Flows of Human Capital
in the Nordic Countries

Paper 1 (STEP Report 13-2003):

**Measuring Mobility –
Some Methodological Issues**

Nordic Industrial Fund
center for innovation and commercial development

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		STEP REPORT 13-2003
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	CLIENT(S) The Nordic Industrial Fund	

ABSTRACT

The paper discusses definitions of mobility, the choice of unit of observation for mobility (establishment or enterprise) and classifications of sectors of the economy. The rationale for the discussion is to find a good basis for using mobility research to investigate flows of human capital in an innovation system. Consequences are then illuminated using Danish and Finnish data.

These aspects of measurement are of interest because they illuminate important consequences of methodological choices related to the use of matched employee/employer register datasets, since the use of these in mobility research is in its infancy.

These methodological considerations are the output of a Nordic project which is dealing with the flow of human capital through job mobility in general, through researcher mobility in particular, and through migration between the Nordic countries. The project is jointly undertaken by STEP, The Danish Institute for Studies in Research and Research Policy, Statistics Finland, Statistics Iceland, and Vinnova.

KEYWORDS	ENGLISH	NORWEGIAN
GROUP 1	Technology management	Teknologiledelse
GROUP 2	Innovation	Innovasjon
SELECTED BY AUTHOR	Mobility	Mobilitet
	Human capital	Humankapital
	Nordic countries	Norden

Foreword and reader's guide[1]

Competence is a key ingredient for innovation and growth. The prosperity of a nation depends on the knowledge, skills and experience that can be put to work in the operation and development of its economic and social life. Research, education of the young, and lifelong learning are being heralded as crucial mechanisms for supplying businesses and the public sector alike with new and updated competence. A growing body of knowledge about these mechanisms is forming an increasingly strong foundation for public policy and private strategy.

The movement of people involves a mechanism of knowledge transfer that is much less understood. When people move between jobs or between social settings, they carry their skills and experience with them to the new firm or region. When a competence meets with a new situation, innovation can occur, so mobility is not only about moving human capital around but also about creating something new in the process. Competence moves with people in a non-trivial way and mobility may be seriously underestimated as a moving force for social and economic development.

However, research and education take place in purpose-built institutions that are highly visible and relatively easy to study for the purpose of policy improvement. Mobility of human capital, on the other hand, is deeply embedded in social and economic institutions whose primary mission is not the moving of human capital, so it is essentially a by-product of other processes and much less visible to the public eye. Thus the understanding of mobility and its contributions (positive and negative) to a country's competence base is merely in its infancy. Briefly put, the research question is still very open: What is the role of mobility in a National Innovation System?

The project "Flows of human capital in the Nordic countries" ("Kompetansestrømmer i Norden") is a small and exploratory step in the quest for understanding the competence aspect of mobility. The project has set out to illuminate issues of

- human capital flows or circulation through the inter-Nordic labour market
- benchmarks and stylised facts of mobility in the Nordic countries (with a particular emphasis on the significance of the business cycle)
- science – industry mobility

all while identifying and addressing the challenges of opening new, large national register databases to international comparative research.

The project was inspired by the Nordic co-operation in the OECD work on National Innovation Systems in the so-called "Focus Group on Human Mobility" in 1997-1998. Research issues of high policy relevance that were addressed included a better understanding of flows of competence embedded in employees changing jobs. The science-industry relation was a particularly hot topic in this respect. The OECD work was in turn based on the newly available "employment files", i.e. matched employer-employee data produced by combining public register databases. These employment files are constructed in different ways in different countries, but all of them contain a common core of data about all individuals in the population above 16 years, the "active population".

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[1] This section is common to the three project reports and the two methodological papers and also appears as the introduction to the summary report.

Until recently it was only the four largest Nordic countries that had such employment files available to researchers and statisticians, but recently Belgium has constructed the first time series of this kind using information from the social security system. In most OECD countries the information exists that would make it possible to construct employment files, but different statistical, legal and political traditions have so far blocked the development of such data sets.

The use of these register data for research purposes is still in an early, explorative phase. Because of this, some caveats are in order for interpreting the results. Firstly, the different mechanisms of knowledge transfer definitely complement each other and they probably also interact. Ideally, mobility rates should be seen in conjunction with measures of research, education and lifelong learning. This has not been possible in the present project.

Secondly, the human capital aspect is not the only aspect of mobility. High mobility increases personnel turnover costs for the firms involved. It disrupts teamwork, makes knowledge accumulation difficult, takes key personnel out of projects that are not finished etc. Low mobility might lead to too little circulation of both experience and new ideas and approaches, incurring high opportunity costs. It is therefore of interest to search for optimal ranges of mobility rates rather than to strive for extreme values. Mobility rates below 5 per cent may indicate stagnation and when they get above 25 per cent, things may seem a bit hectic. Even so, we are not in the position to identify a canonical range.

Our hope is that the results from this project will contribute to the development of research and policy on issues related to stocks and flows of human capital and related labour market issues.

The project has been carried out by a consortium with the following partners:

> The STEP Group[2], Oslo (lead partner) (Anders Ekeland, Håkon Finne, Svein Olav Nås, Nils Henrik Solum)
>
> The Danish Institute for Studies in Research and Research Policy (AFSK), Århus (Kenny Friis-Jenssen, Ebbe Graversen, Mette Lemming)
>
> Statistics Finland, Helsinki (Mikael Åkerblom, Markku Virtaharju)
>
> Vinnova[3], Stockholm (Adrian Ratkic, Christian Svanfeldt, Jonny Ullström)
>
> Statistics Iceland, Reykjavik (Ómar Harðarson).

Beyond the partners, Statistics Norway, Statistics Sweden and Statistics Denmark have provided register data. The Nordic Industrial Fund has been the main financial source for the project. Additional funding has been provided by The Finnish National Technology Agency, the Research Council of Norway.

The project has resulted in a summary report, three detailed reports and two methodological papers, all of which are published in STEP's report series.

The present paper, Paper 1, the **Classification paper** (Virtaharju and Åkerblom (2003): Measuring mobility, some methodological issues. Oslo: SINTEF STEP), is a paper that accounts for the methods and classifications used in the project. The paper focuses on dealing with register data. Its target audience is interested non-specialists and fellow researchers.

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[2] Since 2003-01-01, SINTEF STEP – Centre for Innovation Research.
[3] Until Vinnova's establishment in 2001, the participating analysts belonged to NUTEK.

Paper 2, the **Data source paper** (Harðarson (2003): A note on methodological issues using labour force survey data. Oslo: SINTEF STEP), discusses the relationships between register data and Labour Force Survey (LFS) data in detail. This discussion is important because while many countries perform LFSs regularly, only Nordic countries have register data available for detailed mobility studies. Iceland is the fifth of the Nordic countries to be constructing a register database for this purpose.

Project report 1, the **Migration report** (Graversen et al. (2003a): Migration between the Nordic countries: What do register data tell us about the knowledge flows? Oslo: SINTEF STEP), gives a comprehensive picture of flows of migration of Nordic citizens between the Nordic countries for the period 1988-1998. It studies migration rates, rates for returning to the country of emigration and rates for staying in the country of immigration. It breaks these figures down by a number of demographic and economic indicators. This report is aimed at researchers, statistics officials, policy makers and others interested in the flow of human capital between the Nordic countries.

Project report 2, the **Mobility report** (Graversen et al. (2003b): Mobility of human capital – the Nordic countries, 1988-1998. Oslo: SINTEF STEP), compares domestic job-to-job mobility rates in the Nordic countries, broken down over a number of demographic and economic indicators. Particularly important is the verification of procyclical movements in the mobility rates: propensity to change jobs follows the business cycle for most subgroups. The report has produced benchmarks for mobility and stylised facts about influences on mobility rates. This report is aimed at researchers, statistics officials, policy makers and others interested in the flow of human capital between firms.

Project report 3, the **Researcher report** (Ekeland et al. (2003a): Mobility from the research sector in the Nordic countries. Oslo: SINTEF STEP), is a specialised study of domestic job-to-job mobility rates for personnel in the research sector for the period 1988-1998. This topic is of particular interest for the discussion of the function of specialised research institutions in the innovation system, an expansion of the classical science – industry theme. The report is aimed at researchers, statistics officials, policy makers and other interested parties, including strategy developers of the institutions in the research sector.

The reports and papers are rather detailed. The **Summary report** (Ekeland et al. (2003b): Flows of human capital in the Nordic countries 1988-1998. Oslo: SINTEF STEP) summarises the main findings of the three project reports and the two papers and is recommended as the first intake for all readers. It also contains some material not found in any of the other publications but deemed appropriate for a synthesised formulation.

On behalf of all the partners in the project I would like to thank our sponsors, in particular the Nordic Industrial Fund, for this opportunity to contribute to a literature of growing importance through a stimulating and challenging Nordic co-operative effort.

Oslo, June 2003

Anders Ekeland
Project manager

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1 Introduction

The aim of this paper is to discuss various methodological issues in connection with the Nordic project investigating knowledge flows, using register data to measure the mobility of persons. This report serves as a background paper for various methodological choices made during the project and also demonstrates the effects of these decisions on the presented results. This paper is based on Finnish data complemented by some results from Denmark.

The paper starts with the definition of mobility and presents various options for the calculations. Then various pros and cons connected with the choice of unit of analysis are presented. The influence of enterprise demographic factors on mobility rates is shortly discussed. The classification issues related to the study are addressed in Chapter 4. Methodological aspects in connection with the use of various data sources, in particular the labour force survey but also use of register data, are discussed in a separate paper (Harðarson 2003).

2   Definition of mobility

Mobility can be defined in many different ways. Maybe the most common way of defining mobility is geographical mobility, i.e. movements from one place to another either within a country or between countries. A part of the Nordic study is devoted to an analysis of mobility in and out of the Nordic countries from the perspective of knowledge flows. The main focus of the Nordic study is however to discuss mobility as a change of employer or of employment status. There are two different aspects on this definition. Should we analyse inflows or outflows and should we analyse mobility within employment (narrow) or also flows in and out of employment (wide). Combining these aspects gives 4 different possibilities of defining mobility (mobility in/narrow, mobility in/wide, mobility out/narrow, mobility out/wide).

2.1 Mobility in or mobility out

Firstly we have to determine whether we analyse <u>mobility out</u> (changes between year t and the following year t + 1,) or <u>mobility in</u> (changes between years t-1 and t). In <u>mobility in</u> we are analysing from where those changing employment between years t-1 and t are coming. In <u>mobility out</u> we are analysing where those changing employment between years t and t +1 are going. In the previous Nordic project (see Nås et al. 1998) the <u>mobility out</u> concept was used. There is no conceptual difference between these measures, which one we use depends on what we want to study. In this Nordic study more emphasis has been put on <u>mobility in</u> rates data. From the employers' point of view flows from education to employment are more meaningful to follow with the <u>mobility in</u> approach. On the hand, if we are interested in how the education system is performing or how efficient it is, the outflows are meaningful as it in this case is more useful to know where do students go after education, employment or not, than it is to know where they were before education.

Formally the estimated mobility rates are expressed:

Inflow rate: $R(in)_t = \sum im_{t-1} / N_t$

Outflow rate: $R(out)_t = \sum om_{t+1} / N_t$

where im = 1 when person has changed status from preceding year, 0 when not
    om = 1 when person has changed status in following year, 0 when not
    N = Number of persons i.e. stock in year t

2.2 Narrow or wide mobility

There are also two basic dimensions in the definition of mobility, one narrow on the basis of changes of employers (job-to-job mobility), one wider (overall mobility) on the basis of changes of employers or employment status (unemployment, outside labour force, immigration). Which one to use must again be specified according to the research interest. Both ways of calculating mobility rates have been used in the Nordic study. The mobility rates are quite different according

to these definitions. In Finland the variation is from 14 per cent (lowest narrow) to 30 per cent (highest wide).
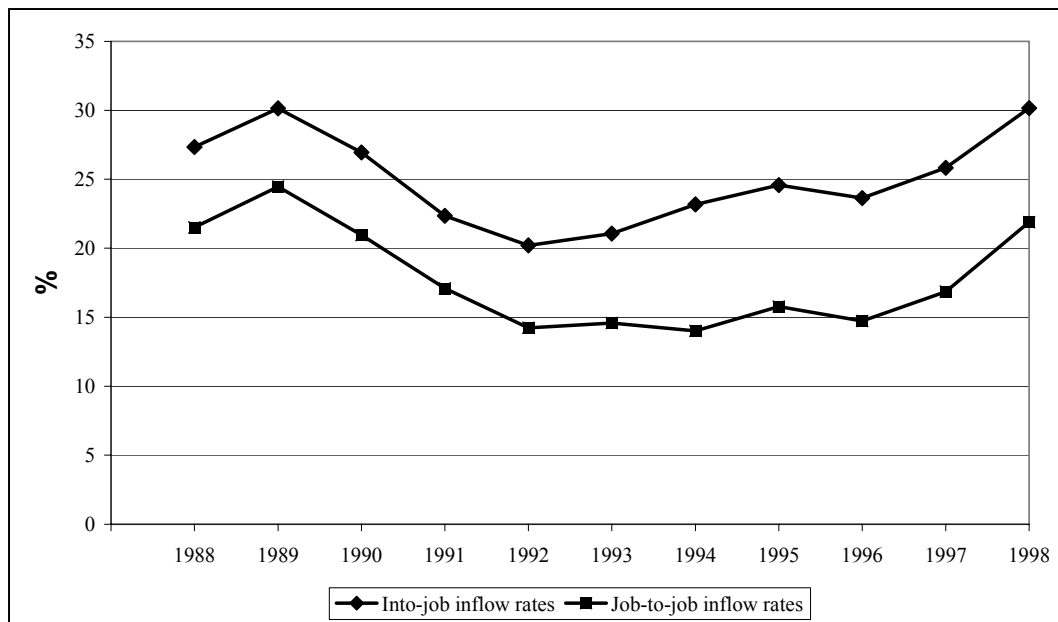

Figure 1: Example of mobility rates by different definitions, Finland 1988-98. Per cent.

3   Unit of analysis

3.1 Description of possible units

Mobility is used to measure knowledge flows as the person who moves to another employer brings along/carries away the cumulated knowledge (human capital) he/she has acquired during years. From the innovation system point of view it is not fully evident which unit of analysis is the best. Change of employer can be defined on at least three different levels (enterprise, establishment or change of both).

> **Definitions**:
>
> An **enterprise** refers to an economic activity carried out by one or more persons for profit–making purposes. Enterprises are natural persons (self-employed persons), legal persons (e.g. limited companies, co-operative societies, savings banks or economic associations), public financial institutions or unincorporated central government enterprises.
>
> An **establishment** is a production unit of an enterprise located on one set of premises and producing goods or services primarily of one kind. A non-ancillary establishment (e.g. a factory, shop, workshop, office) engages in normal production .An ancillary establishment (e.g. main office, warehouse) produces services for enterprise itself.
>
> The definitions are applied accordingly for private and government sectors.

3.1.1   Establishment level mobility

The most disaggregated level is the establishment (local kind of activity unit or local unit according to EU terminology). An advantage with the establishment unit is that it is fairly stable. However, there are new establishments registered purely due to organisational changes. How to handle these changes regarding mobility estimation, is described later in this paper. A part of mobility consists of changes between establishments within the same enterprise. It is in these cases difficult to judge if any knowledge flow, which we are interested in, has taken place. In any case the mobility between the establishments of the same enterprise is a different kind of mobility compared with mobility between establishments belonging to different enterprises. A high mobility within the same enterprise could be regarded as something positive for the enterprise, while mobility between enterprises generally is something negative for the donor enterprise and positive for the recipient enterprise, but should be on the optimal level for the economy as a whole. In some countries information on the establishment level is more readily available in the private sector and calculations on that level are technically more feasible. Therefore, calculations on the establishment level are regarded as more reliable than enterprise level information. On the other hand, the registers in the public sectors are not fully developed on the establishment level, which cause uncertainty in the analysis. Due to pragmatic reasons the establishment level has been used as the unit of analysis in this Nordic study.

3.1.2   Enterprise level mobility

The actors in the innovation system are organisations (enterprises, institutes, universities, etc.). If the knowledge embodied in employees is regarded as an intangible asset, the enterprise unit may be more appropriate as financial accounts and human accounts normally are kept at that level. The employer concept is also more closely related to the enterprise unit than to the establishment unit. The disadvantage with the enterprise unit is that it is more unstable than the establishment unit due to trading of establishments between enterprises and reorganisation of establishments. Enterprise level mobility includes mobility due to changes of establishments from one enterprise to another even if no job change has taken place. A knowledge flow has taken place but it is nevertheless a rather special kind of mobility. For both kinds of units, however, it is essential to adjust for artificial changes in the identification numbers not due to real changes in the units.

3.1.3   Mobility based on change of enterprise and establishment

A third option is to define mobility as a change of both establishment and enterprise. This will mostly give the lowest numbers as could be seen in the next section. Some of the disadvantages using either enterprise or establishment units are eliminated.

3.1.4   Group level mobility

In principle also the group dimension could be considered here. In the context of the Nordic study some calculations based on 19 Finnish groups of enterprises were made. Among these 19 groups the inflow rate on establishment level was 17 per cent in 1997, on enterprise level it was 10 per cent and on the group level 7 per cent. Further still, of the establishment level inflow rate about 4 percentage units were due to persons moving from outside of these 19 groups of enterprises. The group dimension has an effect on mobility but because of the non-existing data, the group level mobility has not been analysed further.

3.2 Analysis of effects of results using different kinds of units

In the following section, comparisons of mobility rates are made using the establishment and the enterprise level definitions. The so called narrow definition (job-to-job mobility) has been applied in order to better reveal the differences in rates as the flows from outside employment, e.g. from unemployment and education, are excluded. The enterprise level and establishment level mobility rates have been computed based on the changed enterprise and establishment codes correspondingly. Furthermore mobility rates have also been calculated based on the criteria when both of these codes have changed. This excludes from the mobility rates cases where people working in the same establishment have been transferred to a new enterprise. The computed mobility rates behave much in the way we might expect: when we apply more restrictive definitions the rates decrease. On the enterprise level the rates are lower than on the establishment level and they decrease further if we require change in both enterprise and establishment levels. Note that the codes for missing (unidentified unit in Finland) are here included as valid values, no adjustment has been done. If we require that both the enterprise and the establishment must have changed for an employee to be counted as mobility, the mobility rates decrease substantially. In Finland roughly 40 per cent of the establishment level mobility takes place within enterprises. Figure 3 shows the Danish figures for enterprise and establishment level mobility. The figures are

not exactly comparable as the Finnish enterprise level figures are based solely on enterprise id-codes and Danish are based on establishment codes. The inflow rates of these two countries nevertheless behave quite similarly to each other. The difference between establishment level mobility rate and the rate when both levels have changed is almost the same, 7 percentage points. The Danish series behave on all levels more regularly than those of Finland, which is probably due to the way the rates are computed.
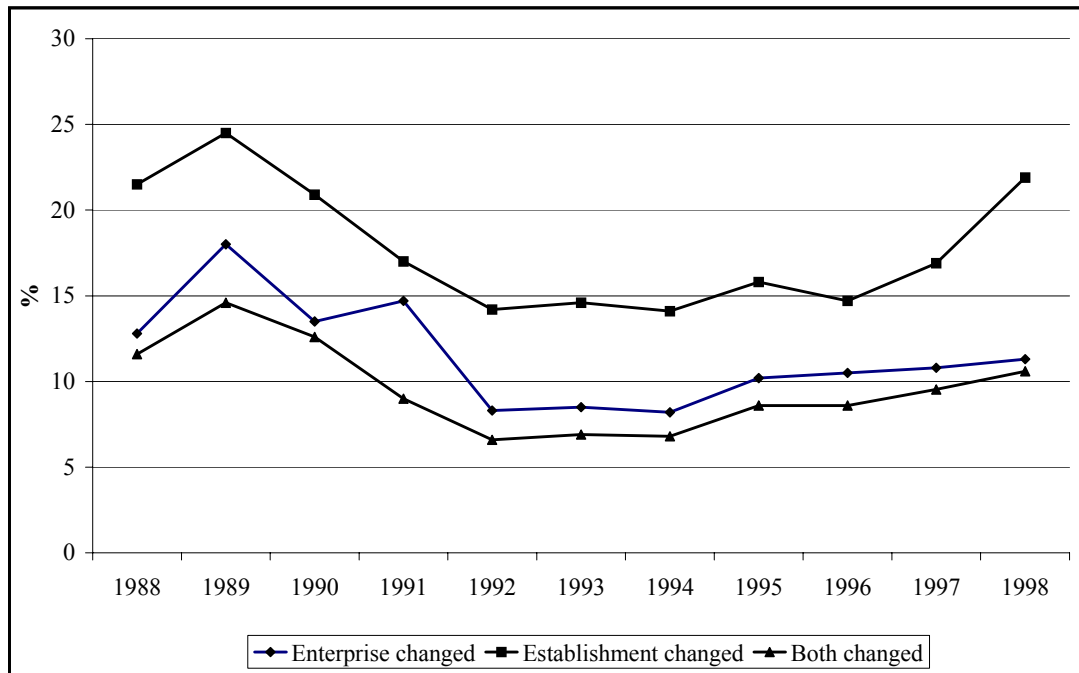
Figure 2: Job-to-job inflow mobility rates on establishment, enterprise, and both levels, Finland 1988-98. Per cent.
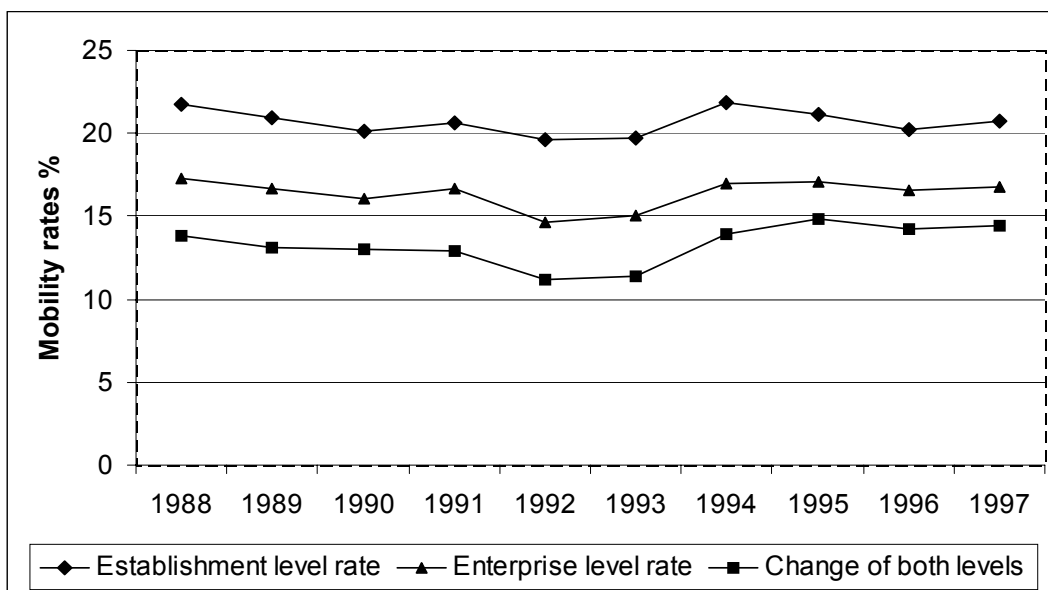
Figure 3: Job-to-job inflow mobility rates on establishment, enterprise and both levels, Denmark 1988-97. Per cent.

Figure 4 presents the Finnish job-to-job inflow rates by industrial sector. The establishment level rate is highest in every sector. A little oddly in ICT sectors (computer and telecommunications

equipment, telecommunication services and computer services) and also in education and research sectors, the mobility rate based on the change of both enterprise and establishment is higher than the enterprise level rate. This happens because of the different industrial sectors on the enterprise and establishment level in multi-establishment enterprises.
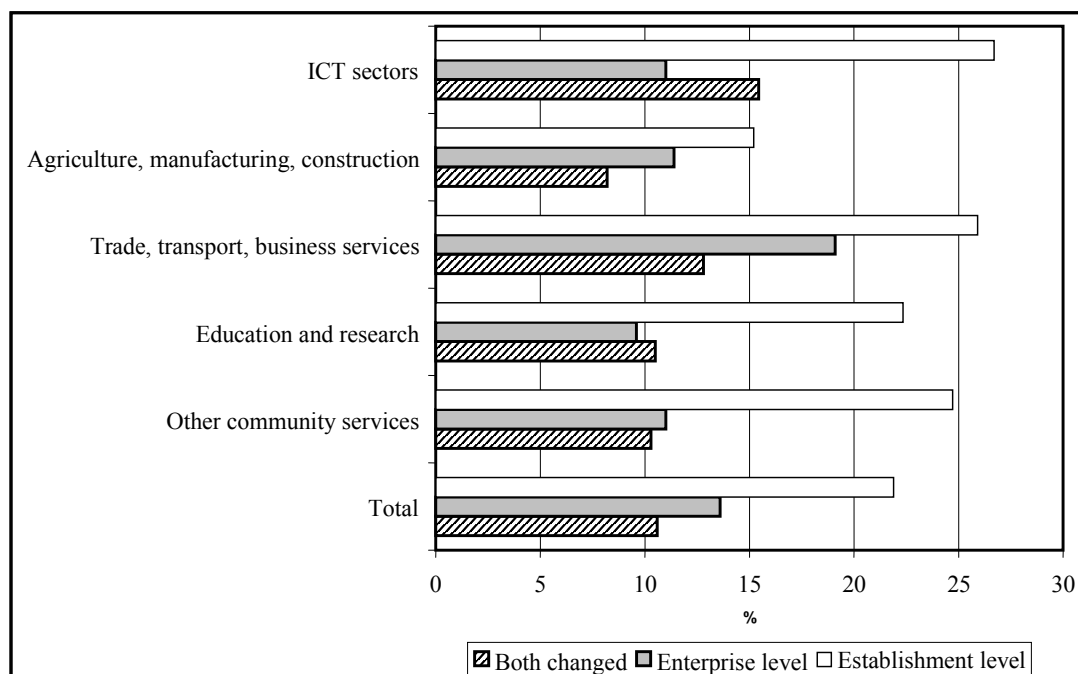
Figure 4: Job-to-job inflow mobility rates by sector, Finland 1998. Per cent.

The decomposed mobility rates by industrial sector (Table 1) for Denmark seem to be closer to each other than for Finland. Only in telecommunications (NACE 64.2), financial intermediation (NACE 65-67) and universities is the difference between enterprise level and establishment level rates substantial.

Table 1: Job-to- job inflow mobility rates on establishment, enterprise and both levels by sector, Denmark 1995. Per cent.

Sector (NACE code)	Establishment level rate	Enterprise level rate	Change of both levels
1, 2, 5	33,3	32,9	27,1
10-14	24,1	21,7	17,3
15-19	17,9	14,9	13,9
20-25	17,9	15,4	14,3
27-29, 31, 33-35	16,4	15,4	13,4
30, 32	19,7	18,8	18,7
26, 36, 37	21,4	19,3	14,6
40, 41	10,1	8,7	8,1
45	24,7	22,8	19,2
50-52, 55	24,5	21,3	18,1
60-63, 641	24,5	19,6	16,2
642	13,8	6,4	4,9
65-67	21,5	12,1	9,1
72	30,1	28,4	24,4
70, 71, 74	21,6	19,8	17,0
Universities 80	31,0	22,6	19,4
Other 80	16,7	12,1	11,2
73	22,1	20,8	16,4
85	21,2	15,1	13,5
75-95 (not 80, 85)	18,9	13,1	12,1

Table 2: Job-to-job inflow mobility rates on establishment, enterprise and both levels by sector, Finland 1995. Per cent.

Sector	Establishment level rate	Enterprise level rate	Change of both levels
1, 2, 5	4,8	5,5	4,1
10-14	12,8	8,4	7,2
15-19	11,2	7,0	6,3
20-25	10,9	5,6	4,9
27-29, 31, 33-35	12,5	11,8	9,0
30, 32	33,2	25,2	22,2
26, 36, 37	9,6	6,0	5,7
40, 41	12,9	6,0	5,6
45	13,7	12,0	10,7
50-52, 55	16,4	10,8	10,5
60-63, 641	17,0	7,7	11,9
642	13,0	10,1	6,7
65-67	25,6	18,8	10,3
72	23,6	17,4	17,4
70, 71, 74	18,0	14,8	14,0
Universities 80	23,1	13,6	13,5
Other 80	23,0	15,5	15,1
73	18,3	8,2	10,1
85	15,5	6,9	6,3
75-95 (not 80, 85)	20,3	11,3	10,5
Total	**15,8**	**10,2**	**9,5**

3.3 The influence of firm demographic factors on the mobility rates

In this section we discuss the effects of firm demographic changes (firm mergers, openings and closings of firms or establishments) on mobility rates. Many changes in firm structures are only organisational and so no real change in the sense of mobility of personnel has taken place. For example, in the Finnish case this can be seen in Figure 2, where there are two sharp upturns in firm level inflow rates for the years 1989 and 1991, which can more reasonably be explained by changes in firm structure than by really increased mobility rates. Another factor that has a substantial effect on estimation, is the updating procedures of business registers (less that of registers of public organisations) that are used to derive the information about one's job. A major inclusion/exclusion of a particular group of firms in one year may lead to 'unexplained' changes of rates. Obviously these factors should be taken into account when estimating mobility rates based on changes in firm id-codes.

Table 3: Adjusted inflow mobility rates, Finland 1997-98. Per cent.

Sector	Inflow rate			
	Enterprise level		Establishment level	
	original	adjusted *	original	adjusted*
1, 2, 5	5,1	5,1	7,4	7,4
10-14	8,4	8,4	25,4	22,6
15-19	9,2	8,6	14,4	13,7
20-25	10,1	7,1	13,7	13,0
27-29, 31, 33-35	10,2	8,3	12,6	11,5
30, 32	11,9	10,6	21,5	20,0
26, 36, 37	9,6	7,4	15,4	14,6
40, 41	5,7	5,4	15,1	14,4
45	19,6	19,3	29,3	28,9
50-52, 55	15,2	14,1	25,3	24,6
60-63, 641	11,0	10,8	28,4	27,4
642	12,7	11,1	22,6	21,4
65-67	12,8	7,8	18,6	15,8
72	29,5	27,5	37,5	35,6
70, 71, 74	18,4	17,6	27,8	27,0
Universities 80	11,2	11,2	19,7	19,7
Other 80	11,3	11,3	23,9	23,1
73	9,7	9,7	13,8	12,0
85	9,0	8,9	24,5	24,5
75-95 (not 80, 85)	12,6	12,6	24,8	24,8
Total	**12,2**	**11,3**	**22,0**	**21,4**

*): Adjustment for inflow rates: Business firms/establishment over 10 persons and at least half of personnel has remained same in the following year.

We have decided in the Nordic study to rely on existing registers and as a matter of fact we did not have the resources to do any large data modifications utilising (perhaps existing) firm demographic data. We have, however, adjusted the inflow rates for new establishments/firms in which the personnel have remained the same although the id-code of the unit has changed. Table 3 presents the results of the correction procedure based solely on information of personnel included in employment registers. The correction for inflow rates was done only for bigger new business firms and establishments. The new unit was defined as one not appearing in the register for the previous year and it was further decided to be old if at least half of its personnel had remained the same. This was not done for public units because the registers of the public organisations and establishments were not as comprehensive as the business registers. This method does not capture the really new units. These employment registers include a varying number of units which appear and disappear from the registers between years.

The results seem to imply that on the total level the adjustment is not so significant, particularly on the establishment level. The establishments of enterprises are more stable than the enterprises themselves. On the enterprise level major changes can take place without having any effect on personnel at establishment level. Thus the described adjustment method seems to work better on enterprise level. Of industrial sectors the difference between original and adjusted rates are greatest in financial sector (NACE 65-67). This is obviously so because of the vast re-structuring of these sectors in Finland in the recent years. Also the results in Table 3 show even more clearly

the difference between 'original' establishment level rates and 'corrected' firm level rates. So the decision of the unit becomes even more important.

The results show clearly that correcting or adjusting procedures based solely on data of the employment registers is not a particularly exact or reliable method due to the already mentioned changes in updating procedures and /or compilation of statistics of which these registers are produced. The more appropriate way to study the effects of structural changes of firms on the mobility rates would be to use auxiliary data of enterprise demography which consist of the genuinely new or closed units. To determine which units are new both establishment codes and enterprise codes have been used. In Table 4[4] the mobility rates have been decomposed into the share of new and old enterprises/establishments. For new units the rates were computed from inflows and for closed units from outflows.

Table 4: Share of new and closed enterprises and establishments in job-to-job inflow and outflow mobility rates, Finland 1998 and 1997.

	1998 Share of inflow*		1997 Share of outflow**	
Sector (NACE code)	New enterprises %	New establishments %	Closed enterprises %	Closed establishments %
1, 2, 5	3,7	6,1	1,8	0,5
10 – 14	4,4	13,8	4,5	1,4
15 – 19	19,4	7,1	12,2	4,0
20 – 25	7,6	5,7	24,1	5,8
27-29, 31, 33-35	4,3	7,9	9,0	4,7
30, 32	9,7	10,8	2,2	0,8
26, 36, 37	10,4	12,8	12,8	4,3
40, 41	0,9	6,5	4,4	3,0
45	9,1	8,8	7,2	5,8
50 – 52, 55	11,4	9,3	14,7	5,5
60 – 63, 641	6,6	6,2	7,8	11,4
642	11,7	9,7	53,4	2,4
65 – 67	7,3	8,1	3,4	7,2
72	14,6	10,1	27,7	18,4
70, 71, 74	10,7	8,9	8,5	8,2
80.300 (universities)	-	-	-	-
Other 80	1,3	1,4	0,3	0,2
73	3,1	2,3	2,4	3,3
85	3,1	3,2	0,8	0,2
75 – 95 (not 80, 85)	3,8	3,4	1,7	0,6
Total	**12,2**	**6,3**	**8,5**	**4,3**

*): The share of persons who changed job into units opened in 1998.
**): The share of persons who left job in units closed in 1998.
The estimated shares include all organisations.
The data of new and closed units include only business enterprises.

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[4] The data of firm demography for these tables originate from another study about the structural changes in Finland by Olavi Lehtoranta.

The data on firm demography were available only for business enterprises as corresponding data on the public sector were not readily available. The results show that on the enterprise level about 12 per cent of the job-to-job inflow is due to new enterprises and that the share is lower (6 per cent) on the establishment level. On the enterprise level the share was highest in consumer goods and computer services. On the establishment level the share was highest in mining, quarrying and other manufacturing.

The share of closed enterprises in the outflow mobility was about 8 per cent in 1998, it was considerably lower (4 per cent) on the establishment level. On the enterprise level the share was highest in computer and telecommunication services and telecommunication equipment. On the establishment level this share was highest in computer services, where almost one fifth of outflow mobility was due to closed units.

Both of these estimated shares of the new or closed units would increase a few percentage points in case we further corrected (or excluded) the data for persons working (still, outflow) in closed units or for those working (already, inflow) in new unit. The years in question, 1997 and 1998 were those of high economic growth which has its own effect on the estimated shares, for the recession years one could expect them to be quite different.

3.4 The influence of the choice of units on sectoral rates

One important topic for mobility analysis is mobility between various sectors (industries). Of particular interest here are flows between universities/research institutes and other sectors. There are several methodological issues involved. Firstly how to define a university and how universities are coded according to NACE. Secondly how to define a research institute and how research institutes are coded according to NACE.

From an innovation systems point of view we have according to our understanding to analyse the knowledge flows between knowledge producing institutions (universities and research institutes) and research utilising institutions (all others).

Within the universities as organisations Table 5 there are establishments coded to other NACE classes such as other education, research institutes or central libraries. The share of establishments coded into other sectors than higher education is according to the Finnish data small and the share also varies between universities. The same goes for the government research institutes and research units in the private non-profit sector. Therefore, both to avoid artificial mobility between sectors and to produce a better picture of these central agents, we have decided to recode all university units into higher education and all government and PNP research institutes into research.

Table 5: Persons employed in education and research sector on the establishment level[*)], Finland 1998.

Establishment	Government research institutes	Universities	Type of institution Business firms, non-research	Business firms, research	Research institutes, PNP	Total
Universities 80	-	23 283	-	-	-	23 283
Other 80	57	1 488	-	-	85	1 630
Research	9 477	1 201	2 445	1 487	261	14 871
Other sectors	890	1 182		177	38	2 287
Total	10 424	27 154	2 445	1 664	384	42 071

*): All persons in universities, government and private non-profit research institutes, all persons in the business enterprises, whose main activity was research, persons in research establishments of business enterprises in non-research sectors.

Also in the case of business enterprises the establishment unit approach causes some difficulties related to the definition of the research sector. In Finland there were NACE 73 establishments in 141 enterprises, of which 23 firms' main activity was other than research. As shown in Table 5, there were more persons employed in these non-research firms than in actual research enterprises. These are research labs of enterprises performing product development on the level of the whole enterprise. The similar activity of some other enterprises can be performed in several establishments not separated into NACE 73 establishments. Thus they have been coded according to the their main activity into sectors other research. There are also problems even with research (NACE 73) enterprises due to the misspecified codes. Units not performing actual research have erroneously been given NACE 73 code in official business registers. Some of the R&D enterprises in bigger groups of enterprises according to classification rules coded correctly to NACE 73 actually have the same position as research establishments in smaller enterprises performing R&D for the benefit of the whole group. So obviously the research group of firms will need some polishing in order to provide the true picture of the research sector.

However, Table 5 shows that the problems discussed above are not very significant and that an analysis based on establishments coded to the research sectors will not necessarily be misleading.

3.5 Conclusions on choice of unit

The results show that the choice of statistical unit and also the definition (narrow or wide) of mobility is essential when calculating the levels of mobility rates. The choice of units does not however influence the trends very much.

The issue of appropriate statistical unit may have to be considered further. Maybe the enterprise unit or the combination of changed enterprise and establishment is the more appropriate for at least certain types of analysis. If the establishment unit is maintained as the main unit, inter-enterprise movements between establishments have always to be identified as an important part of the decomposition.

4 Classifications

4.1 Educational classification

As the idea is to analyse knowledge flows in the innovation system, the main emphasis is on the more highly educated personnel. It has not been possible to take informal qualification into account (work experience and complementary education). The educational systems differ from each other, which makes exact comparisons difficult.

The following groups are defined according to the new international classification of education by Unesco, ISCED (1997). In connection with the revision of ISCED, most countries are revising their educational classifications to take the new ISCED into consideration. In practice, the new ISCED is the general framework for the comparative analysis but the actual classification of educations has to be based on the national codes.

Educational levels used in this study

ISCED level 6

PhD level:
This level is defined as degrees leading to advanced research qualifications preparing for faculty posts in universities offering education on ISCED level 5A.

ISCED level 5
For the purpose of our study it is proposed to break this down into three groups:

a. Long or very long university education (master degrees or equivalent)
This corresponds broadly to a part of new ISCED 5A (long or very long duration). This usually requires at least 5 years of study in most countries. Also university degrees with only formally 160 weeks of study could be included to achieve maximum comparability if they from the labour market point of view are equal to longer educations in other countries. A whole range of degrees are included here, such as lawyers, chartered engineers, basic degrees in medicine, specialist degrees in medicine, highest military degrees. In countries with a two tier degree structure (3-4)+(2-3) the post-graduate level is included here. From this level there should also be a direct link to PhD-level education.

b. Medium university or other tertiary education of medium duration (bachelor or equivalent)
These educations correspond to ISCED 5A (medium duration). Here should be included all other tertiary education with at least three years length. The programs could be up to four years of length.

c. All other tertiary education
These degrees correspond to ISCED 5A (short duration) or ISCED 5B. Vocational education of a mainly practical nature and short university programs are included here. The programs are usually less than three years.

ISCED levels 3+4

All other education beyond basic education

ISCED levels 1+2

Only basic education. With basic education is meant 9 years compulsory education.

A big and complicated question is how to handle educations upgraded during the time period we are interested in. For example a nurse seems to go to either ISCED 5A or 5B (our proposed groups b or c) depending on when the exam is taken. From our analytical point of view this is not good, but we have to live with the official registration routines.

The other major classification of personnel is the international standard occupational classification (ISCO). In the Nordic register systems information on occupation is either missing or not of good quality. Therefore it was decided to not use this as a classification in the Nordic Study.

4.2 Industrial classification

Establishments included in this study have been classified according to the standard industrial classification established by EU, NACE. Two levels of aggregation have been applied, one level which may be appropriate when comparing the results with those countries operating with register data, another level, which only could be used when comparing with countries operating with LFS or corresponding data based on surveys. In the study on the use of LFS data to analyse mobility it was found that the mobility rate in the ICT sectors was considerably higher (see Åkerblom 1998). Therefore, this sector has been separately identified. Compared to the OECD definition of the ICT sectors, the definition is somewhat more narrow as it is based on 2-digit NACE codes with one exception. The applied industrial classification to be used in the Nordic study is as follows:

Sectoral definitions used in this study

ICT sectors

Office accounting and computing machinery and electronic equipment	30, 32
Telecommunications	64.2
Computer and related activities	72

Agriculture, mining, manufacturing (excl. ICT), utilities, construction

Agriculture, forestry, fishing	01, 02, 05
Mining, quarrying	10-14
Consumer goods	15-19
Wood, pulp and paper, printing, oil refining, chemical industry, rubber, plastics	20-25
Metals, machinery (not ICT)	27-29, 31, 33-35
Other manufacturing n.e.c.	26, 36, 37
Energy and water	40, 41
Construction	45

Trade, hotels, restaurants, transport, communications, financial intermediation, other services (excl. ICT, educational and research institutes)

Wholesale and retail trade, hotels, restaurants	50, 51, 52, 55
Transport, storage, post, communications	60-63, 64.1
Financial intermediation	65, 66, 67
Other services	70, 71, 74

Educational and research institutions

Universities, national subgroup	80 (partly)
Other higher education institutions	80 (partly)
Other educational institutions	80 (rest)
Research institutes	73

Other community services

Health activities	85
Other community services	75-95 (not 80, 85)

5 References

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Åkerblom 1998

STEP-gruppen ble etablert i 1991 for å forsyne beslutningstakere med forskning knyttet til alle sider ved innovasjon og teknologisk endring, med særlig vekt på forholdet mellom innovasjon, økonomisk vekst og de samfunnsmessige omgivelser. Basis for gruppens arbeid er erkjennelsen av at utviklingen innen vitenskap og teknologi er fundamental for økonomisk vekst. Det gjenstår likevel mange uløste problemer omkring hvordan prosessen med vitenskapelig og teknologisk endring forløper, og hvordan denne prosessen får samfunnsmessige og økonomiske konsekvenser. Forståelse av denne prosessen er av stor betydning for utformingen og iverksettelsen av forsknings-, teknologi- og innovasjonspolitikken. Forskningen i STEP-gruppen er derfor sentrert omkring historiske, økonomiske, sosiologiske og organisatoriske spørsmål som er relevante for de brede feltene innovasjonspolitikk og økonomisk vekst. Fra 1. januar 2003 er STEP – senter for innovasjonsforskning en del av SINTEF Teknologiledelse.

The STEP-group was established in 1991 to support policy-makers with research on all aspects of innovation and technological change, with particular emphasis on the relationships between innovation, economic growth and the social context. The basis of the group's work is the recognition that science, technology and innovation are fundamental to economic growth; yet there remain many unresolved problems about how the processes of scientific and technological change actually occur, and about how they have social and economic impacts. Resolving such problems is central to the formation and implementation of science, technology and innovation policy. The research of the STEP group centres on historical, economic, social and organisational issues relevant for broad fields of innovation policy and economic growth. As of January 1st 2003, STEP – Centre for Innovation Research is part of SINTEF Industrial Management.