Where Did They Go? A Study on Newly Established Universities and Graduate Mobility in Finland

Saarivirta, Toni and Consoli, Davide

2007

SENTE Working Papers 13/2007

Where Did They Go?

A Study on Newly Established Universities and Graduate Mobility in Finland

Toni Saarivirta & Davide Consoli

University of Tampere
Research Unit for Urban and Regional Development Studies

www.sjoki.uta.fi/sente

ISSN 1457-9995
ISBN 978-951-44-6984-8

Where Did They Go?
A Study on Newly Established Universities and Graduate Mobility in Finland

Toni Saarivirta* & Davide Consoli**

* Contact Details: Research Unit for Urban and Regional Development Studies (Sente), University of Tampere (FI)
toni.saarivirta@uta.fi

** Contact Details: Centre for Research on Innovation and Competition, Manchester Business School - University of Manchester (UK)
davide.consoli@mbs.ac.uk

Summary This paper investigates cross-regional mobility in Finland using individual-level data on a cohort of people over a period of 15 years. The backdrop is that of the institutionalization of science and technology policy in the 1960s, part of which consisted in the expansion of universities in five regions. This had a threefold rationale: increasing participation rates to higher education, widening the recruitment base by facilitating young generations the right to study in their native regions, and stimulating regional economic development by providing skilled labour force. Our empirical analysis reveals high levels of spatial mobility and uneven retention rates across regions. Despite the policy action, graduates are still attracted towards the capital city Helsinki. Through a binary logit regression model we observe that mobility is influenced by the type of studies and to a lesser extent by the socioeconomic background.

1. *Introduction*

The objective of this paper is to investigate patterns of cross-regional mobility in Finland after the expansion of the higher education institutions in the 1960s. The institutionalization of science and technology policy was part of a broader policy programme that the Finnish government undertook to contrast the economic stagnation of the post-war period. The establishment of new universities throughout the country[1] was one of the elected routes to accomplish two targets. First, and most obvious, was widening access to higher education: in egalitarian spirit the government sought to provide young people the right to study in their own region relieving them from the strain of relocating to undertake higher education. The second was to achieve a more homogeneous distribution of qualified professionals among the regions. Both sought to respond to domestic policy concerns related to growing concentration of opportunities of development in the south regions, around the capital Helsinki.

---

[1] For an overview of current research on the interplay between the development of the education system and regional development in Finland see Saarivirta et al (2005) and Saarivirta (2007).

The geographical distribution of universities is relevant for the allocation of capital resources - i.e. employment effects - as well as for the innovative potential associated to capability building. Implicit in this policy design was thus the expectation that the regions could benefit from the availability of skilled labour force, provided that graduates would not relocate. The paper seeks to assess empirically this point and, in particular, the extent to which the expansion of higher education institutions has reduced graduate mobility across Finnish regions. It analyses the patterns of mobility of a cohort of 954 individuals who undertook higher education in five newly established universities, and track their location over a period of 15 years: for study purposes in 1980 and for work after graduation in 1995.

The paper is organized as follows. In the second section we frame the issues at stake in relation to the literature on the dynamics of technological knowledge and of Regional Innovation Systems. The third section connects the economic performance of Finland with key science and technology policy actions undertaken after the Second World War. After having introduced the regions with newly established universities, the fourth section elaborates the data analysis in two steps: first, we look at the aggregate patterns of mobility within the cohort and, subsequently, we assess the factors that influence mobility decisions. The last section concludes.

2. The dynamics of knowledge and regional development: bridging the gap

Countries and regions have in place idiosyncratic systems of innovation in which clusters of different actors compete and collaborate to exploit the resources that are most accessible to them. When looking at these phenomena, policy-makers and scholars alike focus on the conditions that are more conducive to the generation and application of knowledge (Antonelli, 2006). This, in turn, requires a proper grasp of the institutional processes that are necessary to create effective learning opportunities (Keeble and Lawson, 1998; Antonelli and Quere', 2002; Metcalfe and Ramlogan, 2005).

Antonelli (2000) argues that technological knowledge is a collective process that generates two kinds of benefits. First, and perhaps more immediate, are instant improvements that can be implemented in a system of production following, say, a technical discovery. The second class of benefits emerge in the long run when new scientific knowledge triggers a learning process which generates further discoveries. As knowledge is idiosyncratic, progress in more specific areas entails the coordination of different forms of specialisation and, at the same time, the necessary development skills. In sum, collective technological knowledge is a cumulative process, it is distributed over time and over individuals, and is both an input for and an output of economic development. Furthermore, its viability is contingent to the opportunities of communication and interaction that are embedded in national, technical, institutional, regional and industrial settings (Antonelli, 2003; Asheim and Gertler, 2004).

The collective technological knowledge view emphasises the role of universities, research institutes and network of firms for the creation and diffusion of knowledge (Felder, 1990; Rosenberg and Nelson, 1994; Camagni, 1995; Mansfield, 1995, 1996; Rosenberg, 2000). Recent research frames these issues in the context of regional innovation systems and highlights the interconnections across a variety of actors such as knowledge-centres (i.e. universities, research institutes and technology

transfer organizations), business organisations and government departments (Cooke et al, 1997; Doloreux and Parto, 2005, Sotarauta et al, 2006). This paper takes step from the foregoing background, and focuses on policy plans aimed at fostering regional economic development through the expansion of universities.

The economic impact of universities has been studied in relation to various dimensions such as: direct consumption effects (Luger and Goldstein, 1997; Keane and Allison, 1999; Sudmant, 1999; Macfarland, 2001; Clinch and Gerlowski, 2002; see Hedman and Aaltonen, 1999 for a case study on Finnish universities); positive externalities due to the presence of an educated labour force (McMahon, 1998; Asteriou and Agiomirgianakis, 2001; Petrakis and Stamatakis, 2002; Lin, 2004); and status effects (Florida, 2000). Yet one more important feature is the circulation of knowledge due to interactions between universities and the business community (Doloreux, 2002; Dunford, 2003; Niosi, 2002; Mowery and Sampat, 2004).[2] In the main, these works look at the agglomerative role of regions as sites where proximity and a shared institutional setting are key determinants to create and maintain regional competitiveness (Malmberg and Maskell, 1999 and 2002; Morgan, 1997).

We argue that this literature proposes a static view of the connection between geographic concentration and knowledge production, but neglects dynamic elements associated to the circulation of knowledge, including the mobility of human capital. The two-way relation between factor mobility and the distribution of innovative potential is of considerable importance for both the local and national dimensions. Capital and labour movements impinge, directly or indirectly, on a wide range of policy issues, in particular those concerning the distribution of resources (Kaldor, 1970). On the one hand mobility of capital and labour contributes to render operative redistributive programs (Pissarides, 1989; Huber, 2004). On the other hand, factor mobility elicits a periodical reconsideration of the rationale of such policies. In short, factor mobility bears on regional development in unpredictably complicated ways. The next sections frames the themes discussed so far in the context of the structural change of the Finnish economy.

3. Background: economic development and education policy in Finland

In the last few decades the Finnish economy has experienced an impressive expansion in the face of the stagnation and recession that strained the country on more than one occasion. Finland's development is a matter of interest and is held as a prototypical example of economic transformation from resource-based to knowledge-based (Porter et al, 2005; Schienstock, 2004; Boschma and Sotarauta, 2007; Sotarauta and Kautonen, 2007). This process of structural change consists of two key phases. The first was during the post-war decade, when Finland experienced rapid industrialization aided by public investments. This is when activities related to processing the country's natural resources – like paper, pulp, forestry and basic metals – became an established strength. An unwarranted outcome of this process was the creation of regional disparities due primarily to unevenness in the availability of raw materials as well as in responsiveness of the local business environment. In spite of

[2] Among others, geographical distance has been put forth as a relevant factor in this context. See the contributions by Feldman, 1994, 1999; Audretsch and Feldman, 1996; Geuna, 1999; Antonelli, 2001.

efforts to stimulate development also in the north of the country until the late 1980s some 70% of industrial jobs were still located in the south.

After having joined the league of industrialized economies, at the end of the 1980s Finland experienced the most severe recession of its modern history, characterized by fall of exports and high unemployment levels. At root of this were various causes. In the late 1980s domestic banks fuelled a consumption boom that ended with high indebtment among households. This occurred during the collapse of the Soviet Union in 1991 which brought trade with to a grinding halt. Moreover, exogenous shocks such as recessions in Western countries and rising interest rates in Germany after the unification put further strain on the Finnish economy (Honkapohja and Koskela, 1999; Kiander, 2004a; Kiander, 2004b). This crisis heralds the second phase of economic development driven by massive public investments aimed at the expansion of knowledge-intensive sectors, and by reforms to tighten financial markets. In a relatively short time the development of high-technology industries, less dependent on transportation and energy supplies, facilitated the diversification of the industrial base (Hjerppe and Pihkala, 1989; Hjerppe and Vartia, 1997; Ollikainen, 1997).

By the end of the 1990s the perseverant policy of the Finnish institutions proved successful. Among its most important achievements are a versatile industrial and export structure, lower dependence on raw material and energy-intensive industries, and the expansion of high-skilled and high-tech industries. The export matrix of the country changed drastically in the last two decades, with the growth of the Electronics industry compensating for the decline of traditional industries such as Mechanical wood and Paper (Paija, 2001; Romanainen, 2001). The growth of the ICT cluster, arguably facilitated by the growth of global markets, is one macroscopic achievement.[3] No doubt, the economy as a whole recovered well and is placed on a path of innovation-driven growth which just recently has been challenged by international cost-based competition in key sectors like ICTs. Finland's authorities, however, are still expected to tackle domestic issues that are entrenched in the peculiar path of economic development of this economy, which blends together tradition (e.g. forest and metal industry) and modernity (e.g. Electronics) (Schienstock, 2004).

Part of Finland's success is attributable to a two-pronged policy plan. On the one hand the institution of a network of state-owned agencies in the 1960s to overview innovation activities and provide direct assistance through financing instruments and support services. Among the first are Sitra (The Finnish National Fund for Research and Development), the reform of the Academy of Finland, and the university system which provide regional access points, networking activities and co-operation activities. In this latter group are various agencies: Tekes (National Technology Agency of Finland) - which supports R&D on technological innovation; Finnvera or the Finnish Industry Investment - both state-owned providers of risk financing and venture capital; Employment and Economic Development Centres (TE-Centres) – consisting of 15 regional offices to uphold the activity of small firms; and the Foundation for Finnish Inventions (FFI) which provides services aimed to support early phases of innovation (Lemola, 2002; Georghiou et al, 2003).

The second component of the policy was the expansion of the university network. This was partly a result of foreign pressure due to increasing competition in trade, but also of domestic issues

---

[3] While this is not immediately relevant to the purpose of this paper, it goes without saying that the vast majority of works on the growth of this cluster are focused on the Finnish giant Nokia. While the firm's huge success is not doubted, the extent to which the company has contributed to national economic development is a contentious matter. See Yrkkö and Hermans (2004) and Daveri and Silva (2004) for contrasting views on this.

related to the availability of opportunities for development. In the mid 1950s the majority of universities were mainly in the south of Finland, in close proximity with the capital Helsinki. The creation of "regional universities" had thus a two-fold intent. First, the government sought to provide young people the right to study in their own region without being forced to move to undertake higher education. Second, the reform intended to stimulate a change of role for universities in these regions (Nevala, 1983; Oinas, 1999; Eskola, 2002; Saarivirta, 2004).[4] Besides skills supply, tied to the expansion of universities was the expectation that regional economic development would have benefited from systematic interactions with the local business community. While such a vision matches the realities of Tampere (Kautonen et al, 2004) and Turku (Bruun, 2004) where important clusters have emerged exploiting the synergies with the local universities, this does not seem to be the case for all the new university regions. The next section presents an empirical analysis of the migration patterns observed in the regions with newly established universities.

4. The spatial mobility of university graduates in Finland: evidence and discussion

This section presents the analysis of spatial mobility across Finland drawn from our database. This is developed in two steps. First, we provide background information about the regions where the newly established universities are located. Subsequently we analyse patterns of mobility across provinces and its determinants.

Studied universities and their regions in a map

Finland's population density

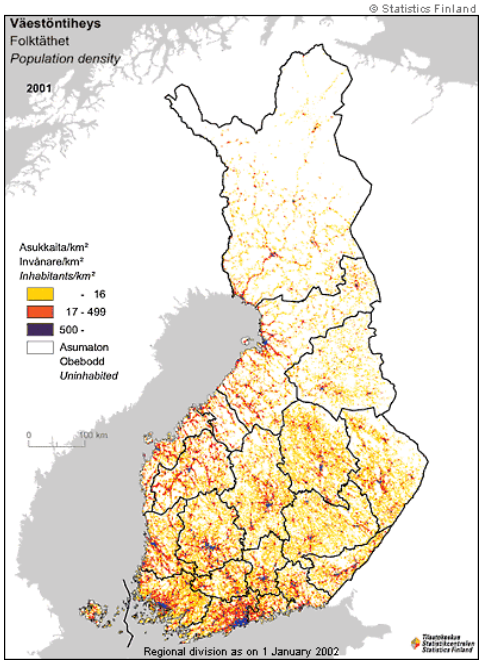

Figure 1. Universities and their regions and Finland's population density. Source: Virtual Finland (2005b) & Statistics Finland (2005a).

[4] The last university established in Finland was the University of Lappi, located in Rovaniemi, in 1979.

4.1 The regions

The regions where new universities have been established as part of the outlined policy are: Lappi (home to the University of Lappi), Pohjanmaa (University of Vaasa), Pohjois-Karjala (University of Joensuu), Pohjois-Savo (University of Kuopio) and Etelä- Karjala (University of Lappeenranta). Their geographical location is shown on the left-hand side of Figure 1, while Finland's population density is on the other side.

Table 1 summarises key economic indicators of the regions in the year of the final observation of our sample, 1995, while values in parenthesis indicate the average for the whole period 1980-1995. For comparative purposes we include also Uusimaa, the province of Helsinki. Data on employment provide a first interesting indication on the growing role of services, though with different intensity and timing across regions. Three groups of regions emerge: those in which forestry and associated activities have been playing a relatively strong role until the late 1980s, like Pohjois-Savo, Pohjois-Karjala and Pohjanmaa, and thus where the transition towards service-led status has been slower. A second group of regions like Etelä-Karjala and Pohjanmaa, characterized by a relatively strong presence of manufacturing activities, respectively wood products and food processing. Finally, Lappi and Uusimaa have been dominated by service activities since the early 1980s. In terms of employment shares, the latter two regions display a relatively stable structure over the entire period as opposed to Pohjanmaa, which in 1980 was characterized by a substantial balance among the three sectors and has thus experienced the strongest degree of transformation over the entire period. We also note that

Table 1. Main economic indicators for regions in 1995 (at constant 2000 prices)

Region		**Uusimaa**	**Etelä-Karjala**	**Pohjois-Savo**	**Pohjois-Karjala**	**Pohjanmaa**	**Lappi**
Main province		Helsinki	Kymi	Kuopio	Joensuu	Vaasa	Rovaniemi
University name		-	Lappeenranta University of Technology	University of Kuopio	University of Joensuu	University of Vaasa	University of Lappi
Population		1,215,697 (1,115,992)	139,922 (142,504)	260,325 (257,794)	139,922 (142,504)	174,176 (172,222)	201,868 (199,986)
Share of GDP		29.8%	2.89%	4.17%	2.50%	3.40%	3.49%
Per-Capita Income (€)		21,846 (20,486)	17,565 (15,435)	15,939 (14,127)	15,292 (13,401)	17,180 (14,922)	16,156 (14,390)
Empl share	*Agr*	1.0%	8.9%	**15.6%**	**14.7%**	**15.0%**	8.3%
		(1.3%)	(11.8%)	**(17.9%)**	**(19.2%)**	**(19.1%)**	(11.5%)
	Man	14.7%	**26.1%**	16.9%	16.5%	**28.3%**	15.4%
		(17.3%)	**(26.4%)**	(17.7%)	(15.8%)	**(28.5%)**	(13.9%)
	Ser	**76.8%**	58.9%	61.4%	63.0%	50.7%	**69.4%**
		(73.8%)	(53.4%)	(55.7%)	(55.7%)	(42.0%)	**(63.3%)**

Source: Statistics Finland (2004a), Statistics Finland (2004b)

services and trade and accommodation have the largest shares across the regions (Saarivirta, 2003). The net immigration rates shown in Figure 2 indicate that Uusimaa attracts the highest number of immigration, while the differential among the other regions tends to reduce over the period. Another interesting indication is that during the recession between 1989 and 1994 immigration falls systematically.

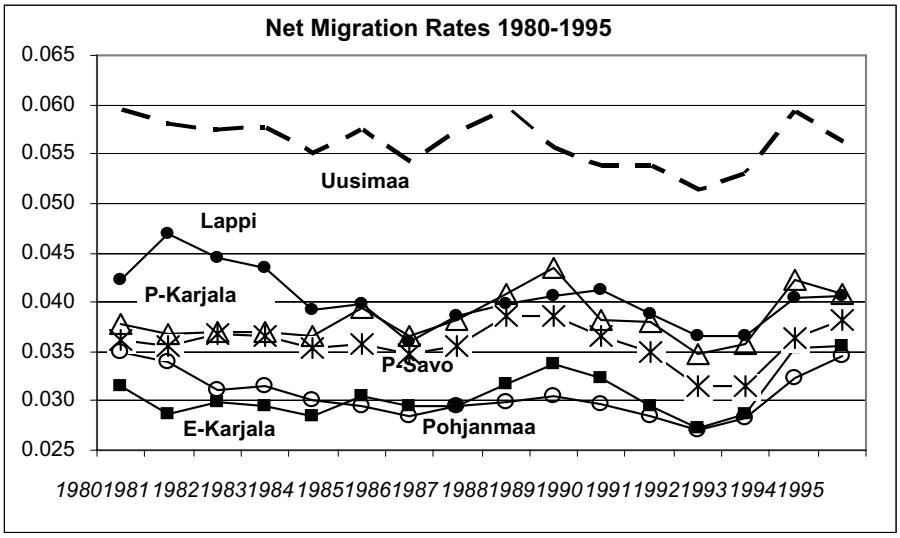

Figure 2. Net Migration Rates of Regions in 1980-1995. Source: Statistics Finland (2006)

Figure 3 shows a positive relationship between per capita Income and the migration rate in each region: on the vertical axis is the average annual migration from 1980 to 1995, while the horizontal axis plots the log of per capita income at the beginning of the period in 1980.

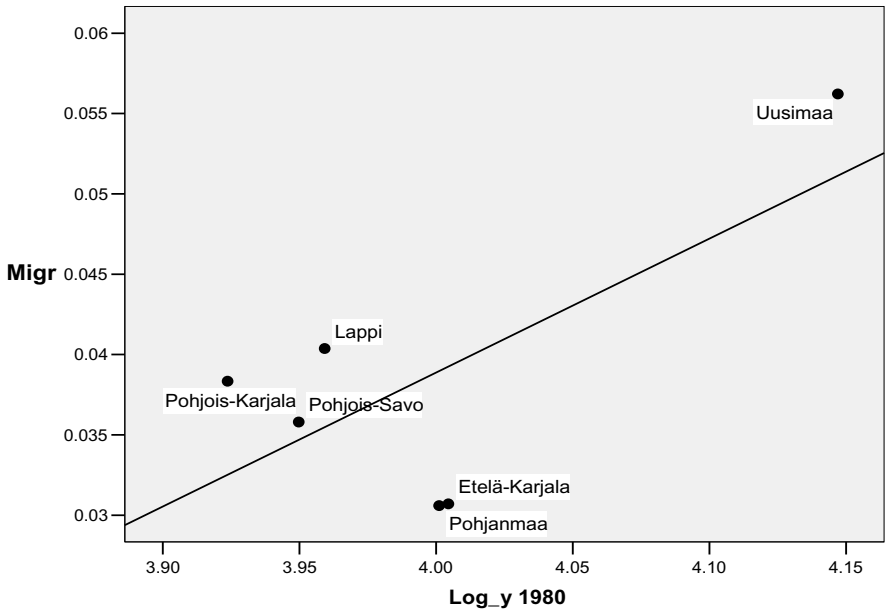

Figure 3. Per Capita Income and Migration Rates in Regions in 1980-1995. Source: Statistics Finland (2006)

This figure confirms the broad indications provided by Table 1. Pohjanmaa and Etelä-Karjala are the two main outliers with a higher than average per capita income but a low net migration rate of about 3%. This confirms previous studies. Pohjanmaa is a region characterized by low migration rates (Österlund, 1997) and home to a large Swedish-speaking community. Their tight internal connections, higher than average life expectancy and high levels of social capital might be at root of its observed low immigration-high per-capita income combination (Hyyppä, 2002). Etelä-Karjala, on the other hand, is home to the second oldest population in Finland (Etelä-Savo being the oldest), whereas mobility is more likely among young, highly educated people (Hämäläinen, 2002; Virtaharju, 2002).

Before concluding this background section, we provide a snapshot of the unemployment levels in the regions, shown in Figure 4. As anticipated earlier, this was due to the crisis that hit Finland at the beginning of the 1990s. The trend is similar across all regions but Lappi has the highest level of unemployment, with a peak of 27.2 % in 1996, while Pohjanmaa performed relatively well compared to the others with. Although the situation has improved considerably, Finland is still suffering from unemployment (Statistics Finland 2005c).

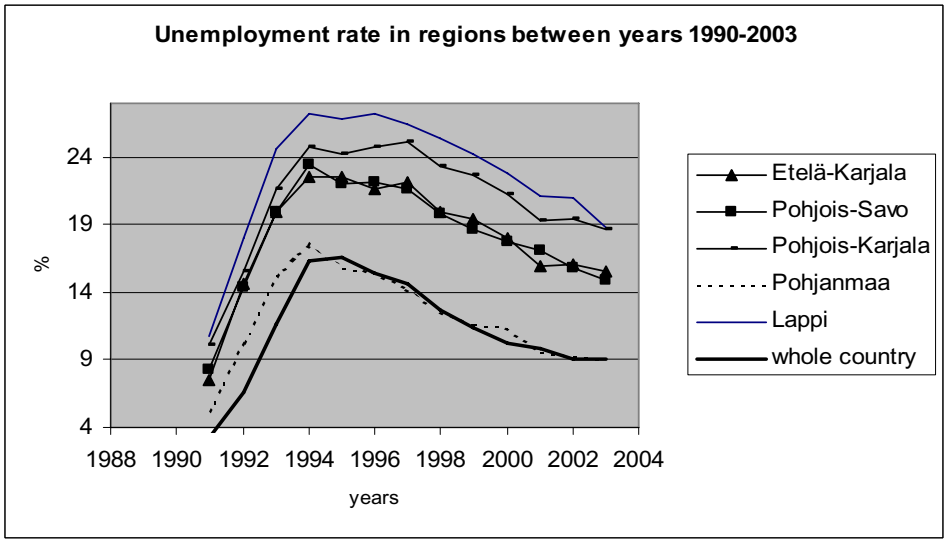

Figure 4. Unemployment rate in regions between years 1990-2003. Source: Statistics Finland 2004a, Statistics Finland 2005b

4.2 The data: mobility across provinces

The paper uses an original dataset assembled by the University of Joensuu's Computing Centre[5] on 6366 students who entered university in 1980. From this we selected those who attended the five universities which were established during the 1960s: Lappeenranta University of Technology in the Kymi province, University of Vaasa (Vaasa province), University of Kuopio (Kuopio province), University of Joensuu (Pohjois-Karjala province) and University of Lappi (Lappi province). Our

[5] The data was originally produced by Statistics Finland, and with the permission of University of Joensuu, the data was allowed to use by the corresponding author of this paper.

objective is to analyse the mobility of 954 individuals of which we have the following information: gender, native province, occupation of the father/mother in 1980, province of undergraduate studies, faculty, province of residence and social position of the individual in 1995.

Before analysing the mobility patterns, we briefly summarize the disciplinary orientations of the universities. The University of Joensuu is traditionally associated with humanities, but has also faculties of education, (natural) sciences, forestry, theology and social sciences.[6] The University of Vaasa is most known for its business studies. Over the years its supply of education has expanded to include degree courses in humanities, social sciences and engineering.[7] The core course at the Lappeenranta University of Technology consisted initially of engineering, complemented after 1991 by business studies.[8] The University of Kuopio, best known for its tradition in medicine, now offers courses on business, social sciences, natural sciences and pharmaceutics.[9] Finally, the University of Lappi includes five faculties: Art and Design, Business and Tourism, Education, Law and Social Sciences.[10]

In the first part of the analysis we overview the movements of individuals across regions in 1980, at the beginning of their studies, and in 1995, after graduation. The sample structure is synthesized in Table 2 which shows that the majority of people move on both occasions, with higher frequency in 1995.

Table 2: Mobility Across the Regions

(Yes=subject moved; No=did not move)				
		Mobility_1995		**Total**
		Yes	No	
Mobility_1980	Yes	542	153	**695**
	No	161	98	**259**
Total		**703**	**251**	**954**

We then disaggregate the sample according to mobility choices observed in 1980 (Table 3) and 1995 (Table 4). Percentages in the grids indicate respectively the cross-tabulation of subjects according to birthplace (rows) and university attended (columns) in Table 3, and place of study (columns) and final residence (rows) in Table 4. Notably, natives of Mikkeli and Pohjois-Karjala jointly account for 40% of subjects in the sample. Table 3 reveals that the University of Joensuu (Pohjois-Karjala) attracts the most students who relocate, while Vaasa the least. Table 4 shows that Uusimaa is the strongest attractor for graduates, accounting for 28% of subjects within the sample, followed by the university provinces of Kymi, Kuopio and Pohjois-Karjala, which taken together attract about 30%. Table 5 compares the ability of university provinces to retain natives, as well as graduates. In relative terms Lappi and Pohjois-Karjala, followed by Kymi, manage to retain the most in both the observations, while Vaasa and Kuopio the least.

---

[6] www.joensuu.fi/faculties.html
[7] www.uwasa.fi/info/info-fi.html
[8] www.lut.fi/fi/yliopisto_lyhyesti/index.html
[9] www.uku.fi/tutustu/tiedekunnat.shtml
[10] www.ulapland.fi/contentparser.asp?deptid=13906

Table 3. Cross-tabulation of People: birthplace and university

	Vaasa	Kymi (Lappeenranta)	P-Karjala (Joensuu)	Lappi	Kuopio	**Total (Native province)**
Uusimaa	0.3%	1.9%	1.7%	0.5%	1.0%	**5.5%**
Vaasa	2.4%	1.0%	1.7%	1.7%	0.2%	**7.0%**
Kymi	0.0%	4.0%	3.2%	0.5%	0.5%	**8.3%**
P-Karjala	0.0%	1.7%	12.9%	2.8%	1.7%	**19.1%**
Lappi	0.0%	0.5%	1.2%	5.6%	0.2%	**7.4%**
Kuopio	0.0%	1.0%	5.1%	1.2%	2.3%	**9.6%**
Mikkeli	0.0%	8.6%	9.0%	0.9%	1.7%	**20.2%**
K-Suomi	0.1%	0.6%	2.2%	0.5%	0.4%	**3.9%**
Hame	0.1%	2.7%	1.8%	0.6%	0.4%	**5.7%**
Oulu	0.4%	0.7%	2.6%	4.5%	0.4%	**8.7%**
Turku-Pori	0.2%	2.0%	1.7%	0.5%	0.2%	**4.6%**
Total (Residence_1980)	**3.6%**	**24.8%**	**43.1%**	**19.4%**	**9.1%**	**100%**

Table 4. Regional Attraction of Students

	Vaasa	Kymi (Lappeenranta)	P-Karjala (Joensuu)	Lappi	Kuopio	**Total (Residence_1995)**
Uusimaa	1.3%	10.8%	11.3%	3.1%	1.6%	**28.1%**
Vaasa	1.8%	0.8%	0.2%	2.2%	0.1%	**5.1%**
Kymi	0.0%	5.3%	4.9%	0.5%	0.3%	**11.1%**
P-Karjala	0.1%	0.8%	8.5%	0.4%	0.2%	**10.1%**
Lappi	0.0%	0.2%	0.8%	6.7%	0.0%	**7.8%**
Kuopio	0.1%	0.8%	4.8%	0.8%	4.0%	**10.6%**
Mikkeli	0.1%	1.0%	3.6%	0.4%	0.6%	**5.8%**
K-Suomi	0.0%	0.8%	1.0%	0.8%	0.8%	**3.6%**
Hame	0.1%	2.7%	3.6%	1.5%	1.0%	**8.9%**
Oulu	0.0%	0.4%	2.1%	2.3%	0.2%	**5.0%**
Turku-Pori	0.1%	0.9%	2.2%	0.5%	0.2%	**4.0%**
Total (Residence_1980)	**3.6%**	**24.8%**	**43.1%**	**19.4%**	**9.1%**	**100%**

Table 5. Retain % of University Provinces

	1980		**1995**	
	Stay	*Move*	*Stay*	*Move*
Lappi	75%	25%	86%	14%
P-Karjala (Joensuu)	68%	32%	80%	20%
Kymi (Lappenranta)	48%	52%	48%	52%
Vaasa	34%	66%	35%	65%
Kuopio	24%	76%	38%	62%

Let us now pick 'winners' and the 'losers' among geographical areas in relation to the ability to attract and retain people over the 15-year period. With the aid of Figure 5 we sketch the net effects of the redistribution of people across provinces between 1980 and 1995. The province of Helsinki, Uusimaa, emerges as the strongest attractor followed by the university provinces of Kymi (home to the University of Lappeenranta) and Kuopio. Overall Uusimaa, Kymi, Kuopio, Hame and Lappi have all positive net values, all the other provinces lose a portion of residents in 1995, including the two university provinces of Vaasa and P-Karjala.

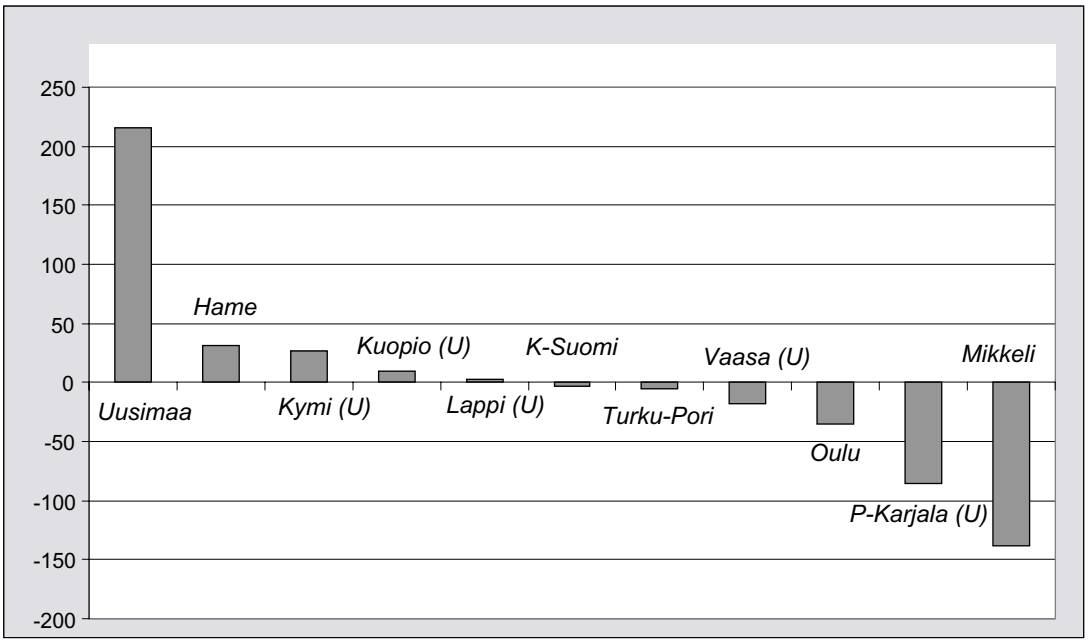

Figure 5. Net Flow of students/graduates 1980-1995

These observations are consistent with the analysis at regional level presented before. First, P-Karjala was the second region most badly hit by unemployment during the economic crisis of Finland. Second, despite showing the third highest aggregate migration rate in the 1990-1995 subperiod, it has also the lowest per capita income which has a positive and significant relation with the migration rate, as seen before. Also the data on Vaasa seem to be consistent with the previous analysis, in particular where we observed that the home region, Pohjanmaa, displays the lowest migration rate.

When we relate the chosen location in 1995 with the type of university studies (Figure 6) we obtain a first indication that mobility is influenced by the subject studied, in particular Education graduates in Pohjois-Karjala (73 of graduate residents), Engineering in Kymi (48) and Uusimaa (38), and Law in Lappi (49).

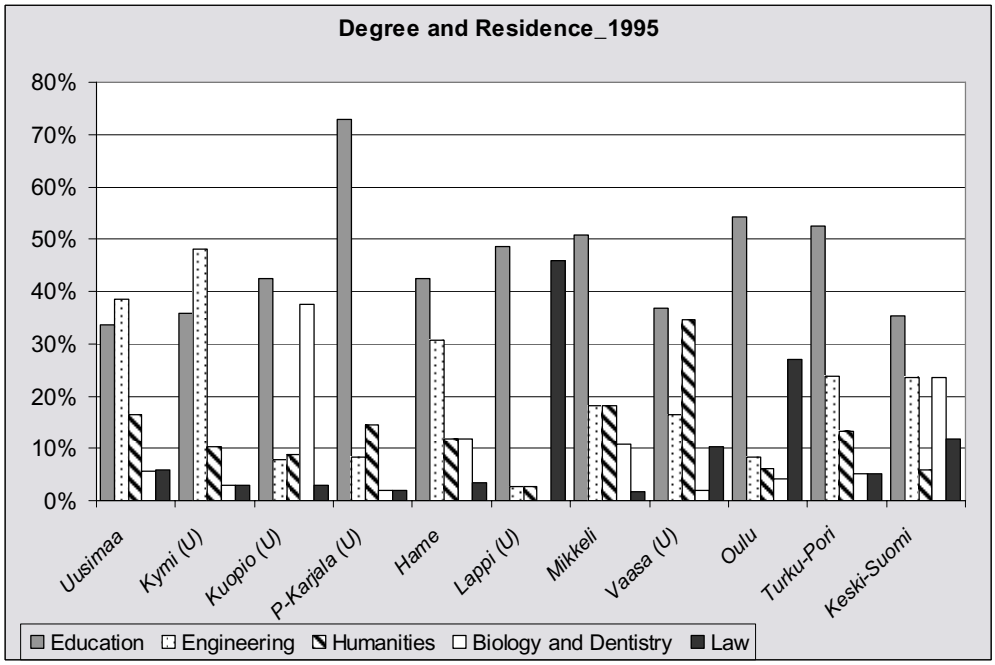

Figure 6. Graduates Degree and Residence in 1995

Using the work of Vanderkamp (1971) as reference, we can partition mobility choices according to whether relocating after graduation implies returning to the province of birth or moving to a different one. We call these groups respectively Repeat migrants and Return migrants. Table 6 shows that 43% of people in our cohort are Repeat migrants, thus confirming a high turnover across locations, while only 14% are Return migrants.

Table 6. Cohort partition

Tot. relocations	Zero	One		Two		**Total_1995**
	Stay	*Study*	*Work*	*Repeat*	*Return*	
Uusimaa	-	-	5.5%	19.8%	2.8%	**28.1%**
Vaasa	1.5%	0.3%	0.5%	1.8%	1.0%	**5.1%**
Kymi	1.8%	3.6%	0.9%	3.8%	1.0%	**11.1%**
P-Karjala	3.1%	5.3%	0.1%	0.7%	0.7%	**10.1%**
Lappi	3.0%	3.7%	0.2%	0.7%	0.1%	**7.8%**
Kuopio	0.8%	3.1%	2.3%	3.4%	0.9%	**10.6%**
Mikkeli	-	-	1.3%	1.7%	2.8%	**5.8%**
K-Suomi	-	-	1.6%	1.7%	0.3%	**3.6%**
Hame	-	-	2.2%	4.9%	1.8%	**8.9%**
Oulu	-	-	1.6%	2.3%	1.2%	**5.0%**
Turku-Pori	-	-	0.7%	1.8%	1.5%	**4.0%**
All	10.3%	16.0%	16.9%	42.6%	14.3%	**100%**

Summing up, the analysis of this section indicates that:

- The cohort under observation displays high levels of mobility, both for study and after graduation, with few return migrants and a strong majority of repeat migrants. On average, only 29% of people reside in their birthplace in 1995; natives of University regions are half of the total sample (491 out of 954), and 47% of them relocate to study; overall University provinces manage to retain about half of the graduates;
- Among university provinces Lappi and Pohjois-Karjala keep relatively more natives to study and attract more students, while Vaasa and Kuopio retain the least;
- The patterns of mobility observed within the cohort confirm some indications emerged in the broader analysis presented in the previous section: Uusimaa, the province of the capital Helsinki, is a strong attractor for graduates; Kymi and Kuopio attract the most repeat movers.

In the remainder of the section we explore the association between these mobility patterns and the categorical information we have on the subjects within the sample.

4.3 A logit analysis of spatial mobility

In this section we carry out a binary logit analysis to investigate the determinants of spatial mobility in 1980 and in 1995 on the basis of the categorical information provided by the dataset. Table 7 summarizes the categorical variables used in the model. We choose as dependent variables the two mobility indexes, MOB80 for 1980 and MOB95 for 1995. The dependent variable is set equal to 1 when the subject moves either to study in 1980 or after graduation as observed in 1995, and 0 otherwise; with respect to the independent variable, we take as reference those with the highest frequencies: Female (SEX=1) for gender, Education (FAC80) for faculty, Employee (SOC80) – i.e. professional rather than manual worker – for Social Background in 1980, and Employee (SOC95) for own Social Background in 1995.

Table 8 presents the estimations for mobility in 1980. The model shows a significant Chi-Square and predicts 73% of the responses correctly. In this first model gender does not bear significant influence, while both Occupation of the father/mother (SOC80) (which we use as a reasonable proxy for socio-economic background) and the faculty (FAC80) have a significant effect on the choice to move to study. Students whose parents are manual workers (SOC80=1) are associated with a lower probability or moving than students whose parents are employees (reference variable). Furthermore, those who studied biology/dentistry (FAC80=3) and law (FAC80=4) are associated with a lower probability of moving than those who studied Education, with odds increasing by a factor of 1.755 (as measured by the odds ratio). On the other hand, Education students in 1980 were significantly more likely to move to another province than those who opted for Humanities (FAC80=2) and Law (FAC80=4).

Table 7. Description of the variables

Variable	Description
Regression 1 (Mobility index in 1980)	
Dependent	
MOB80	Mobility index in 1980 • Moved to study (MOB80=1); • Did not move to study (MOB80=0).
Independent	
SEX	Gender: • Female (SEX=1); • Male (SEX=0).
SOC 80	Occupation of the main family earner in 1980: • Employee (SOC80); • Manual Worker (SOC80=1); • Other (e.g. Pensioners) (SOC80=2); • Self-Employee (SOC80=3).
FAC 80	Faculty in 1980: • Education (FAC80); • Engineering (FAC80=1); • Humanities (FAC80=2); • Biology, Dentistry (FAC80=3); • Law (FAC80=4).
Regression 2 (Mobility index in 1995)	
Dependent	
MOB95	Mobility index in 1995 • Moved after studies (MOB95=1); • Did not move after studies (MOB95=0).
Independent	
SEX	Gender: • Female (SEX=1); • Male (SEX=0).
SOC 95	Position of the subject in 1995: • Employee (SOC95); • Other (e.g. Pensioners) (SOC95=1); • Self-Employee (SOC95=2); • Manual Worker (SOC95=3);
FAC 80	Faculty in 1980: • Education (FAC80); • Engineering (FAC80=1); • Humanities (FAC80=2); • Biology, Dentistry (FAC80=3); • Law (FAC80=4).
MOB80	Mobility index in 1980 • Moved to study (MOB80=1); • Did not move to study (MOB80=0).

Table 8. Logit Regression of Mobility in 1980

Variable	*Coeff.*	*Std. Err.*	*Odds Ratio*
Constant	.1291**	.187	3.635
SEX (SEX =1)	-.206	.168	.814
SOC 80			
SOC 80 = 1	-.463**	.198	.629
SOC 80 = 2	-.111	.208	.895
SOC 80 = 3	-.251	.211	.778
FAC 80			
FAC 80 = 1	.562**	.227	1.755
FAC 80 = 2	-.549**	.213	.578
FAC 80 = 3	.035	.273	1.036
FAC 80 = 4	-.529**	.254	.589
No. Observations	954		
Correct Predictions	72.9		
Chi-Square (df. 8)			
Hosmer and Lemeshow Test	8.262		
Prob > Chi-Square	.408		

** p < .10; ** p < .05;*** p < .01; ^ p < .001*

Table 9 shows the estimated coefficients for the mobility index observed in 1995, that is, whether the subject has moved after graduation (MOB95=1) or not (MOB95=0). The model has a 74 rate of successful prediction and significant Chi-Square. We observe that, once again, gender does not play a significant role together with the type of job the person has taken after studying (SOC95). Conversely, faculty (FAC80) plays a significant role.

Table 9. Logit Regression of Mobility in 1995

Variable	*Coeff.*	*Std. Err.*	*Odds Ratio*
Constant	.758***	.203	2.133
SEX (SEX =1)	-.247	.176	.781
SOC 95			
SOC 95 = 1	.181	.268	1.198
SOC 95 = 2	.776	.515	2.174
SOC 95 = 3	.394	.796	1.482
FAC 80			
FAC 80 = 1	-.115	.222	.892
FAC 80 = 2	.236	.254	1.267
FAC 80 = 3	-1.003***	.255	.367
FAC 80 = 4	-.790**	.261	.454
MOB 80	.797***	.165	2.218
No. Observations	954		
Correct Predictions	73.7		
Chi-Square (df. 8)			
Hosmer and Lemeshow Test	7.760		
Prob > Chi-Square	.457		

** p < .10; ** p < .05;*** p < .01; ^ p < .001*

More in detail, those in the sample who studied Education (FAC80) moved to another province after graduation significantly more likely than those who choose Humanities (FAC80=3) and Biology (FAC80=4). We also observe that having moved to study (MOB80) influences positively and significantly the choice to move after the graduation, with odds increasing by a factor of 2.218, which is also confirmed by the positive and significant correlation between two mobility indexes shown in Table 10.

Table 10. Correlation between mobility in 1980 and 1995

		MOB80	MOB95
MOB80	Pearson Correlation	1	.160(***)
	Sig. (2-tailed)	.	.000
	N	954	954
MOB95	Pearson Correlation	.160(***)	1
	Sig. (2-tailed)	.000	.
	N	954	954

*** Correlation is significant at the 0.01 level (2-tailed)

4.4 Discussion

A growing stream of literature has examined the patterns of cross-regional migration in Finland in recent years. The common thread across these is a broad substantiation of the preference of highly skilled workers to locate in dense urban agglomerates (Sjastaad, 1962; Barro and Sala-i-Martin, 1991). This is so because large metropolitan areas feature integrated labour markets where workers can move through jobs at a relatively low cost and risk, and thus expected wages are higher and prospective career opportunities are better (Pissarides and Wadsworth, 1989; Krugman, 1991; Huber, 2004). In addition this literature suggests that labour force mobility features a demographic component whereby younger and highly educated individuals relocate more easily (see Hämäläinen, 2002; Virtaharju, 2002).

Dahllöf et al. (1998) studied the mobility of graduates from the University of Lappeenranta, and observed that the majority were native and that they did not relocate after graduation, as opposed to our findings that only half of those students are natives and that just about 21% of graduates choose to stay.[11] Riikkinen (2002) used a questionnaire to interrogate employees of the same university, and found that wages have a significant positive effect on mobility decisions and investments in infrastructures and living standards affect students' decision. Tervo (2000) analyses the relationship between unemployment and labour force mobility and shows that regional unemployment differentials in Finland decrease as a consequence of interregional migration. The corollary of is that high-unemployment regions are locked in a process of cumulative causation whereby young and educated workers tend to leave. Similarly, empirical findings by Kauhanen and Tervo (2002) indicate that highly educated young people tend to reside in prosperous areas while depressed regions attract

[11] The study by Dahllöf et al. was based on university personnel interviews and not on longitudinal survey statistics and therefore it seems plausible that these results could produce a bias due to interviewees' willingness to portray optimistically the employment opportunities in that region. This has deep roots in the general emphasis that universities play in regional development in Finland (see Virtanen, 2002).

older return migrants, a process that is held at root of disparities across regions. Pekkala (2003) articulates migration patterns across Finnish regions according to macroeconomic indicators such as population density and migration rates, and finds that between 1960s and 1990s least developed regions have systematically lost skilled people to the five most developed ones. While this may be expected in the case of remote rural areas, Pekkala finds that medium-sized cities and surrounding areas have experienced higher losses to big cities (Haapanen, 2000). This suggests that the gap across regions may widen as highly skilled people tend to concentrate in fewer areas (Ritsilä and Tervo, 1999). The analysis of Pekkala evidences also that new migrants head towards regions with more educational facilities and that lagging regions experience a higher rate of return migrants. This picture seems consistent also with the macroeconomic conjuncture of Finland in the 1990s, where high levels of unemployment due to a recession have presumably influenced the mobility of the labour force.

The analysis proposed in this paper is cast against the backdrop of policy actions undertaken in the 1960s with the intent to erase regional differences by expanding the public sector, and to complement this with the opening of new universities. This resonates in prima facie with the observation that Education is the largest field of study in our cohort, and that the public sector employs the majority of workers in these regions (Saarivirta, 2007). Universities like Lappi and Joensuu, for example were primarily created to feed the demand for labor of the public sector in their regions. In other cases new universities were seen as the route to strengthen the local industrial base, especially through the opening of technical faculties (Saarivirta, 2003). The University of Lappeenranta is a typical example of this. Furthermore, the paper integrates the existing studies by looking at the determinants of mobility choices at individual level. This part of the analysis indicates that at the beginning of the period (1980) family source of income (i.e. occupation of the father or mother) and the faculty influence the choice of relocating to undertake university education. In particular, the probability to relocate is higher for offspring of employees than of manual workers'. At the same time students of Education are less likely to move compared to those of Engineering. Conversely, mobility choices as observed in 1995, after graduation, suggest that the subjects whose background is in Education and, more generally, those who relocated previously to study are more likely to move again.

Nilson et al (2003) estimate that the growth in higher education attendance between 1960 and 1990 that is attributable to new universities in Finland is around 30000 people. In purely static terms this means that the objective of matching growing demand for higher education has been achieved. Whether this has contributed to regional development, however, remains debatable. Overall, the empirical results on retention rates indicate otherwise and precisely that better career prospects are still in the vicinity of Helsinki.

These results suggest some considerations in relation to a broader set of issues. In recent it has been suggested with growing emphasis that fostering regional economic development requires tight coupling between the characteristics of the production system and the design of supporting policies (Arbo and Benneworth, 2006). Contrary to the vision propounded by centrally-planned policies *en vogue* in the 1960s, there is currently a strong belief that the elements of cross-regional diversity need to be encouraged rather than targeted as an 'anomaly' to eliminate. In this sense, the patterns

of mobility observed in this paper provide a primary indication of how some regions have been unable to achieve more balanced regional development, arguably due to the absence of regional - as distinct from national - innovation policy. Such a perspective would lend support to a more nuanced approach based on the idea that performance differentials across regions are not transient features, and that at root of observed disparities are the factors that drive the path of economic development. These factors stem from the past and over time are supplemented by new ones, stimulated by the structural change of the economy. Thus, rather than resorting to the familiar static perspective based on differential resource endowment, one should rather look at the process of economic development as both the cause and the effect of such persistent differences. As Kaldor (1970: 340) aptly makes clear "The capital needed for industrialisation was largely provided by the very same individuals who acquired wealth as a result of the process of development, and not prior to it". Put differently, as the static efficiency argument has it, the free circulation of labour and capital across jurisdictional boundaries can counter factor imbalances. But in a dynamic perspective, and coherent with the view of collective knowledge, such distributional effects of factor mobility cannot be settled on an *a priori* basis.

In general, labour and capital are plausibly mobile but the horizon over which such mobility matters can change. This is to say that when the properties of collective technological knowledge are fully accounted for, the central point is not the allocation of given resources over a geographical space but rather the ability to retail the benefits of new knowledge and, thus to employ it both as an output and as an input for the production and circulation of new knowledge. This is a reflection of the principle of cumulative causation that links the growth of competitive advantage to the mutual growth of industry and development of skills and know-how (Mydral, 1957; Kaldor, 1970). In relation to this, it is not surprising that macro-economic policies aimed at the expansion of higher education throughout the country, like in the case of Finland, are only partially effective. These should be coupled with regional programs which take into consideration the specific features of the local markets. Competing at regional level on dynamic efficiency, as it were, requires the ability to create a dynamic co-ordination between the basic needs of a region and its instituted knowledge base.

5. Conclusions

In this paper we observed the spatial mobility of the educated labour force in Finland after the expansion of the University network of the 1960s. This was part of a wider policy plan responding to the prevalent view that centrally-planned government intervention should erase cross-regional disparities. In the context of Finland, the main support to this action came from the belief that young people should be granted the right to study in their native regions and not be forced to relocate. At the time it was also expected that the local economies would benefit from the presence of a highly educated labour force and that universities would take a leading role in the economic development of the regions.

Universities are a key component of innovation systems in every region and country in that they operate as prime engines of economic development through the mobilisation of important resources,

namely: the production of skilled labour force, the generation of direct consumption effects for the surrounding areas, and the creation of knowledge. To be effective this kind of process requires also the establishment of formal and informal channels of co-operation among interdependent agents. Regional communities that share common knowledge bases highlight the importance of specific resources for stimulating the innovation capability and competitiveness. Universities, as sites specialised in the creation and the diffusion of knowledge, provide an obvious route to pursue such objectives. As argued by Porter (1998), this has a strong reflection also on the national level.

On the basis of this, the degree of retention of graduates is an interesting indicator of the ability of regions to set in motion the dynamic process of capability building that is at root of economic development. The results of our panel data on five Finnish regions show that on average university provinces manage to retain only half of their natives, and half of the overall graduates, while most of the graduates are attracted by job opportunities in the area of the capital city Helsinki. Our analysis also shows that if a subject moves once, the probability to relocate after graduation increases by a factor of two. Thus, the policy aimed at the local development of opportunities within the regions seems to have partially failed. Arguably this is a failure in terms of consistency between policy objectives and instruments, as a well-known principle has it (Tinbergen, 1952). Put in a wider frame, the paper highlights the changing and uneven effects of education and knowledge on economic growth at regional and national level in one of the most dynamic economies of Europe[14]. In so doing, it hopefully paves the way for future work aimed at developing cross-country comparisons.

Acknowledgements. Previous drafts of this paper were presented at the DRUID summer conference (Copenhagen, June 2005), and at the Proact Innovation Pressure Conference (Tampere, March 2006). The authors wish to thank all those who provided comments on those occasions. We are also grateful to Cristiano Antonelli, Stan Metcalfe, Ronnie Ramlogan, Francesco Quatraro and Markku Sotarauta for constructive suggestions which helped us clarify several points. The usual caveat applies.

References

Antonelli, C. (2000) Collective Knowledge Communication and Innovation: The evidence of technological districts, *Regional Studies* 34(6), 535-547.

Antonelli, C. (2001) *The Microeconomics of Technological Systems*, Oxford University Press.

Antonelli, C. (2003) Knowledge Complementarity and Fungeability: Implications for Regional Strategy, *Regional Studies* 37(6/7), pp. 595-607.

Antonelli, C. (2005) Models of Knowledge and Systems of Governance, *Journal of Institutional Economics* 1(1), pp.51-73.

Arbo, P. and Benneworth, P. (2006) Understanding the regional contribution of higher education institutions: a literature review. OECD.

Asheim, B. and Gertler, M. (2004) The Geography of Innovation, in Fagerberg, J., Mowery, D. and Nelson, D. (Ed) *The Oxford Handbook of Innovation*, Oxford University Press.

Asteriou, D. and Agiomirgianakis, G.M. (2001) Human Capital and Economic Growth. Time Series Evidence from Greece, *Journal of Policy Modeling* 23, pp. 481-489.

Audretsch D.B. and Feldman, M. (1996) Spillovers and the Geography of Innovation and Production, *American Economic Review 86*, pp. 630–40.

Barro, R.J. and Sala-i-Martin, X. (1991) Convergence Across States and Regions, *Brookings Papers on Economic Activity* 1, pp. 107-182.

Boschma, R. & Sotarauta, M. (2007) Economic Policy from an Evolutionary Perspective: the case Finland, *International Journal of Entrepreneurship and Innovation Management, 7*, pp. 156-173.

Bruun, H. (2004) The emergence of a regional innovation network: BioTurku in Turku, Finland, in G. Schienstock (ed.) *Embracing the Knowledge economy: the dynamic transformation of the Finnish innovation system*, Edward Elgar.

Castells, M. and P. Himanen (2006) *The Information Society and the Welfare State: the Finnish model*. Oxford University Press.

Clinch, R. P. and Gerlowski, D. A. (2002) *The Economic Impact of the University System of Maryland: A Fiscal Perspective,* Adelphi, Maryland.

Cooke, P., M.G. Uranga and G. Extebarria (1997) Regional Innovation Systems: Institutional and organizational dimensions, *Research Policy* 26, 475-491.

Cowan, R., David, P.A. and Foray, D. (2000) The Explicit Economics of Knowledge Codification and Tacitness, *Industrial and Corporate Change* 9 (2), pp. 211-253.

Dahllöf, U. & Goddard, J. & Huttunen, J. & O´Brien, C. & Román, O. & Virtanen, I. (1998) *Towards the Responsive University. The Regional Role of Eastern Finland Universities*, Publications of Higher Education Evaluation Council 8/1998, Oy Edita Ab. Helsinki.

Daveri, F. and O. Silva (2004) Not only Nokia: what Finland tells us about new economy growth, *Economic Policy* 19(38), pp. 117-163.

Doloreux, D. (2002) What We Should Know about Regional Systems of Innovation? *Technology in Society* 24, pp. 243-263.

Doloreux, D. and Parto, S. (2005) Regional Innovation Systems: Current discourse and unresolved issues, *Technology in Society* 27, pp. 133–153.

Dunford, M. (2003) Theorizing Regional Economic Performance and the Changing Territorial Division of Labour, *Regional Studies* 37(8), pp. 839-854.

Etelä-Karjalan tilastokatsaus (2003) Etelä-Karjalan liiton julkaisu A:1/2003.

Eskola, S. (2002). Tiedepolitiikka ja korkeakoulut, in Tommila, P. (Ed) *Suomen tieteen historia 4. Tieteen tutkimuksen yleinen historia 1880-luvulta lähtien*, WSOY. WS Bookwell Oy, Porvoo.

Felder, I. (1990) Universities as Engines of R and D-based Economic Growth, *Research Policy* 19 (4), pp. 335-348.

Feldman M.P. (1994) *The Geography of Innovation*, Kluwer Academic, Dordrecht.

Feldman M.P. (1999) The New Economics of Innovation Spillovers and Agglomeration: a review of empirical studies, *Economics of Innovation and New Technologies* 8, pp. 5–26.

Florida, R. (2000) *The Economic Geography of Talent*, Available online at heinz.cmu.edu/~florida/pages/pub/working_papers/economic_geography_talent_graphs.pdf (read 11.2.2005)

Georghiou, L., K. Smith, O. Toivanen, and P. Ylä-Anttila (2003) *Evaluation of the Finnish innovation support system*, Ministry of Trade and Industry (Finland). Available online at: http://www.tekes.fi/ohjelmat/arviointi/arviointi.html (28.02.2006)

Geuna A. (1999) *The Economics of Knowledge Production*, Edward Elgar, Cheltenham.

Haapanen, M. (2000) Expected earnings and interregional migration, University of Jyvaskylä School of Business and Economics, working Paper 221.

Hämäläinen, K. (2002) Unemployment, Selective Employment Measures and Inter-Regional Mobility of Labour, *Papers in Regional Science* 81, pp. 423-441.

Hedman, J. and Aaltonen, S. (1999) *External Economic Impacts of the University of Turku. Turun yliopisto*, Rehtorinviraston julkaisusarja 6/1999, Kehittäminen ja suunnittelu, Turku.

Hjerppe, R. and Pihkala, E. (1989) Suomen taloudellinen kasvu, in Loikkanen, H. and Pekkarinen, J. (Ed) *Suomen kansantalou – instituutiot, rakenne ja kehitys,* WSOY, Porvoo.

Hjerppe, R. and Vartia, P. (1997) Taloudellinen kasvu ja rakennemuutos*, in* Loikkanen, H., Pekkarinen, J., Siimes, S-A. and Vartia, P. (Ed) *Kansantaloutemme – rakenteet ja muutos,* Taloustieto Oy, Tammer-Paino Oy, Tampere.

Honkapohja, S. and Koskela, E. (1999) The Economic Crisis of the 1990s in Finland. *Economic Policy*, October 1999, pp. 401-436.

Howells, J. (2002) Tacit Knowledge, Innovation and Economic Geography, *Urban Studies* 39, pp. 871-884.

Hyyppä, M. T. (2002) *Elinvoimaa yhteisöstä, Sosiaalinen pääoma ja terveys*, Otavan kirjapaino Oy, Keuruu.

Huber, P. (2004) Inter-Regional Mobility in Europe: a note on the cross-country evidence *Applied Economics Letters* 11, pp. 619-624.

Kaldor, N. (1970) The Case for Regional Policies, *Scottish Journal of Political Economy* 18 (3), pp. 337-348.

Kauhanen, M. and Tervo, H. (2002) Who Moves to Depressed Regions? An analysis of migration streams in Finland in the 1990s, *International Regional Science Review* 25: 2, pp. 200-218.

Kautonen, M., Koski, P. and G. Schienstock (2004) From the national industrial heartland towards a node in the global knowledge economy: the case of Tampere Region, in G. Schienstock (ed.) *Embracing the Knowledge economy: the dynamic transformation of the Finnish innovation system*, Edward Elgar.

Keane, J. and Allison, J. (1999) The Intersection of the Learning Region and Local and Regional Economic Development: Analysing the Role of Higher Education, *Regional Studies*, pp. 896–902.

Keeble, D. and Lawson, C. (1998) Collective learning processes, networking and 'institutional thickness' in the Cambridge region, in: Keeble, D. and Lawson, C. (Ed) *Collective Learning Processes and Knowledge Development in the Evolution of Regional Clusters of High Technology SMEs in Europe*, pp. 99-115. ESRC Centre for Business Research, University of Cambridge.

Kiander, J. (2004a) *The Evolution of the Finnish Model in the 1990s: from depression to high-tech boom,* VATT Discussion Papers 344, Government Institute for Economic Research. Helsinki.

Kiander, J. (2004b). *Growth and Employment in Nordic Welfare States in the 1990s: a tale of crisis and revival,* VATT Discussion Papers 336, Government Institute for Economic Research, Helsinki.

Krugman, P. (1991) Increasing Returns and Economic Geography, *Journal of Political Economy* 99, pp. 483–499.

Lawson, C. and Lorenz, E. (1999) Collective Learning, Tacit Knowledge and Regional Innovative Capacity, *Regional Studies* 33(4), pp. 305-317.

Lemola, T. (2002) Convergence of National Science and Technology Policies: the case of Finland, *Research Policy* 31, pp. 1481-1490.

Lever, W. F. (2002) Correlating the Knowledge-base of Cities with Economic Growth, *Urban Studies* 39, pp. 859-870.

Lin, T. –C. (2004) The Role of Higher Education in Economic Development: an empirical study of Taiwan case, *Journal of Asian Economics* 15, pp. 355-371.

Loasby, B. (1991) *Equilibrium and Evolution: an Exploration of Connecting Principles in Economics*, Manchester University Press: Manchester and New York.

Luger, M.I. and Goldstein, H.A. (1997) What is the Role of Public Universities in Regional Economic Development? In Bingham, R.D. and Mier, R. (Ed) *Dilemmas of Urban Economic Development, Issues in Theory and Practise*, Urban Affairs Annual Reviews 47, SAGE Publications, California.

MacFarland, T.W. (2001) *An Estimate of Nova Southeastern University's Economic Impact on South Florida and Florida for Fiscal Year 2000*, Nova Souhteastern University Research and Planning.

Malmberg, A. and Maskell, P. (1999) Localized Learning and Industrial Competitiveness, *Cambridge Journal of Economics* 23, pp. 167–185.

Malmberg, A. and Maskell, P. (2002) The Elusive Concept of Localization Economies: towards a knowledge-based theory of spatial clustering, *Environmental Planning* 34, pp. 429–449.

Mansfield, E. (1995) Academic Research Underlying Industrial Innovations: sources, characteristics, and financing, *Review of Economics and Statistics 2*, pp. 55-65.

Mansfield, E. and Lee, Jeong-Yeon (1996) The Modern University: contributor to industrial innovation and recipient of industrial R&D support, *Research Policy* 25 (7), pp. 1047-1058.

McMahon, W.W. (1998) Education and Growth in East Asia*, Economics of Education Review* 17, pp. 159-172.

Metcalfe, J.S. (2002) Knowledge of Growth and the Growth of Knowledge, *Journal of Evolutionary Economics* 12(1), pp. 3-15.

Metcalfe, J.S. and Ramlogan, R. (2005) Limits to the Economics of Knowledge and Knowledge of Economics, *Futures* 37 (7), pp. 655-674.

Morgan, K. (1997) The Learning Regions: institutions, innovation and regional renewal, *Regional Studies* 31(5), pp. 491–503.

Mowery, D. and Sampat, B. (2004) Universities in National Innovation Systems, in Fagerberg, J., Mowery, D. and Nelson, D. (Ed) *The Oxford Handbook of Innovation*, Oxford University Press.

Mydral, G. (1957) *Economic Theory and Underdeveloped Regions*, London, Duckworth.

Nevala, A. (1983) *Joensuun korkeakoulun perustamisvaiheet*, Joensuun korkeakoulun offsetpaino, Joensuu (in Finnish).

Nilsson, J.A., P. Arbo, M.S. Dahl, B. Dahlum, I.R. Edvardsson, H. Eskelinen, K. Nielsen, Å. Uhlin and H. Ylinenpää (2003) The Role of University in Regional Innovation System. Nordic Industrial Fund, Centre for Innovation and Commercial Development. Online at www.nordicinnovation.net/_img/Universitetens_ roll_forregionale_innovationsystem.pdf

Niosi, J. (2002) National Systems of Innovation are "x-efficient" (and x-effective). Why Some are Slow Learners? *Research Policy 31*, pp. 291-302.

Oinas, A. (1999) Se syntyi sittenkin, in Matkalla Kojamoon (Ed) *Muisteluksia Lapin yliopiston alkuvaiheista*, Lapin yliopiston hallinnon julkaisuja 41, Rovaniemi (in Finnish).

Ollikainen, M. (1997) Luonnonvara- ja ympäristötalous, in Loikkanen, H., Pekkarinen, J., Siimes, S-A. and Vartia, P. (Ed) *Kansantaloutemme – rakenteet ja muutos,* Taloustieto Oy, Tammer-Paino Oy, Tampere (in Finnish).

Österlund, T. (1997) *Pohjanmaan alueen muuttoliike vuosina 1988-1996*, Siirtolaisinsituutti, Pohjanmaan aluekeskus, Research Reports No. 1.

Paija, L. (2001) The ICT cluster in Finland - Can we explain it? in L. Paija (Ed.) *Finnish ICT cluster in the digital economy*, Helsinki: Taloustieto.

Pekkala, S. (2003) Migration flows in Finland: regional differences in migration determinants and migrant types, *International Regional Science Review* 26 (4), pp. 466-482.

Petrakis, P.E. and Stamatakis D. (2002) Growth and Educational Levels: a comparative analysis, *Economics of Education Review* 21, pp. 513-521.

Pissarides, C.A. and Wadsworth, J. (1989) Unemployment and the Inter-Regional Mobility of Labour, *The Economic Journal* 99, pp. 739-755.

Porter, M. (1998) Clusters and the New Economics of Competition, *Harvard Business Review* (November/December), pp. 77–90.

Porter, M.E., K. Schwab and A. Lopez-Claros (2005) *The Global Competitiveness Report 2005-2006.* World Economic Forum: Palgrave Macmillan.

Riikkinen, S. (2002) *Lappeenrannan teknillisen korkeakoulun alueellinen vaikuttavuus*, Hallinnon julkaisuja 109, Lappeenrannan teknillinen korkeakoulu, Lappeenranta.

Ritsilä, J. and Tervo, H. (1999) Regional Differences in the Role of Migration in Labour Market Adjustment: The Case of Finland. In: Crampton G (ed.) *Regional Unemployment, Job Matching and Migration, Series on European Research in Regional Science*. Pion, London, pp. 166-182.

Romanainen, J. (2001) The cluster approach in Finnish technology policy, in OECD (ed.), *Innovative Clusters: Drivers of National Innovative Systems*, Paris: OECD.

Rosenberg, N. (2000) *Schumpeter and the Endogeneity of Technology: some American perspectives*, The Graz Schumpeter Lectures. London, New York Taylor and Francis.

Rosenberg, N. and Nelson, R.R. (1994) American universities and technical advance in industry, *Research Policy* 23 (3), pp. 323-348.

Saarivirta, T. (2003) *Yliopistollinen toiminta Satakunnassa – yliopistollisen koulutuksen ja tutkimuksen synty, kehittyminen ja laajentuminen 1960-luvulta 2000-luvulle*, Porin kaupungin tutkimuksia 125/2003, Pori.

Saarivirta, T. (2004) *Koulutuksen ja tutkimuksen taloudellinen merkitys – vertaileva tutkimus yliopistollisen koulutuksen ja tutkimuksen taloudellisesta merkityksestä seitsemälle alueelle,* Acta Universitatis Tamperensis 1008, Tampere University Press, Tampere.

Saarivirta, T. (2007) Finnish Higher Education Expansion and Regional Policy, *Higher Education Quarterly* (forthcoming).

Saarivirta, T., Ramlogan, R. and Consoli, D. (2005) The Impact of Education in the Regional Economic Development of Finland. Centre for Research on Innovation and Competition (CRIC), University of Manchester, Mimeo.

Schienstock, G. (2004) The Finnish model of the knowledge economy, in G. Schienstock (ed.) *Embracing the Knowledge economy: the dynamic transformation of the Finnish innovation system*, Edward Elgar.

Sjastaad, L. (1962) Interpreting the Effect of Distance on Migration, *Journal of Political Economy* 81, pp. 1153-1169.

Sotarauta, M. & Kautonen, M. (Forthcoming) Co-evolution of the Finnish National and Local Innovation and Science Arenas: Towards A Dynamic Understanding of Multilevel Governance. *Regional Studies*.

Sotarauta, M., Dubarle, P., Gulbrandsen, M., and Nauwelaers, C. (2006) Supporting the Contribution of Higher Education Institutions to Regional Development, *Peer Review Report: Trondelag (Mid-Norwegian Region), Norway,* OECD, Paris.

Statistics Finland (2004a) Altika Database.

Statistics Finland (2004b) Regional Accounts.

Statistics Finland (2005a) http://www.stat.fi/tup/suoluk/taskus_kansantalous.html (10.3.2005)

Statistics Finland (2005b) http://tilastokeskus.fi/tup/suoluk//taskus_tyoelama.html (14.3.2005)

Statistics Finland (2005c) http://www.stat.fi/tup/tiedotteet/v2005/tiedote_022_2005-04-26.html (5.5.2005)

Statistics Finland (2006) Altika Database.

Sudmant, W. (1999) *The Economic Impact of the University of British Columbia on the Greater Vancouver Regional District*, Planning and Institutional Research, The University of British Columbia.

Tervo, H. (2000) Migration and Labour Market Adjustment: empirical evidence from Finland 1985-1990, *International Review of Applied Economics* 14, pp. 343-360.

Tinbergen, J. (1952) *On the theory of economic policy*, Amsterdam.

Virtaharju, M. (2002) *Korkeasti koulutetun väestön liikkuvuus*, Tiede, teknologia ja tutkimus 2002: 1, Tilastokeskus (in Finnish).

VIRTANEN, I. (2002) *Yliopistojen kolmas tehtävä*. Kunnallisalan kehittämissäätiön Polemiasarjan julkaisu nro 44, Vammalan Kirjapaino Oy, Vammala (in Finnish).

VIRTUAL FINLAND (2005b) http://virtual.finland.fi/finfo/images/people/popumap_b.gif (14.3.2005)

WORLD ECONOMIC FORUM (2005) http://www.weforum.org/site/homepublic.nsf/Content/United+States+in+Second+Place+Behind+Finland+in+Global+Competitiveness+Report (24.5.2005) www.cia.gov/cia/publications/factbook/geos/fi.html (10.3.2005) www.joensuu.fi/faculties.html (14.3.2005) www.lut.fi/fi/yliopisto_lyhyesti/index.html (14.3.2005) www.research.fi/OECD (2002). Main Science and Technology Indicators, November 2002. (15.10.2003) www.uku.fi/tutustu/tiedekunnat.shtml (14.3.2005) www.ulapland.fi/contentparser.asp?deptid=13906 (15.3.2005) www.uwasa.fi/info/info-fi.html (14.3.2005)

YRKKÖ, J.A. AND HERMANS, R. (2004) Nokia: a giant in the Finnish innovation system, in G. Schienstock *Embracing the Knowledge economy: the dynamic transformation of the Finnish innovation system*, Edward Elgar.