# Regional Sorting of Human Capital – the Choice of Location among Young Adults in Sweden*

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**Abstract**

Migration rates are highest among young adults, especially students, and their location choices affect the regional distribution of human capital, growth and local public sector budgets. Using Swedish register data on young adults, the choice of whether to enroll in education and the choice of location are estimated jointly. The results indicate a systematic selection into investment in further education based on school grades and associated preferences for locations with higher per capita tax bases. For students, the estimates indicate lower preferences for locations with higher shares of older people. The importance of family networks for the choice of location is confirmed.

**Key words:** Agglomeration; human capital; local public sector; location choice

**JEL classifications:** R23; J24; J61

*This work was supported by the Swedish Research Council, Linnaeus Grant and Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS). The authors are grateful for excellent proofreading and editing by Cyndi Berck, and helpful comments from Thomas Aronsson, Jörgen Hellström, Magnus Wikström and four anonymous referees. Sofia Tano thanks the Graduate School in Population Dynamics and Public Policy, Umeå University for financial support.

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## 1. Introduction

Many regions within OECD countries face increasing public expenditures due to ageing populations, accompanied by insufficient growth in regional tax bases (EU, 2010). At the same time, young adults, especially university students and graduates, are migrating away from areas of economic decline and a high share of senior citizens, choosing instead to live in metropolitan areas in growing regions (see, e.g., Jackman and Savouri, 1992; Tervo, 2000; Faggian and McCann, 2009; Bjerke, 2012).[1] The combination of these trends is likely to affect the capacity of declining regions to cope with the financial pressure of ageing populations. The decisions of young people affect this process because younger people have both higher rates of investment in human capital and higher rates of migration (see, e.g., Haapanen and Tervo, 2012). Enrollment in tertiary education has become a major factor underlying long distance migration. About half of the high school graduates in OECD countries enroll in tertiary education, in many cases migrating to a different region for school (OECD, 2009). In Sweden, the enrollment rate stands at 38 percent and is increasing. Previous research has shown that regional accessibility to university education affects both the probability for enrollment and mobility (see, e.g., Sá *et al*., 2004; Eliasson, 2006). Although Gibbons and Vignoles (2012) argue that while distance is of minor importance for participation in higher education, it is important for the choice of institution,

which is reflected in mobility and regional sorting of students. This paper jointly estimates the education and location choice of young adults starting out in Northern Sweden as a function of their prior educational performance, the characteristics, particularly the tax base and proportion of older people, in the regions they might migrate to, and many controls. Looking at the location choice and education jointly is important because those that choose university and those that do not both migrate at different rates and migrate to different places.

Earlier research shows that the educational level of the regional work force is positively correlated with growth in regional incomes and population growth (e.g., Glaeser *et al.*, 1995; Clark and Murphy, 1996; Glaeser and Saiz, 2004; Partridge *et al*., 2008; Whisler *et al*., 2008). Also, an individual's grade point average (GPA) in secondary school correlates positively with sorting into university education, mobility, and future income (e.g., French *et al.*, 2010). Because young people who migrate from rural regions to university towns typically do not return, the location decisions of young people have long-run implications for the population and age structure in rural areas, particularly for those far from urban labor markets. In fact, university graduates tend to locate in or near larger cities and metropolitan areas (e.g., Costa and Kahn, 2000; Elvery, 2010), thus reinforcing the differences in regional age distributions and local public sector finances.[2]

While there are many micro-data based studies of regional out-migration, few of them examine location choice in developed countries.[3] Knapp *et al*. (2001) examine the choice of location of intra-metropolitan and inter-metropolitan migrants in the U.S., and they distinguish between locations in central cities and suburbs for inter-metropolitan movers. Their findings are that there are "push" and "pull" factors of location attributes such as job growth and sunny days and that these factors work in the anticipated direction. Détang-Dessendre *et al.* (2008) studies the location choice in France for individuals of working age. They distinguish between three types of locations: urban, suburban, and rural, and find that young people are most attracted to large labor markets. Jauhiainen (2008) finds that highly educated couples in Finland are concentrated in the Helsinki metropolitan area and university cities.

The microdata in this study is from the Swedish population registers, which have exceptionally detailed data on the *whole* population. Among the data unique to the registry system are all past and present locations of all individuals and their relatives, early high school grades, and yearly employment history. The data are for two cohorts of individuals, living in Northern Sweden when they were 19 years old in 1993 and 1995, respectively. Northern Sweden contains many areas with large shares of older people, low tax bases, and slow growth. The individual's choice of residential location is observed when they are 22 years old.[4] These two cohorts are chosen because they entered the labor market or invested in further education under two different macroeconomic conditions. The older cohort was leaving the nest just after the Swedish economic downturn at the beginning of the nineties, while the younger cohort left home after the economic situation had turned around.

This study enlarges on earlier research in two major ways. Firstly, the data offers rich information on individual and family characteristics, such as individual performance in secondary school, the location of parents and siblings, and information on where families lived in the past. We are thus able to control for the individuals' ninth grade GPA as a measure of individual ability and of their potential for further investment in human capital after leaving high school. To the extent school grades correlate with productivity in a broad sense, we may identify a crucial feature of regional allocation of human capital. The location of close relatives is an important piece of information because it reflects family ties, place attachment, access to information, and other network utilities (see e.g. Moilanen, 2009; Mulder and Cooke, 2009). In addition to information on the individual's school achievement, the Swedish population register data also allow controls for the parents' educational attainment and the individual's attachment to the labor market at a young age. All are important attributes for identifying the selection into higher education and location outcomes. Secondly, the interrelation between the decision to

enroll in further education and the choice of location is considered simultaneously within a nested logit framework.

Our results confirm the expected positive sorting on GPA in secondary school into enrolment in further education. But they also indicate that young individuals who invest in further education prefer locations with a lower share of the population above retirement age. In contrast, this association is not consistently observed for non-students. Another finding is that young adults are attracted to locations with higher tax bases. We also find strong support for the importance of family related place attachment for the location choice of the young adults.

In the next section, the concept of location choice is discussed. Data and descriptive statistics are presented in section three. Empirical method and results are provided in sections four and five respectively. Section six concludes.

## 2. Location choices

In the economic theory of residential location choice, individuals are assumed to choose locations that maximize subjective utility given the attributes of locations, individual preferences and different types of restrictions, including incomplete information (e.g. Greenwood, 1997). Theory and empirical findings show that the latent propensity for migration increases at key life-cycle events: nest leaving, enrolment in higher education, entering the labor market and family formation (see e.g. Mulder and Wagner, 1993; Clark and Whiters, 2008). A major problem in empirical applications is that individual preferences and restrictions are not directly observed. Empirical studies rely on revealed preferences derived from actual behavior, or stated preferences from surveys. Individual heterogeneity in preferences is one reason to include observable attributes such as age, education, and indicators of place attachment in empirical models. These indicators may also be useful as restrictions, e.g. education and the locations of friends and relatives may reflect heterogeneity in availability of information. Generally, empirical modeling of location choice benefits from control for life-cycle specific events and rich information on individual attributes including information on the family.

Another fundamental problem in interregional location modeling is the definition of a relevant individual choice set. Theoretically, virtually all places on the planet are possible locations. In reality, the observed choices are strongly determined by the initial location and limited to a relatively few regional destinations.[5] Within this limited choice set, there is stability in the origin-destination flow pattern, at least in the short run. Most people stay put, most migrants move short distances, and long distances moves are mainly headed to the largest population concentrations within a region and to the nation's largest cities. In the Nordic countries, as well as in many other developed countries, decentralization of higher education has

created regional university towns which have become growth centers and expanding commuting areas, and have become increasingly attractive as locations, not only for students.

The most probable choices of an individual will differ depending on the initial location. In Sweden, as in many other countries, this is partially due to the big difference in the general spatial population distribution of regions and substantial regional differences in distances between cities/urban areas in other parts of the country. This is reflected in observed origin-destination migration patterns. The present study is based on a sample of young individuals starting out in northern Sweden. This region has a population of about 500,000 and represents a mixture of rural and urban locations with large variation in regional attributes, ranging from a sparsely populated and economically depressed inland to growing urban areas with university towns on the Bothnian coast. There are relatively large migration flows over longer distances within the region, as well as a considerable migration interchange of young people with the rest of Sweden. The gross outflow destinations are primarily neighboring locations and the metropolitan area of Stockholm.

Thus northern Sweden shares features with many regions in Europe and the US, where depopulation of rural areas is accompanied by growth of vital cities within the region. In Sweden, residents of the growing but smaller cities enjoy on average living standards similar to the average of the population in the rest of the country.

## 3. Data

The register data used in this study comes from the population registers of Statistics Sweden (SCB) and is obtained through the Linnaeus Database, which allows us to connect individuals with their respective family members.[6] Apart from having an individual ID, all individuals also have a family ID, making it possible to sort out information on parents, siblings, and partners. The sample encompasses two different birth cohorts: all individuals born in 1974 and 1976 and who at age 19 were residents in the northern part of Sweden comprising the counties of Västerbotten and Norrbotten (Region SE-08 according to the European NUTS2-classification).[7] The definition of the choice set of locations is based on commuting patterns and observed migration flows in previous years. Table 1 shows the coding of seventeen locations in the choice set, four within the region of origin and thirteen in the rest of Sweden.

**Table 1.** The choice set.

| **Locations within region of origin SE-08** |
|---|
| 1. Urban centers; *Umeå, Skellefteå, and Luleå* |
| 2. Other municipalities at the coast; Nordmaling, *Robertsfors, Kalix, Piteå,* and *Haparanda* |
| 3. Municipalities within commuting distance to *Umeå and Luleå* |
| 4. Small municipalities within region of origin. |
| **Locations in the rest of Sweden** |
| 5. North-Central Sweden: Urban centers; *Gävle, Sundsvall, Örnsköldsvik, and Östersund* |
| 6. North-Central Sweden: Municipalities with costal border; T*imrå, Härnösand, Kramfors, Nordanstig, Söderhamn, and Hudiksvall* |
| 7. North-Central Sweden: small municipalities |
| 8. Eastern Sweden: Stockholm with surrounding municipalities |
| 9. Central Sweden: Urban centers with Universities; *Uppsala, Linköping, Karlstad, and Örebro* |
| 10. Central Sweden: Large municipalities w/o University; *Nyköping, Eskilstuna, Norrköping, Västerås, Falun,and Borlänge* |
| 11. Central Sweden: small municipalities |
| 12. Southern Sweden: Malmo with surrounding municipalities |
| 13. Southern Sweden: Other large municipalities; *Jönköping, Kalmar, Växjö, Karlskrona, Helsingborg, and Kristianstad* |
| 14. Southern Sweden: Other municipalities, Southern Sweden |
| 15. Western Sweden: Göteborg with surrounding municipalities |
| 16. Western Sweden: Other large municipalities; *Halmstad, Varberg, Uddevalla, Trollhättan, Borås, and Skövde* |
| 17. Western Sweden: small municipalities. |

The initial locations are defined as places of residence at age 19. To capture the first move away from the childhood home, the choice of location of the individuals is observed at age 22. The particular points in time are chosen to set the age of the individuals at the initial location at 19, i.e. the age when the vast majority of the Swedish youth finishes three years of secondary school. In our sample, 95 percent have graduated from high school by the age of 20. Normally, the first move away from the parents takes place shortly after graduation from secondary education. A three year gap is chosen to allow for eventual lag in the decision to relocate. Individuals' recorded as living in the northern region at age 19 are observed at the age of 22 in one of the locations listed in Table 1, which includes the initial location. The alternative locations are finely graduated near the place of origin so as to include many local options and are more broadly aggregated for locations further away. Locations outside the region of origin are grouped by type (e.g. metropolitan areas, university towns) and distance from the home region. Although all municipalities are obliged by law to offer adult education, and all universities offer some distance education, locations with universities have been separated from those without such opportunities.

The empirical model includes two dependent variables; an indicator of whether or not the individual has enrolled in education, and an indicator of the choice of location. The former is a dummy variable which is equal to 1 if the individual received any student benefits

during 1996 (cohort 1) or 1998 (cohort 2), i.e., the same year as observations of the location choice.[8] The data does not allow differentiation between types of further education and therefore it may be either at the university level or complementary high school (i.e., vocational education).

*Explanatory variables*

The covariates in the empirical model measure individual characteristics at age 19, family characteristics, and attributes of locations. Individual characteristics include indicators of the young person's gender, employment history, and grade point average in ninth grade. Family characteristics include parents' education and the location of parents and siblings. In line with results from previous studies, the probability of continuing on to further education is expected to be larger for females, for those with more highly educated parents, and for those with higher grades. It is more of an open question as to whether or not labor force participation during high school education is predictive of further schooling. Many Swedish high school students participate in work, part time at night, weekends and school breaks. Therefore they may be eligible for unemployment benefits. On one hand, employment during high school could indicate a higher opportunity cost of enrolling in education or, for other reasons, an early decision not to pursue additional investment in education. On the other hand, finding a job and work extra hours is an extra-curricular activity and may be evidence of high ambition, speaking in favor of a higher probability of further education. The effect of receiving unemployment benefits and participation in labor market programs can be interpreted in a similar fashion. These variables may indicate a lower opportunity cost of education, although it seems reasonable to believe they signal a lower probability of further investment in education.

The data on the locations in the choice set includes "general" attributes of locations, such as tax base, and "specific" attributes, which are related to location but vary with each individual. The person-specific location attributes include the presence of a parent or sibling in the location, which is expected to be attractive, as discussed in Section 2. All regional variables are measured at the respective locations in the choice set when the individual is 19 years old. The individual is believed to observe the attributes of the alternatives at age 19, when making the joint decision of enrolment or not, and whether and where to migrate. Variable definitions and descriptive statistics are given in Tables 2 and 3.

**Table 2**.Definitions of variables.

| **Individual attributes** | **Description** |
|---|---|
| *Female* | Dummy variable, equal to one if female. |
| *Youth is unemployed at age 19* | Dummy variable, equal to one if individual received unemployment benefits at age 19. |
| *Youth's income at 19* | Income from employment, in hundred SEK at age 19. |
| *Labor market program* | Dummy variable, equal to one if individual participated in a labor market program. |
| *Grade 9th grade* | The average grade of the individual from 9th grade in Swedish, English and Mathematics. Ranges from 1-5. |
| *Parents education* | Years of education for the parent with the highest educational attainment. |
| *Student* | Dummy variable, equal to one if individual received student benefits/grants at age 22. |

| **Attributes of Locations** | **Description** |
|---|---|
| *Density* | The average population density (persons/km$^2$) over the municipalities in a choice. |
| *Tax base* | The average tax base per capita over the municipalities in a choice. |
| *Employment rate* | The employment rate, in percent over the municipalities in a choice. |
| *Admission places* | The average number of admission places to higher education over the municipalities in a choice. |
| *Share of 65+* | The average share of population older than 65 over the municipalities in a choice. |
| *Parent in location* | Dummy variable, equal to one for a location, other than the individuals location at age 19, if the individual has a parent living in the location. |
| *Sibling in location* | Dummy variable, equal to one if the individual has a sibling living in the location. |
| *Parent in past location* | Dummy variable, equal to one if the individual has a Parent living in the location either in 1970 or in 1980. |
| *Distance* | The bird distance, in km, between locations (population centers). |

Note: All attributes measured when individuals' are 19. Attributes of potential locations pertain to each element in the choice set.

It can be noted that the older cohort has a much larger share of participants in labor market programs and unemployment experience, reflecting the worse macro-economic conditions at the time. The regional *Tax base* is determined by per capita income from employment (including self-employment). It may be problematic to incorporate this variable with other regional attributes in estimations. To some extent it is expected to reflect wage levels, employment rates, age structure, and the value of property in a location. Even if higher per capita tax base generally signals a thriving economy with positive net migration, it may also signal a higher regional price level or other types of congestion costs which means that the sign of the estimated parameter is indeterminate *a priori*.[9]

**Table 3a.** Descriptive statistics of individual attributes.

| **Variables** | **1974** Students | | Non-students | | **1976** Students | | Non-students | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std dev | Mean | Std dev | Mean | Std dev | Mean | Std dev |
| *Youth's income at 19** | 188.6 | 220.3 | 298.8 | 345.9 | 192.3 | 215.7 | 301.1 | 343.4 |
| *GPA from grade 9** | 3.61 | 0.56 | 2.94 | 0.63 | 3.57 | 0.57 | 2.95 | 0.60 |
| *Parents' Education** | 13.33 | 3.10 | 11.79 | 2.66 | 13.27 | 2.98 | 12.01 | 2.67 |
| *Female* | 0.57 | | 0.43 | | 0.57 | | 0.41 | |
| *Youth unemployed* | 0.03 | | 0.14 | | 0.01 | | 0.05 | |
| *Labor market program* | 0.21 | | 0.40 | | 0.08 | | 0.13 | |
| *Share of movers* | 0.33 | | 0.15 | | 0.34 | | 0.15 | |
| *N* | 2825 | | 4161 | | 2414 | | 3303 | |

*Personal income is measured in hundreds SEK. Parent education is in years. Grading scale 1-5 with 5 being highest.

**Table 3b.** Descriptive statistics of regional attributes (cohort 1974).

| Location | *Density Persons/km$^2$* | *Tax base per capita** | *Employment rate** | *Admission places* | *Share of 65+* |
|---|---|---|---|---|---|
| **1** | **30.6** | **94** | **68.3** | **5850** | **0.143** |
| **2** | **9.7** | **81** | **64.4** | **465** | **0.185** |
| **3** | **6.7** | **82** | **70.7** | **358** | **0.213** |
| **4** | **1.5** | **83** | **66.7** | **244** | **0.212** |
| 5 | 30.3 | 94 | 70.5 | 3396 | 0.177 |
| 6 | 19.3 | 85 | 69.2 | 716 | 0.201 |
| 7 | 7.4 | 80 | 70.5 | 349 | 0.225 |
| 8 | 767.1 | 108 | 73.3 | 3260 | 0.124 |
| 9 | 74.1 | 93 | 67.9 | 9489 | 0.163 |
| 10 | 72.0 | 93 | 68.0 | 3052 | 0.176 |
| 11 | 33.3 | 84 | 69.7 | 372 | 0.195 |
| 12 | 312.8 | 92 | 70.2 | 2719 | 0.145 |
| 13 | 103.0 | 89 | 69.3 | 3567 | 0.183 |
| 14 | 41.6 | 81 | 71.8 | 522 | 0.194 |
| 15 | 240.4 | 93 | 72.7 | 3462 | 0.139 |
| 16 | 83.3 | 89 | 70.0 | 2495 | 0.180 |
| 17 | 30.2 | 81 | 74.1 | 445 | 0.202 |

* Choices 1-4 pertain to locations within Northern Sweden, SE-08. The tax base is measured in thousands SEK. Employment rate is in %.

The population density of a location may be a signal of an attractive place (possibly because of amenities) and may therefore attract the young, which also goes for the employment rate, at least for non-students.[10] Finally, the percentage of regional population over the age of sixty five in an area may discourage in-migration and promote out-migration of young people for the following reasons: 1. Young people are discouraged due to the economic infrastructure needed to sustain the older population; 2. It is a negative measure of young population and their economic infrastructure – certain cultural and sporting facilities, schools, bars, etc.; 3. It measures latent characteristics of the shrinking population in economically depressed locations, i.e. a proxy for employment decline in regions dependent on natural resource industries. Presumably, the number of admission places into tertiary education will be important for decision making,

especially for the individuals that decide to enroll in higher education now, or consider enrolment in the future.

Distance between locations is correlated with direct costs for migration and information costs. Probably more important, distance is still a main determinant of costs for important social interactions despite new technologies of communication. Locations further away are generally associated with higher costs. This may not be true if family members or closest friends are located in distant locations. Locations of friends are not observed, but the data do allow us to control for the locations of parents and siblings (Indicated by the dummy variables *Sibling in location* and *Parent in location*). In addition, data includes observations of the parents' place of residence in 1970 and 1980. The variable *Parent in past location* indicates whether at least one of the parents has lived in a location in 1970 or 1980 (i.e. in the individual's childhood). It captures a family connection to a specific location in the past. However, the family connection variables are coded to one only for locations outside the location where the individual lived in the year of 1993 or 1995. This is to avoid having the variables reflect the decision to stay put.

The empirical model controls for distance between the initial location and other locations in the choice set. For the alternative of staying in the initial location, the migration cost is zero, but there are still non-zero costs for social interactions. Assuming a large share of the social network to be located within the initial region of residence, the distance related cost for interaction will depend on the spatial structure of these regions. Individuals living in metropolitan areas or in larger cities have relatively lower interaction costs within the region because of shorter distances and access to effective public transportation. In geographically large regions with long distances between urban areas, the cost for communication and social interaction is higher. Given that social interaction costs are non-zero for all locations in the choice set, a social interaction cost is proxied also for the initial location as the log of average distance between major urbanisations within the region.[11]

**Table 4.** Location choices in percent for the two cohorts.

| | **All** | | ***Students*** | | ***Non-Students*** | |
|---|---|---|---|---|---|---|
| *Location* | *1974* | *1976* | *1974* | *1 976* | *1974* | *1976* |
| **1** | **49.1** | **50.7** | **58.8** | **58.0** | **42.5** | **44.5** |
| **2** | **12.9** | **12.2** | **7.9** | **7.9** | **16.2** | **15.8** |
| **3** | **8.2** | **7.4** | **5.7** | **5.7** | **10.0** | **8.9** |
| **4** | **17.4** | **15.9** | **7.5** | **8.3** | **24.1** | **22.3** |
| 5 | 1.0 | 1.2 | 1.5 | 1.8 | 0.6 | 0.6 |
| 6 | 0.2 | 0.4 | 0.4 | 0.6 | 0.1 | 0.2 |
| 7 | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | 0.3 |
| 8 | 3.8 | 4.3 | 4.9 | 4.8 | 3.1 | 3.8 |
| 9 | 2.4 | 2.7 | 5.2 | 5.3 | 0.5 | 0.6 |
| 10 | 0.7 | 0.7 | 1.0 | 1.3 | 0.5 | 0.2 |
| 11 | 0.4 | 0.7 | 0.6 | 1.1 | 0.3 | 0.4 |
| 12 | 0.7 | 0.7 | 1.3 | 1.1 | 0.3 | 0.4 |
| 13 | 0.5 | 0.4 | 1.0 | 0.7 | 0.1 | 0.1 |
| 14 | 0.4 | 0.6 | 0.5 | 0.6 | 0.3 | 0.6 |
| 15 | 1.5 | 1.2 | 2.5 | 1.7 | 0.9 | 0.8 |
| 16 | 0.4 | 0.5 | 0.7 | 0.8 | 0.2 | 0.3 |
| 17 | 0.1 | 0.3 | 0.1 | 0.3 | 0.1 | 0.2 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Note: Choices 1-4 pertain to locations within Northern Sweden, SE-08. See Table 1 for definitions of locations.

Table 4 gives the distribution of the location choices made by the two cohorts at age 22. The noticeable features of the table are the tendency to stay near home, the attractiveness of the big cities, particularly Stockholm, and the attractiveness of the university towns for those who enroll in further education. As in other studies of interregional migration, the lion's share of the sample stay put. For the first cohort, the proportion of non-movers out of the region is 80 percent of those who study and 93 percent of non-students. The second cohort seems to be slightly more mobile where the corresponding numbers of non-movers are 80 percent for students and 91 percent for non-students. So in gross terms, enrolment in education is on average associated with a ten percentage point increase in the rate of exit from the initial region. As expected, there is also a strong concentration in the cities at the coast (location 1). Location 1 includes Umeå, with the largest university in the North, which is the destination of 59 (58) percent of students and 43 (45) percent of non-students in this study. Naturally, this pattern is in line with expectations - enrolment in further education is important for the choice of location.

## 4. Regression Methodology

The choice of whether to pursue further studies and the choice of residential location are assumed to be functions of deterministic elements, including characteristics of the individual, the family and attributes of locations.[12] Making no assumptions regarding a specific sequence between the two interrelated choices, the empirical model is specified and estimated as a nested logit model.

The nested logit (NL) model is part of the generalized extreme value (GEV) family of logit models (Ben-Akiva, 1973; McFadden, 1981). It provides partial relief from the Independence from Irrelevant Alternatives (IIA) assumption; the IIA holds within the nest but not across the nests (Train, 2009). An alternative GEV estimate is random parameters logit (RPL). While RPL potentially offers great generality, in practice the number of parameters that can be treated as distributions is limited to a very few. Below we will compare the NL to one feasible RPL and show that they agree on the effect of GPA on location. The NL model in this study is estimated using two nests. The group of all the places to live, while attending school, is one nest. The group of all places to live, while not attending school, is the other nest. Figure 1 shows this nested structure.

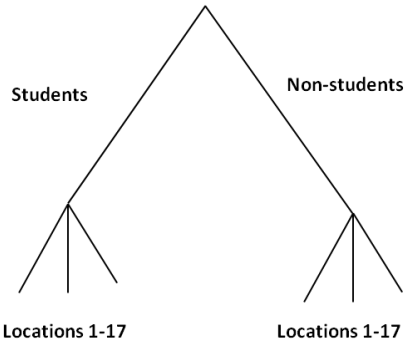


**Figure 1.** The choice tree for the individuals.

Nested logit estimates parameters beta, gamma, and lambda of the following probability model:

$$P_{nBki} = P_{nBk} * P_{ni|Bk} \quad (1)$$

In other words, the probability of observing choice i in nest $B_k$ is the probability of choosing nest $B_k$ times the probability of observing choice i, given that nest $B_k$ is chosen.
The standard formulas for these probabilities are:

$$P_{nBk} = \frac{e^{\gamma' z_{nk} + \lambda_k I_{nk}}}{\sum_{l=1}^{K} e^{\gamma' z_{nl} + \lambda_l I_{nl}}} \quad (2)$$

$$P_{ni|Bk} = \frac{e^{\beta' x_{ni|m}/\lambda_k}}{\sum_{j \in Bk} e^{\beta' x_{nj}/\lambda_k}} \quad (3)$$

$$I_{nk} = \ln \sum_{j \in Bk} e^{\beta' x_{nj}/\lambda_k} \quad (4)$$

Following Train (2009), utility for person n making choice i in nest $B_k$ can be written as the sum of utility that derives from (1) variables that are constant within the nest (2) from variables that are different for different choices within the nest and (3) from an error term. In our study the variables $Z_n$, for person n, are those variables that are constant for all alternatives within a nest; they are the covariates most likely to influence the choice to go to school and include the personal variables gender, unemployment, enrolment in a labor market program, income, GPA and parents' education. The variables $X_{ni}$ are the variables that determine location choice, given the school/no school choice. They include all the regional variables for the alternatives e.g. the share of elderly, tax base, admission places, and parents' and siblings' locations and are different for each alternative, i, within nest k. The chosen alternative is the alternative with the highest utility.

The interpretation of $I_{nk}$ is the expected utility from the choices within the branch $B_k$ where there are K branches. So the formula for the choice of branch includes the expected utility from the choices within the branch plus the added utility from the branch choice itself (the $\gamma'Z$ term). Estimation of the model is performed by full information maximum likelihood. The scale parameter, $\lambda_k$ shows the correlation of the alternatives within the nest. A higher value indicates less correlation and, when equal to one, it drops out and the model can be estimated as a standard logit.[13] Further, this method is used to generate parameter estimates that are consistent with the Random Utility Model (RUM).[14] When the scale parameter is within the unit interval, the model is consistent with the RUM.

## 5. Results

This section presents the coefficients of the explanatory variables with respect to the decision to invest in further education and the choice of location. Further analysis shows the marginal effects of certain variables of particular interest. These include one individual variable ($9^{th}$ grade GPA); two location variables (*Tax Base* and *Share of 65+*), and one location characteristic specific to individuals (presence of a parent or sibling in the location of choice.) Differences between the cohorts are discussed briefly, but there was not too much difference between the cohorts with respect to the variables of interest.

Estimation results from two alternative specifications are presented. They include measures of population density (specification 1) and distance (specification 2) interchangeably in the lower level of the model because convergence could not be reached when including both regressors. The scale parameters are within the range of 0 and 1 suggesting that they are consistent with the random utility model. They are also significantly different from one, which suggests that the nested logit is a better model than the multinomial logit.

**Table 5.** Nested logit estimates for enrollment in education.

| | Specification 1 | | Specification 2 | |
|---|---|---|---|---|
| | **1974** | **1976** | **1974** | **1976** |
| *GPA 9th grade* | 1.5971*** | 1.6105*** | 1.7440*** | 1.6652*** |
| *Parents education* | 0.1359*** | 0.0669*** | 0.1327*** | 0.0686*** |
| *Female* | 0.4009*** | 0.3027*** | 0.3561*** | 0.2813*** |
| *Youth is unemployed* | -0.6112*** | -0.6963*** | -0.5848*** | -0.6532*** |
| *Youth's Income* | -0.1436*** | -0.1782*** | -0.1399*** | -0.1764*** |
| *Labor market program* | -0.5290*** | -0.4134*** | -0.4756*** | -0.3952*** |
| *N* | 6986 | 6117 | 6986 | 6117 |

***, **, * = Significance at 1%, 5%, 10% level.

The estimates pertaining to the upper level of the model, i.e. the choice of whether or not to enroll in education, are given in Table 5. Most of the results are in line with expectations and confirm that a higher GPA and parents with higher education increase the probability of enrolment in education. The higher enrolment rates among females are clearly visible in the descriptive statistics for Sweden, but are evident also here when school grades and parents educational attainments are taken into account. Table 5 also shows that a 19-year-old is less likely to enroll in further education if he or she has participated in a labor market program, had relatively high earnings, or been unemployed. A plausible explanation is that these variables primarily reflect early attachment to the labor market because of a lower opportunity cost of working part time during high school education for those with vague or no plans for investment in education. Note that our indicator of unemployment has the pre-requisite of some employment in previous periods for eligibility for unemployment insurance. Overall, there are no differences in signs of estimated parameters and only marginal differences in the size of estimates between specifications.

**Table 6.** Nested logit estimates of location choice.

| | **Cohort 1974** | | **Cohort 1976** | |
|---|---|---|---|---|
| | (1) | (2) | (1) | (2) |
| **Non-students** | | | | |
| *Parent in location* | **0.6398*** ** | **0.1659*** ** | **0.2883*** ** | **0.1854*** ** |
| *Sibling in location* | **0.4962*** ** | **0.0189** | **0.3331*** ** | **0.0316** |
| *Parent in past location* | **0.6767** ** | **-0.0580** ** | **0.5849*** ** | **0.0138** |
| *Share of 65+* | **-0.2815*** ** | **0.0570*** ** | **-0.1137*** ** | **0.1282*** ** |
| *Admission places* | **-0.2555*** ** | **-0.0305*** ** | **-0.0730*** ** | **0.0090*** |
| *Tax base* | **0.1098*** ** | **0.0607*** ** | **0.0595*** ** | **0.0916*** ** |
| *Employment rate* | **-0.1231*** ** | **-0.0607*** ** | **-0.0928*** ** | **-0.1002*** ** |
| *Density* | **-0.0723*** ** | | **-0.0334*** ** | |
| *Distance* | | **-0.4927*** ** | | **-0.6100*** ** |
| **Students** | | | | |
| *Parent in location* | **0.3928*** ** | **0.8130*** ** | **0.3346*** ** | **0.7852*** ** |
| *Sibling in location* | **0.1710*** ** | **0.1911** ** | **0.1812*** ** | **0.2111*** ** |
| *Parent in past location* | **0.2168*** ** | **0.1761*** ** | **0.1645*** ** | **0.0546** |
| *Share of 65+* | **-0.1948*** ** | **-0.1198*** ** | **-0.1747*** ** | **-0.0596*** ** |
| *Admission places* | **-0.0153** ** | **0.1117*** ** | **-0.0266*** ** | **0.0874*** ** |
| *Tax base* | **0.0275*** ** | **0.0304*** ** | **0.0198*** ** | **0.0374*** ** |
| *Employment rate* | **-0.1436*** ** | **-0.0896*** ** | **-0.0970*** ** | **-0.0668*** ** |
| *Density* | **-0.0186*** ** | | **-0.0187*** ** | |
| *Distance* | | **-0.9120*** ** | | **-0.8611*** ** |
| *Scale Parameter Non-students* | **0.8149*** ** | **0.2173*** ** | **0.5009*** ** | **0.2472*** ** |
| *Scale Parameter Students* | **0.3277*** ** | **0.7816*** ** | **0.3150*** ** | **0.7021*** ** |
| PseudoR$^2$ | **0.2490** | **0.4329** | **0.2486** | **0.4366** |
| Log Likelihood Function | **-18500.6** | **-13968.7** | **-16206.8** | **-12151.9** |

***, **, * = Significance at 1%, 5%, 10% level.

Table 6 reports estimates from the two specifications of the lower level of the model. Because the Pseudo $R^2$ and log likelihood suggest that the specification including distance fits the model better, the results will be discussed primarily from that specification. Marginal effects pertaining to the four locations within Northern Sweden and the average of marginal effects for the other locations are presented in Table 7.

**Table 7.** Marginal Effects for variables *Share of 65+* and *Tax Base*, based on the estimates from specification (2)

| **Cohort 1974** | *Share of 65+* | | *Tax Base* | |
|---|---|---|---|---|
| Choice | Students | Non-students | Students | Non-students |
| 1 | -0.7019 | 1.0982 | 0.1778 | 1.2502 |
| 2 | -0.0308 | 0.0824 | 0.0078 | 0.0939 |
| 3 | -0.0161 | 0.3284 | 0.0041 | 0.3739 |
| 4 | -0.0115 | 0.5333 | 0.0029 | 0.6072 |
| Outside region | -0.0018 | 0.0036 | 0.0005 | 0.0041 |

| **Cohort 1976** | *Share of 65+* | | *Tax Base* | |
|---|---|---|---|---|
| Choice | Students | Non-students | Students | Non-students |
| 1 | -0.4402 | 2.0575 | 0.2759 | 1.4701 |
| 2 | -0.0251 | 0.4054 | 0.0157 | 0.2897 |
| 3 | -0.0147 | 0.3354 | 0.0092 | 0.2396 |
| 4 | -0.0076 | 0.8536 | 0.0048 | 0.6099 |
| Outside region | -0.0014 | 0.0052 | 0.0009 | 0.0037 |

**Note:** Marginal effects are calculated for changing 1 percentage point of elderly, and increasing tax base per capita with 1000 SEK.

The estimates indicate that locations with a higher per capita tax base are preferred. For students, the estimates indicate negative association between the share of older people and location choice. For non-students, this is not robust with respect to alternative specifications. Looking at marginal effects, they are highest for location 1 (i.e. the urban centers in the region). An increase of *Share of 65+* in location 1 by one percent is associated with a decrease in the number of students choosing this location by 0.7 percent. Again, the estimated "effects" do not necessarily imply causal effects but the estimates still reflect a systematic pattern of regional sorting of human capital. Due to high correlation between tax base and share of older people we tested alternative specifications, including using the quotient tax base/share of 65+ as a regressor. The results of these more restrictive specifications are consistent with the findings reported here. The estimates for *Admission places* are significantly positive for students in the estimations with the density variable while for the non-student the estimates are negative or close to zero. The parameters on *Employment Rate* have unanticipated negative signs.[15] For students, this could reflect preference for towns with large shares of individuals in education rather than employment.

**Table 8.** Simulation: Percentage change in each location choice, by parent and sibling location, based on the estimates from specification (2).

**Parents' location.**

| | 1974 | | 1976 | |
|---|---|---|---|---|
| Location | Students | Non-Students* | Students | Non-Students* |
| 1 | 3.4 | 0.3 | 4.3 | 0.1 |
| 2 | 0.9 | 0.4 | 1.4 | 0.1 |
| 3 | 0.7 | 0.7 | 1.1 | 0.1 |
| 4 | 0.5 | 0.7 | 0.8 | 0.1 |
| Outside region | 0.2 | 0.1 | 0.3 | 0.1 |

**Siblings' location.**

| | 1974 | | 1976 | |
|---|---|---|---|---|
| Location | Students | Non-Students | Students | Non-Students |
| 1 | 14.8 | 5.5 | 15.9 | 4.9 |
| 2 | 5.5 | 4.2 | 7.2 | 5.5 |
| 3 | 3.9 | 7.2 | 5.6 | 5.0 |
| 4 | 3.1 | 6.9 | 3.7 | 5.4 |
| Outside region | 1.1 | 0.5 | 1.4 | 0.5 |

Note: ***** parameter estimate is non-significant. Simulations based on changing the variable from indicating no sibling/parent in location to sibling/parent residing in location. Numbers are the percentage increase of individuals for each location.

The estimates for the parents' location are positive and significant for the non-student group, while for the students, both the locations of parents and siblings are attractive. This underscores the importance of family network as a determinant of location specific human capital and other aspects of family relations in individual's utility functions. The marginal effects, shown in Table 8, are higher for the parents' location than for the siblings' location. Also, they tend to be lower for non-students, which might only be a reflection of the lower mobility of this group. The exceptions here are the locations in the inland where the marginal effects are higher for non-students. Relatively to students, having family members located in the inland provide additional marginal utility of these locations for non-students.

A problem with adding the distance variable is that the estimated coefficient may mainly reflect the fact that most individuals stay in their initial location, especially the non-students. The measure of distance seems to be crucial and somewhat complex since the major cost of distance probably comes from social interaction costs. These results are partially sensitive with respect to specification. Clearly, some regional attributes seems to be correlated with distance. However, the estimated parameter on *Distance* is consistently negative for both cohorts, indicating that a location far away is less attractive.

To check the robustness of results, several alternative specifications have been estimated. The first approach is to change the choice set into a smaller or larger set of locations.[16] By and large, the results change only marginally, although some estimates for non-students turned out statistically insignificant. However, the point estimates were similar to the ones presented here. Attempts to include measures of the local public sector, expenditure for elderly care and leisure in the municipalities as additional regressors were also tested. Here, the estimates for *Tax Base* were greatly affected and the estimates for the two new variables were ambiguous. When using a gravity type measure by controlling for *Distance* weighed with *Density,* some of the estimated coefficients on family variables become insignificant and it also affected the estimates for *Share of 65+* for non-students. Finally, alternative measures of regional labor market conditions (unemployment, change in employment) gave the same unexpected results as when using the employment rate.

The overall impression of the estimations is that locations with higher tax bases are preferred by both students and non-students, although this is, as expected, sensitive to inclusion of variables indicating the structure of local public expenditures. Moreover, the parameter on *Share of 65+* is negative and significant for students, while for non-students the results are mixed and sensitive to alternative specifications. Presumably, this is partially the result of regional sorting of human capital in the past, but also an indication that out migration from locations with higher shares of elderly is accentuated among students, who also have higher propensity to migrate. Students are also more likely to move to university towns or locations where there is a lower share of elderly compared to those who do not invest in further education.

**Table 9** Simulation: Percentage change by location when increasing *GPA* by 0.3 and increasing *Admission places* by 10 % in all location choices.

**GPA**

| Location | 1974 | 1976 |
|---|---|---|
| 1 | 2.3 | 1.8 |
| 2 | 0.1 | -0.6 |
| 3 | -1.4 | -0.7 |
| 4 | -2.2 | -2.0 |
| Outside Region | 1.2 | 1.3 |

**Admission places**

| | **1974** | | **1976** | |
|---|---|---|---|---|
| Location | Students | Non-students | Students | Non-students |
| 1 | 3.0 | -2.0 | 1.6 | -0.4 |
| 2 | 0.2 | -0.4 | -0.1 | -0.4 |
| 3 | 0.1 | -0.6 | -0.1 | -0.4 |
| 4 | 0.1 | -0.9 | -0.1 | -0.6 |
| Outside region | 0.7 | -0.3 | 0.4 | -0.1 |

Because a large and increasing part of youth migration is tied to enrolment in higher education, this study carries out simulations with respect to increases in *GPA* and in an overall increase in *Admission places*. These are reported in Table 9. In the simulation, *GPA* was increased by 0.3 points to study the effects both on number of students and choices among the 17 locations. This 0.3 increase in *GPA* generated approximately 10 percent more students. What is more noticeable is the net effects on the locations. The simulations indicate a positive net change for location (1), which is the location within the northern region where the universities are placed, and to locations outside the northern region. These results suggest that location in university towns and other urban areas would be greater with an increasing number of young people who have a relatively high likelihood of becoming students, as shown by GPA. By contrast, the net change is negative for the locations in the northern inland (3 and 4). To support this analysis, another simulation was conducted, simulating an increase of the number of *Admission places* in all locations by 10 percent. The results are similar to the *GPA* simulation, i.e. there's a positive net change for location (1) and a negative change for the other locations within the region. The outflow to the rest of Sweden is also quite large. These results hold for both cohorts, but the 1974 cohort, which experienced the recession, has a much larger effect for students. Both an increase of the grade point average and increased admission places in all locations would therefore imply a larger concentration of individuals in the university municipalities in the northern region, net out-migration of young individuals from the depressed northern inland, and a bigger total net-outflow of nest-leavers from the north of Sweden (SE-08) as a whole.

In order to evaluate the NL framework relative to an RPL framework, we estimated an RPL model with the coefficient on *GPA* randomized. More specifically, we assumed that utility depended on the same variables as in our preferred model, that the coefficients in the utility function were potentially different in the student and non-student outcomes, and that the coefficient on *GPA* were draws from a normal distribution with a mean and variance that we estimated. We then estimated the parameters including the eight hyper parameters, one mean and one variance for the *GPA* term, for the utility gained by students and those gained by non-students. We computed the change in choice of location for an increase of 0.3 grade points and compared it to the outcome for the NL model. The results are very similar, instead of 1.31 percent increase probability of leaving the region, for the NL model, the RPL estimates the increase in probability to be 1.01 percent.

## 6. Summary and discussion

Three findings in this study are of pronounced interest. First, an individual's GPA in the 9th grade of primary school predicts not only enrolment in further education after high school, but

also mobility and preference for specific destinations. Second, the estimated association between the share of older individuals in the region and the choice of location among students is negative. For non-students, this result is not robust with respect to model specification. Third, individuals at the nest-leaving age tend to choose locations with higher per capita tax base.

The results in this study also corroborate earlier research showing that children having parents with higher educational attainment have higher probability of investing in further education. Females have higher probability than males of pursuing further education after leaving high school. Even when controlling for the individuals' grade point average in primary school and other individual characteristics. The results in this study also confirm the anticipated effects of family networks; siblings or parents in a location, or if the family lived in a location previously, affect choice probabilities. Also in line with expectations, the regional supply of higher education generally attracts in-migration. Our finding that young adults prefer locations with higher regional per-capita tax bases may in itself bode ill for low-tax base regions where the public sector already may be under strong financial pressure. The systematic negative relationship between the share of older individuals in the region and the location choice of students adds to regional divergence in regional public sector finances for three major reasons. First, students constitute the most mobile group in the population, in connection with enrollment as well as after graduation. Second, most of them remain where they graduate, or move to other regions with an already higher than national average level of human capital Third, they are more productive than the average citizen because they have higher than average human capital. The finding that students have a preference for regions with a lower share of elderly is likely to reflect the consumption preferences of the students in terms of bars, culture activities, restaurants and locations with universities. As discussed in section 3 the underlying reasons for lower preference of locations with a high share of elderly may also be due to the young being reluctant to support the infrastructure needed to sustain the older population or that it may simply reflect demographic change of regions in economic decline. In all, young adults' preference for regions with a higher tax base and students' preference for regions with a lower share of senior citizens may be an important factor driving the divergence in regional public sector finances. This is via both the revenue and the expenditure side of budgets. Consequently, this would also act in divergent directions when it comes to regional differences in coping with the burden of support for aging populations. Regions with already slim tax bases and a large share of older citizens do not seem to benefit from the location choices of young adults.

Moreover, the results from simulations indicate that a nation wide increase in the number of students, or in the supply of education in all locations, would reinforce the attractiveness of the dynamic university cities at the northern coast. It would also add to net-out

migration of young individuals from the rural northern inland, and increase the total outflow from the north to locations with universities further south in Sweden. Depending on policymakers' goals for regional policy, the observed pattern in the location choices of the young may call for targeted measures to assist regions with unfavorable changes in age and educational structure of the population. For example, measures that may lower municipalities fixed costs (incurred by state regulations) and measures directly targeting regional tax bases.

## NOTES

1. This is, for example, an apparent pattern in some parts of the US, Canada, and in the EU, e.g. within inland areas of the northern regions of Finland, Norway, and Sweden.
2. Migration may contribute to convergence in regional per capita incomes (e.g. Barro and Sala-I-Martin, 2004; on Swedish data e.g. Aronsson *et al.,* 2001; Østbye and Westerlund, 2007), but income and population growth is concentrated to cities and metropolitan areas within regional units.
3. The urban economics literature offers numerous studies, typically involving choice of residence within and around urban centers.
4. Another major reason for the choice of these cohorts is that the present paper will be followed by a second study pertaining to the same individuals at mid-age - when child rearing and graduation from tertiary education are of importance for their choice of location. The reason for not choosing even younger cohorts is partially governed by the availability to information on school grades.
5. This is a general problem, *e.g.*, in the literature on choice of travel mode or travel route, theoretical alternatives chosen by zero or by very few individuals are excluded or collapsed into an outside option consisting of many seldom chosen alternatives.
6. For further description on the Linnaeus data base, see Bonita *et al.,* 2011.
7. Nomenclature of Units for Territorial Statistics (NUTS) is a classification of administrative boundaries, made by Eurostat. NUTS 2 incorporates counties or group of counties with a population between 28,000 to 3,000,000.
8. The student benefit is split into two parts; a loan and a grant. The grant is generally claimed by all students enrolled at university, no matter the income level, making it a strong indicator of university studies.

9. Studies on public expenditures and location choice show mixed results. Friedman (1981) finds that people are attracted by high local public expenditures while Quigley (1985) find a slightly negative effect. On Swedish data see Westerlund and Wyzan, 1995.
10. Dahlberg *et al.* (2012) shows the importance of the public service when it comes to making residential location choices. Municipalities with lower unemployment and larger population size attracted migrants. He found no significant result on housing prices since the signaling effect is twofold: it reflects an attractive region, but at the same time the living expenses will be high.
11. Regions' attractiveness in young people's eyes depends also on various types of amenities (see e.g. Greenwood and Hunt, 1989; Ferguson *et al.,* 2007). These are presumably partially captured by the tax base and share and other regional attributes in our model. Regional differences in natural amenities are relatively low. Experiments with indicators for coast/shore line were not successful due to problems with multicollinearity.
12. One reason for the choice to use 9th grade GPA is that it is unlikely that a student's preferences measured at age 19 could influence GPA at age 15.
13. The coefficients of the lower model, can be estimated either by dividing by the scale parameter or by not dividing by the scale parameter. Heiss (2002) finds that if there's no coefficient that is common across the nests, dividing by $\lambda_k$ is not necessary and the model is still consistent with utility maximization.
14. This approach is referred to as the Random Utility Model 2 in e.g. Silberhorn *et al.,* 2008; Hensher and Greene, 2002.
15. This is not an unusual finding in migration studies including all individuals in working ages. Individual experience of unemployment is often more important for the decision to relocate than regional employment/unemployment rates.
16. For example by dividing the university towns Umeå and Luleå into two different locations or merging locations with small choice probabilities. Splitting the two university towns in the north increased the standard errors affected the results for the non-students.

## References


Aronsson, T., Lundberg, J., and Wikström, M. (2001). Regional Income Growth and Net Migration in Sweden 1970–1995, *Regional Studies,* 35, 823–830.

Barro, R.J., and Sala-I-Martin, X. (2004). *Economic Growth*. (2nd ed.) Cambridge and London: MIT Press.

Ben-Akvia, M. (1973). *The structure of travel demand models*. PhD. Diss, MIT.

Bjerke, L. (2012). Where do university graduates go? PhD. Diss. No.078. Jönköping International Business School, Jönköping University.

Bonita R., Brändström, R., and Malmberg, G. (2011). Linneaus: Alive and Well. *Global Health Action,* 4, 57-60.

Clark, D.E., and Murphy, C.A. (1996). Countywide employment and population growth: An analysis of the 1980s. *Journal of Regional Science,* 36, 235-256.

Clark, W., and Whiters, S. (2008). Family migration and mobility sequences in the United States: Spatial mobility in the context of the life course. *Demographic Research,* 17, 591-622.

Compton, J., and Pollak, R.A. (2007). Why Are Power Couples Increasingly Concentrated in Large Metropolitan Areas? *Journal of Labor Economics,* 25(3), 475 – 512.

Costa, D.L., and Khan, M.E. (2000). Power Couples: Changes in the Locational Choice of the College Educated, 1940 – 1990. *Quarterly Journal of Economics,* 115(4), 1287 – 1315.

Dahlberg, M., Eklof, M., Fredriksson, P., and Jofre-Monseny, J. (2012). Estimating Preferences for Local Public Services using Migration Data. *Urban Studies,* 19(2), 319-336.

Détang-Dessendre, C., Goffette-Nagot, F., and Piguet, N. (2008). Life Cycle and Migration to Urban and Rural Areas: Estimations of a Mixed Logit Model on French Data. *Journal of Regional Science,* 48(4), 789–824.

Eliasson, K. (2006). College Choice and Earnings among University Graduates in Sweden. PhD. Diss., Department of Economics, Umeå University.

Elvery, J. (2010). City Size and Skill Intensity, *Regional Science and Urban Economics*, 40(6), 367-379.

EU. (2010). Investing in Europe's Future, fifth report on economic, social, and territorial cohesion. Report from the commission No. 2010-11. Luxemburg: Publications Office of the European Union.

Faggian, A., and McCann, P. (2009). Universities, Agglomerations and Graduate Human Capital Mobility. *TESG Journal of Economic and Social Geography*, 100(2), 210–223.

Ferguson, M., Kamar, A., Olfert, M.R., and Partridge, M. (2007). Voting with Their Feet: Jobs versus Amenities. *Growth and Change*, 38(1), 77-110.

French, M.T., Homer, J.F., and Robins, P.K. (2010). What You Do in High School Matters: The Effects of High School GPA on Educational Attainment and Labor Market Earnings in Adulthood. University of Miami Working Paper No. 2010-26.

Friedman, J. (1981). A Conditional Logit Model of the Role of Local Public Services in Residential Choice. *Urban Studies*, 18, 347-358.

Gibbons, S., and Vignoles, A. (2012). Geography, choice and participation in Higher Education in England. *Regional Science and Urban Economics*, 42(1–2), 1-38.

Glaeser, E.L., and Saiz, A. (2004). The Rise of the Skilled City. *Brookings-Wharton Papers on Urban Affairs*, 5, 47-94.

Glaeser, E. L., Scheikman, J. A., and Shleifer, A. (1995). Economic growth in a cross-section of cities. *Journal of Monetary Economics*, 36, 117-143.

Greenwood, M. (1997). Internal Migration in Developed Countries. In M.R. Rosenweig and O. Stark (Ed.), *Handbook of Population and Family Economics Vol 1B (*pp. 647–711). Amsterdam: Elsevier.

Greenwood, M., and Hunt, G. (1989). Jobs Versus Amenities in the Analysis of Metropolitan Migration. *Journal of Urban Economics,* 25(1), 1-16.

Haapanen, M., and Tervo, H. (2012). Migration of the Highly Educated: Evidence from Residence Spells of University Graduates. *Journal of Regional Science,* 52(4), 587-605.

Heiss, F. (2002). Structural choice analysis with nested logit models. *The Stata Journal,* 2(3), 227-257.

Hensher, D.A., and Greene, W.H. (2002). Specification and estimation of the nested logit model: alternative normalisations. *Transportation Research Part B,* 36(1), 1–17.

Jackman, R., and Savouri, S. (1992). Regional Migration in Britain: An Analysis of Gross Flows Using NHS Central Register Data. *The Economic Journal,* 102, 1433-1450.

Jauhiainen, S. (2008). Regional Concentration of highly educated couples. In J. Poot, B. Waldorf, and L. van Wissen (Ed.), *Migration and Human Capital* (pp. 97-110). Cheletenham: Elward Elgar.

Knapp, T. A., White, N.E., and Clark, D. E. (2001). A Nested Logit Approach to Household Mobility. *Journal of Regional Science,* 41, 1 – 22.

McFadden, D. (1981). Econometric models of probabilistic choice. In C. Manski, and D. McFadden (Ed.), *Structural Analysis of Discrete Data* (pp. 198-271). Cambridge: MIT Press.

Moilanen, M. (2009). Job is where the heart is? An analysis of geographical labor mobility among young adults. In *Regional Labor Mobility*, PhD. Diss., Tromsø University Busines School, Tromsø.

Mulder, C. H., and Cooke, T. J. (2009). Family ties and residential choices. *Population, Space and Place,* 15, 294-304.

Mulder, C. H., and Wagner, M. (1993). Migration and marriage in the life course: a method for studying synchronized events. *European Journal of Population,* 9(1), 55-76.

OECD. (2009). *Education at a Glance*. Paris: OECD. Retrieved from http://www.oecd.org/dataoecd/41/25/43636332.pdf

Østbye, S., and Westerlund, O. (2007). Is Migration Important for Regional Convergence? Comparative Evidence for Norwegian and Swedish Counties 1980-2000. *Regional Studies*, 41(7), 901-915.

Partridge, M. D., Rickman, D. S., Ali K., and Olfert, M.R. (2008). The geographic diversity of U.S. nonmetropolitan growth dynamics: A geographically weighted regression approach. *Land Economics*, 84, 241-266.

Quigley, J.M. (1985). Consumer Choice of Dwelling, Neighborhood and Public Services. *Regional Science and Urban economics*, 15, 45-63.

Sá C., Florax, R.J.G.M., and Rietveld P. (2004). Determinants of the Regional Demand for Higher Education in the Netherlands: A Gravity Model Approach. *Regional Studies*, 38(4), 373–390.

Silberhorn, N., Boztug, Y., and Hildebrandt, L. (2008). Estimation with the nested logit model: specifications and software particularities. *OR Spectrum*, 30, 635-653.

Tervo, H. (2000). Migration and labour market adjustment: empirical evidence from Finland 1985–90. *International Review of Applied Economics*, 14, 343–360.

Train, K. (2009). *Discrete Choice Methods with Simulation.* (2nd ed.) Cambridge: Cambridge University Press.

Waldorf, B.S. (2009). Is human capital accumulation a self-propelling process? Comparing educational attainment levels of movers and stayers. *Annals of Regional Science*, 43, 323-344.

Westerlund, O., and Wyzan, M.L. (1995). Household Migration and the Local Public Sector: Evidence from Sweden, 1981-1984. *Regional Studies*, 2, 145-157.

Whisler, R. L., Waldorf, B. S., and Mulligan, G. F., and Plane, D.A. (2008). Quality of life and the migration of the college-educated: A life-course approach. *Growth and Change*, 39, 58-95.