during the last week of 1993; 0 = otherwise	0.499
# children under 7	Continuous	Number of children under age 7	0.296
# children aged 7-18	Continuous	Number of children aged 7-18	0.556
Homeowner	(0, 1)	1 = homeowner; 0 = otherwise	0.565
Work experience	Continuous	No. of months of employment during 1987–93 divided by 10	6.450
Work experience squared	Continuous	Work experience squared	47.658
Employed	(0, 1)	1 = main activity is employment during the last week of 1993; 0 = otherwise	0.768
Unemployed	(0, 1)	1 = main activity is unemployment during the last week of 1993; 0 = otherwise	0.163
Commuting	(0, 1)	1 = commuting from the municipality in the last week of 1993; 0 = otherwise	0.328
Reg. rate of unempl.	Continuous	Regional rate of unemployment, %	23.824
Share of service workers	Continuous	Share of employed labour force in services	6.817
Living in reg. of birth	(0, 1)	1 = living in region of birth; 0 = otherwise	0.574
Distance to the closest growth-centre	Continuous	Individual's dist. to the closest growth-centre using distances by road (10 km)	10.993
Municipal tax	Continuous	Population weighted average of municipal taxes in the region of residence	17.662
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.	1.653
Ln(predicted net annual income)	Continuous	Natural logarithm of predicted annual net income for 1995 (1,000 euro) in the three migration alternatives; see Appendix, Table A1.	2.151 (alt.0) 2.074 (alt.1) 2.095 (alt.2)

Notes: All variables measured at the region of origin in 1993 if not otherwise stated. Number of observations: N = 9,221. Reference category for the educational dummies is primary education. Individual's distance to the closest growth-centre region was calculated as follows: First the distance between two regions was calculated by using a distance matrix based on municipalities (Source: Finnish Road Administration). Then in each subregion the most populated municipality was chosen to represent the location of the region.

Hence, we proceeded by estimating the income parameters with the standard ordinary least squares (OLS). Because the income parameters are not the focus of this paper, the results are only presented in Appendix (Table A1) and are not discussed further: they are merely used to generate expected net income for each individual in the three migration alternatives (see bottom of Table 1 for mean values).

4 Estimation results

Table 2 presents the estimation results of the random parameters logit model that corresponds to equations (1) and (3). Before considering the impact of the expected net income on the migration choices, we first briefly discuss the results for the control variables. By comparing the coefficients for the periphery and growth-centre migration alternatives, we can identify the factors, apart from the expected net income, which influence the decision to move and the destination choice of migrants.

As expected, Table 2 shows clearly that old people are less likely to move than young and that the highly educated are very likely to move to a growth-centre region (see also Ritsilä and Haapanen, 2003). Family considerations are also important determinants of migration. The results imply that spouse's employment reduces migration propensity for married individuals. A parent also becomes less willing to move to a growth-centre region in the presence of school-aged children. One can also be tied to a house, as might be the case for a homeowner. Our results indicate that owning a house reduces significantly the propensity to move to another peripheral region, but not to a growth-centre region.

An interesting outcome is that an individual's distance to the closest growth-centre region is positively and significantly related to migration. An explanation for this can be found in the literature that views migration and commuting as alternatives to each other (see, for example, van Ham, 2002). The further away in the periphery an individual lives, the further away from the higher employment and wider services and leisure activities of the growth centres (s)he lives. Therefore, migration becomes more likely compared to commuting and travelling to the growth-centres. This explanation is also in accordance with the finding that a higher share of workers significantly decreases the likelihood of migration to a growth-centre region. We also find that living in one's region of birth reduces willingness to move. Thus, it seems that individuals are attached to the region of birth.

TABLE 2 Parameter estimates of the random parameters logit model

	Alternative			
Non-random parameters	Periphery migration		Growth-centre migration	
Constant	1.094	(1.132)	-1.903	(1.121)
Age	-0.403**	(0.127)	-0.771**	(0.149)
Lower secondary degree	-0.582	(0.299)	0.903*	(0.424)
Upper secondary degree	-0.358	(0.408)	1.342**	(0.287)
Lower academic degree	0.201	(0.437)	1.630**	(0.343)
Higher academic degree	0.344	(0.577)	2.575**	(0.420)
Married or cohabiting	0.274	(0.341)	0.544	(0.290)
Spouse is employed	-0.752**	(0.253)	-0.557*	(0.251)
# children under 7	-0.106	(0.177)	-0.344	(0.185)
# children aged 7-18	-0.139	(0.159)	-0.703**	(0.208)
Homeowner	-0.967**	(0.208)	-0.347	(0.188)
Work experience	-0.123	(0.082)	0.040	(0.050)
Employed	0.174	(0.315)	-0.461	(0.283)
Unemployed	1.386*	(0.605)	0.426	(0.322)
Commuting	0.936**	(0.274)	1.780**	(0.250)
Regional rate of unemployment	-0.007	(0.027)	-0.024	(0.025)
Share of service workers	-0.447**	(0.120)	-0.181	(0.109)
Living in region of birth	-0.935**	(0.195)	-0.744**	(0.185)
Distance to the closest growth-centre	0.039**	(0.014)	0.047**	(0.015)
Initial earnings	-0.443**	(0.172)	-0.077	(0.150)
Normally distributed random parameter for expected net income:				
	Mean, g : 1.463* (0.719); Std. dev, s : 0.021 (0.942)			

Notes: Reference state is staying. First the estimated parameter is given, followed by the asymptotic standard errors in brackets. See Table 1 for the variable definitions and mean values. Log-likelihood: -1,155.47. Number of observations: N = 9,221. Replications for simulated probabilities (Halton): 500. * (**) = statistically significant at the 0.05 (0.01) level.

Personal unemployment seems to significantly enhance the likelihood of moving to the periphery, but not to a growth-centre (see also Kauhanen and Tervo, 2002). The insignificant result for regional unemployment is in line, for example, with the study on Finnish unemployed workers by Hämäläinen, 2002. The insignificance of most of these unemployment variables can also be explained by the fact that we have been able to control for factors that have been omitted in many previous studies (for example, spouse's employment status, person's work experience, earnings and distance to a growth-centre region). We also did not find any significant impact of municipal taxation on the migration propensity of individuals. Hence, the highly insignificant and small coefficients were omitted from the final model. The result is expected because the differences in the taxation are fairly small between regions in Finland (see Appendix) and thus the tax competition seems limited.[9]

Next let us proceed to the main explanatory variables, expected net income. As discussed earlier, the impact of the expected net income on migration was estimated with a normally distributed random parameter. Table 2 shows that the mean value of the parameter density, g , is significant at the 0.05 level, but no significant random variation in the income expectations parameter is found. This is reflected on the insignificance of the standard deviation, s . We also tried other densities besides the normal, namely triangular and uniform, but the results were very similar and therefore are not reported.

To quantify the impact of the expected net income on the likelihood of migration, Table 3 presents predicted migration probabilities that are calculated as averages over all observations. First, reference probabilities are calculated with the observed data. Then, we consider what would happen to the migration probabilities, if an individual's expected net income is increased by 10% and 25% in the staying and periphery migration alternatives (that is, if no move to a growth-centre region takes place). The results suggest that, on average, the 10% increase in the expected net income would increase individual's probability of staying in the region of origin by approximately 0.2% (0.18 percentage points), but it would have hardly any impact on the likelihood of moving to another peripheral region. Most importantly, the results suggest that the probability of growth-centre migration would decrease by 11.9%. The respective figures for the 25% increase in the expected net income are 0.4% (0.39 percentage points), 1.4% and -26.4%.

TABLE 3 Probabilities before and after a 10% and 25% increase in expected net income for an average individual

Alternative	Probability before an increase	Probability after 10% increase (Change, %)	Probability after 25% increase (Change, %)
Staying	0.9704	0.9722 (0.2%)	0.9743 (0.4%)
Periphery migration	0.0138	0.0139 (0.7%)	0.0140 (1.4%)
Growth-centre migration	0.0159	0.0140 (-11.9%)	0.0117 (-26.4%)

Notes: An individual receives the increase in the net income, if he does not move to a growth-centre region. Probabilities are simulated with 500 replications (Halton) using parameter estimates given in Table 2. The probabilities are calculated as averages over all observations.

[9] Another possible explanation for the insignificance is that we do not have information on the services provided by the municipalities (see discussion in Charney, 1993). However, the previous studies also suggest that income and welfare are more significant determinants of migration than taxation (see, for example, Islam, 1989, and Moffitt, 1992).

5 Discussion of policy implications

To discuss policy implication of our model, we consider two hypothetical income policy interventions that are only targeted at employed persons living in the four northernmost regions in Finland (see Figure 2). The policies try to reduce net-migration from periphery to growth-centre by increasing persons' expected net income by 10% and 25%, if they will not move to growth-centre regions (cf. Table 3). For example, the latter 25% growth could be achieved approximately by assuming that these persons do not have to pay municipal tax.[10]

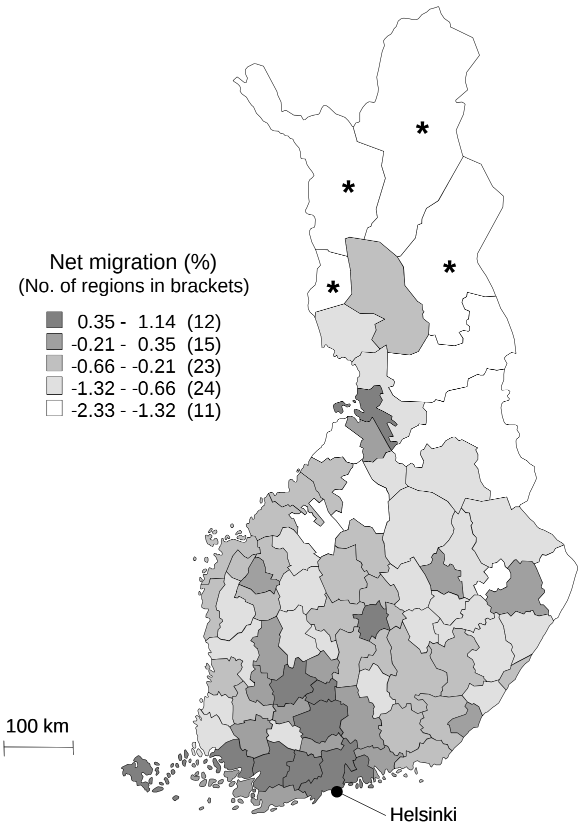

FIGURE 2 Net migration per population in 1999, % (Source: Statistics Finland's Kuntafakta; * indicates regions used in the policy analysis)

[10] 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.

Table 4 gives some rough estimates of the cost affectivity of such policy interventions for 1999. The costs will depend positively on the number of employed persons affected by the policy and their level of income, and negatively on the number of people deciding to move to the growth-centre regions during the policy. We can see from Table 4 that there were 26,898 employed persons living in those four regions and that their average annual net income was 9,137 euro in 1999. If we assume that 1.41 percent of the individuals move to a growth-centre, as in our sample data for these four regions, then the two income policy interventions would cost approximately 24.238 and 60.569 million euro, respectively. In practice, the costs would be probably slightly lower, since out-migration to the growth-centre would diminish as a result of the policies (see Table 3).

TABLE 4 Approximate costs and effects of two income policy interventions for 1999

	Without the policy interventions [1]	10% increase in annual net income	25% increase in annual net income
Costs			
Employed individuals	26,898	26,898 [2]	26,898 [2]
Annual income per individual, euro	13,453	13,453 [2]	13,453 [2]
Annual net income per individual, euro	9,137	10,051	11,421
Annual costs per individual, euro	-	914	2,284
Total annual costs, million euro	-	24.191	60.422
Effects			
In-migration	1,927	1,927 [2]	1,927 [2]
Out-migration	3,284	2,890 [3]	2,139 [3]
Net in-migration	-1,357	-963	-212

Notes: The policy interventions are targeted at employed individuals living in the four regions that are given in Figure 2. [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 Table 3.

To evaluate the effects of the above policies on net-migration, we should first note that approximately only one third of Finnish migrants are employed and thus are directly affected by the policies. Second, Table 3 suggests that, on average, the migration from the peripheral regions would diminish by around 11% and 25% as a result of the first and second policies, respectively. Hence, our rough estimate is that, after the implementation of the two policies, the net out-migration from the four peripheral regions would fall by 394 and 1,145 individuals, resulting in the net in-migration deficit of 963 and 212, respectively (see Table 4). Our analysis, however, assumes that everything else remains unchanged. In practise, the policies would also attract more than just employed persons to stay in the four regions, for example, by increasing motivation of unemployed workers to search for a job. Moreover, it would presumably increase willingness to migrate to the regions where the policy is implemented. As regards to the cost affectivity of the income policy interventions, it seems that the increase in the annual net income required to stabilise the migration flows in the regions would have to be over 25%. Hence, even though the income policy interventions would slow down the concentration of the population, they appear to be very expensive compared to the potential results. However, the cost affectivity of an intervention policy could be improved, if it could be targeted at young individuals because, on average, they are more likely to move than older people and their levels of income are smaller.

Yet, there are other problems with such income policy interventions. Firstly, if they are targeted only on some of the peripheral regions, equality between individuals and regions is at stake. Thus, co-operation between regions may suffer from the unequal treatment of the regions. Secondly, there is also a large pool of unemployed workers in the peripheral regions and therefore their benefit from the policy interventions may remain relatively small. Finally, the affectivity of such policies may depend on the economic trend because migration flows have been found to increase during economic upturn and decrease during recession (see, for example, Milne, 1993; and Pekkala, 2000). The data set used covers only years of economic recession and therefore our results may not apply in general.

6 Conclusion

In this paper, we have analysed migration behaviour of individuals who live in the peripheral regions of Finland. The focus has been on the migration-impact of income policy interventions. We have shown that the decision to migrate can be affected by net income expectations, as the human capital theory predicts. For example, a policy that increases an individual's expected net income by 10%, if he will not move to a growth-centre region, would decrease his probability of growth-centre migration by around 12%.

However, the costs of such income policy interventions are very high. Therefore, they have to be targeted carefully. We think that a policy would be more cost-effective, if it could be targeted at young individuals because they are more likely to move than older people and their levels of income are on average smaller. In addition, it is important to improve the level of services and infrastructure in the peripheral regions, so that people are willing to stay there after the policy intervention is no longer operative. For example, it might be sensible to invest on people working in (nursery) schools and public health care.

Appendix

Constructing net income

Measure of the net income was constructed using information on the Finnish tax system from the Finnish Tax Administration. Figure A1 illustrates how earned income was taxed in Finland in 1995. Mean values of municipal and church taxes were used in producing the figure. 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, he had to pay approximately 20% in taxes.

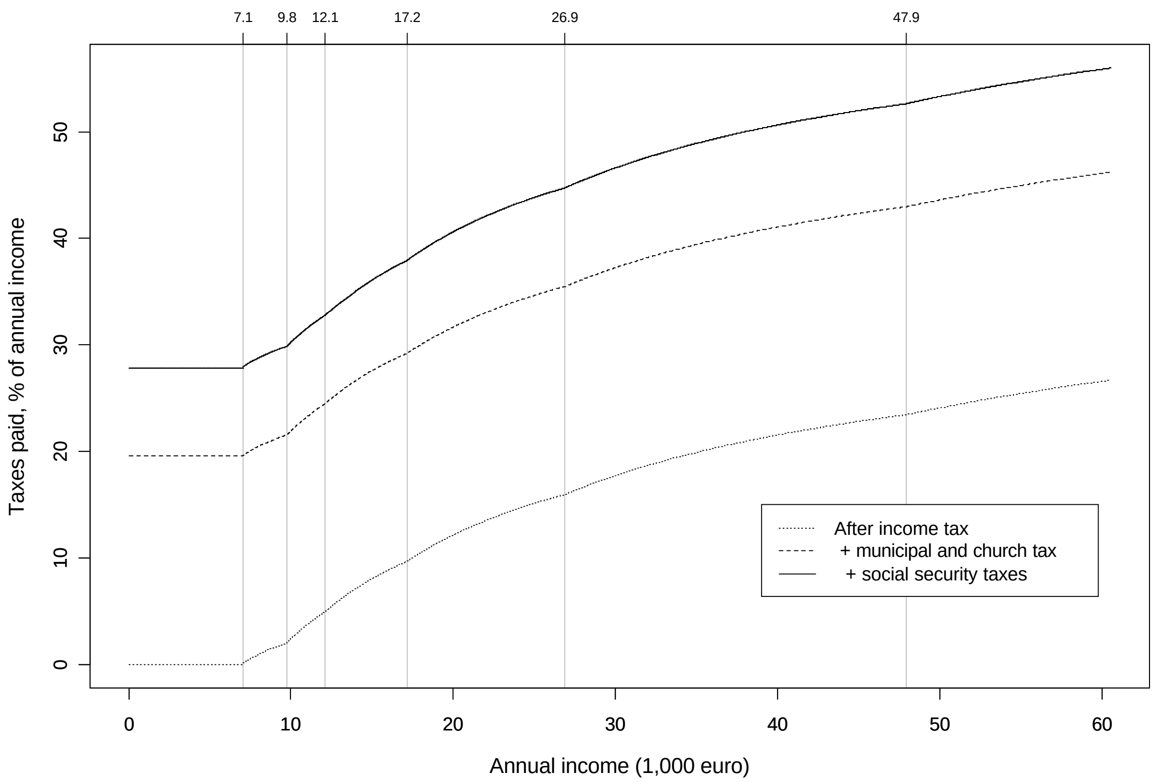

FIGURE A1 Illustration of progressive taxation in Finland in 1995

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. The members of the Finnish Evangelical Lutheran and Orthodox churches pay Church tax. These tax 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%.

Hence, an individual's net income in 1995 was calculated by subtracting the state, municipal, church, and social security taxes from the earned annual income. Possible tax deductions were not taken into account in the calculations. Due to us knowing which region an individual lives, but not in which municipality, we had 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 their region.

TABLE A1 Ordinary least squares estimates of the net income equations

Variable	Sample in the estimation of net income equation					
	Stayers		Periphery migrants		Growth-centre migrants	
Constant	0.901**	(0.093)	1.191	(0.791)	0.414	(0.934)
Sex (male = 1)	0.226**	(0.013)	0.167	(0.120)	0.065	(0.124)
Age	0.249**	(0.054)	-0.086	(0.525)	0.948	(0.615)
Age squared	-0.031**	(0.007)	0.016	(0.074)	-0.123	(0.083)
Lower secondary degree	0.092**	(0.016)	0.304	(0.162)	-0.354	(0.234)
Upper secondary degree	0.225**	(0.019)	0.657**	(0.166)	0.184	(0.209)
Lower academic degree	0.454**	(0.026)	0.879**	(0.196)	0.309	(0.251)
Higher academic degree	0.727**	(0.034)	1.258**	(0.261)	0.417	(0.273)
Married or cohabiting	0.083**	(0.018)	-0.258	(0.136)	-0.156	(0.142)
# children under age 7	-0.087**	(0.011)	0.057	(0.095)	-0.208	(0.120)
Unemployed	-0.171**	(0.031)	-0.316	(0.182)	-0.057	(0.185)
Employed	0.387**	(0.030)	-0.272	(0.184)	0.255	(0.179)
Work experience	-0.022	(0.012)	0.137	(0.097)	0.005	(0.110)
Work experience squared	0.008**	(0.001)	0.001	(0.010)	0.002	(0.012)
Dist. to closest growth-centre	-0.003**	(0.001)	0.000	(0.008)	-0.012	(0.008)
R^2	0.308		0.422		0.267	
t-test for self-selection	-1.478		1.353		-1.921	
Number of observations	8,948		127		146	

Notes: Dependent variable: ln(net income in 1995). First the estimated parameter is given, followed by the standard errors in brackets. All variables measured at the region of origin in 1993; see Table 1. * (**) = statistically significant at the 0.05 (0.01) level.

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SUMMARY IN FINNISH (YHTEENVETO)

Tämä väitöskirja esittelee viisi empiiristä tutkimusta, jotka tarkastelevat alueellista muuttokäyttäytymistä ja väestön keskittymistä. Tutkimusaineistona käytetään pääsääntöisesti suomalaista pitkittäisaineistoa vuosilta 1993 – 1996. Tutkimuskysymystä lähestytään useiden kehittyneiden yksilöekonometrisin menetelmin, joiden avulla pyritään varmistamaan tulosten luotettavuus.

Varsinaisia tutkimuksia edeltää johdantoluku. Siinä kuvaillaan ensin alueellista väestökehitystä Suomessa vuosien 1980 ja 2000 välisenä aikana. Aluekehitystä kuvataan muun muassa luonnollinen väestönkasvun, maansisäisen muuttoliikkeen, siirtolaisuuden, huoltosuhteen ja väestötiheyden avulla. Sitten johdanto esittelee aikaisemman muuttopäätöstä selittävän kirjallisuuden sekä keskustelee lyhyesti väitöskirjan tutkimusmenetelmät ja sen keskeiset tulokset.

Toinen luku tarkastelee työmarkkinoilla suoriutumisen vaikutusta muuttamiseen. Vertailuryhmä on muodostettu muun muassa iän, koulutuksen ja työkokemuksen mukaan. Tulokset antavat ymmärtää että työmarkkinoilla suoriutuminen ei vaikuta muuttoalttiuteen, pois lukien syrjäseudulla asuvat naiset: heikosti suoriutuminen kasvattaa heidän muuttoalttiutta. Kolmannessa luvussa mielenkiinnon kohde on odotettu suoriutuminen tulevaisuudessa. Tulosten mukaan odotettavissa olevat tulot vaikuttavat merkitsevästi muuttoalttiuteen, mutta vaikutus on pieni.

Neljäs luku painottaa korkeasti koulutettujen muuton vaikutusta inhimillisen pääoman jakautumiseen Suomessa. Tutkimuksen tulokset osoittavat, että muuttoliike on valikoivaa koulutuksen suhteen. Korkeasti koulutetut ovat herkempiä muuttamaan kaupunkialueille, jotka tarjoavat paremmat työllistymismahdollisuudet sekä runsaasti vaihtoehtoja itsensä kehittämiseen ja vapaa-ajan harrastuksiin.

Viiden luku tutkii havaitsemattomien tekijöiden mallintamista ja niiden vaikutusta muuttopäätökseen. Tulosten mukaan satunnaisparametrinen logit-malli voi antaa realistisemman kuvan muuttokäyttäytymisestä kuin tavallinen kiinteäparametrinen logit-malli. Luvussa kuusi hyödynnetään satunnaisparametrista mallia tutkittaessa tulopoliittisten interventioiden mahdollisuuksia vaikuttaa syrjäseudulla asuvien henkilöiden muuttopäätökseen. Tutkimuksen tulosten mukaan tulopoliittisilla interventioilla voidaan vaikuttaa muuttokäyttäytymiseen esimerkiksi kasvamalla henkilön odotettuja tuloja. Tulosten mukaan sellaisten interventioiden kustannukset voivat olla hyvin korkeat suhteessa vaikuttavuuteen.

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