Flows of Human Capital
in the Nordic Countries

Summary report:

Flows of Human Capital in the Nordic Countries 1988-1998

A project by STEP, The Danish Institute for Studies in Research and Research Policy, Statistics Finland, Statistics Iceland, and Vinnova

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Flows of human capital in the Nordic countries 1988-1998

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ABSTRACT

This is the summary report from the project "Flows of human capital in the Nordic countries". It draws on three project reports and two papers, where further details can be found. It displays selected statistical information for the period 1988-98 about

- Nordic migration – win-win or win-lose in flows of human capital
- mobility between jobs in the Nordic countries – benchmarks and stylised facts for flows of human capital, broken down over demographic and economic indicators
- mobility of researchers in these countries, with emphasis on the outflow of science and engineering personnel from the research producing sector to industry and services.

These statistics are of interest because mobility is a ubiquitous yet under-researched mechanism of competence flow in the national innovation systems. Innovation policy will become more effective if these mechanisms are better understood. Working with register data as here (as opposed to surveys with smaller samples) gives major advantages but also some challenges that are addressed.

These first comprehensive detailed human capital statistics of mobility in the Nordic countries are the output of a Nordic project which uses comprehensive national matched employee – employer register datasets. 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	Innovation	Innovasjon
GROUP 2	Mobility	Mobilitet
SELECTED BY AUTHOR	Human capital	Humankapital
	Nordic countries	Norden
	Migration	Migrasjon

1 Introduction[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".

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

[1] This section is based on a *Foreword and reader's guide* common to the three project reports.

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.

Paper 1, the **Classification paper** (Åkerblom and Virtaharju (2001): Measuring mobility, some methodological issues. Helsinki: Statistics Finland), 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.

Paper 2, the **Data source paper** (Harðarson (2001): A note on methodological issues using labour force survey data. Reykjavik: Statistics Iceland), discusses the relationships between register data

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

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 present report, 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.

2 Flows of human capital through Nordic migration

The **Migration report** (Graversen et al. 2003a) has drawn on register data in Denmark, Finland, Norway and Sweden. The analysis is limited to Nordic migration, which for these four countries typically makes up 20 to 30 per cent of their total immigration and 25 to 50 per cent of their total emigration. Although this accounts for somewhere between 80 and 90 per cent of the total Nordic migration, it means that the situation of Iceland and the other Nordic island regions (Greenland, Faroe Islands, Åland) is not within the scope of this analysis. For these regions, the Nordic migration typically accounts for 60 to 100 per cent of their total migration. Only migration spells lasting more than 12 months are included in the analysis.

There is great political interest in the migration of the highly skilled, researchers and top level scientists in particular. The basic data problem of this field is that the education and/or occupation of immigrants are not registered, not even in the Nordic registers. This is no surprise as the educational registration builds upon the databases that universities and schools maintain. It is of course no easy task to classify foreign education, but a rough classification that would be useful for most statistical purposes is feasible, but has not been implemented yet.

More information is available for emigrants. We can, for instance, check if and when they return. This leads to two important findings. First, only 30.000 to 50.000 persons migrate to other Nordic countries every year. Second, between 60 and 90 per cent of them return. But there are great differences. The return migration to Finland is shown below in Figure 1 – notice also how similar the curves are for each cohort.

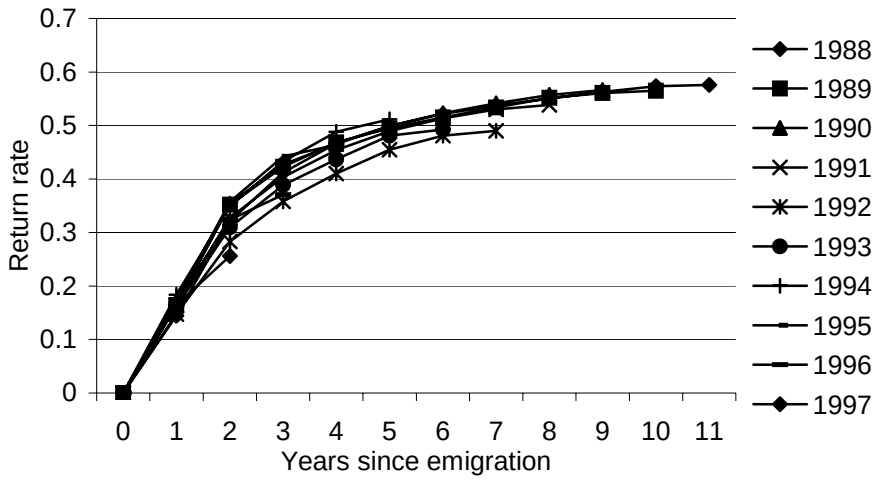

Figure 1: Returning rates to Finland over time for Finnish citizens emigrating 1988-97 from Finland to all other Nordic countries.

In comparison, the returning rate to Norway is much higher and varies more between cohorts (see Figure 2):

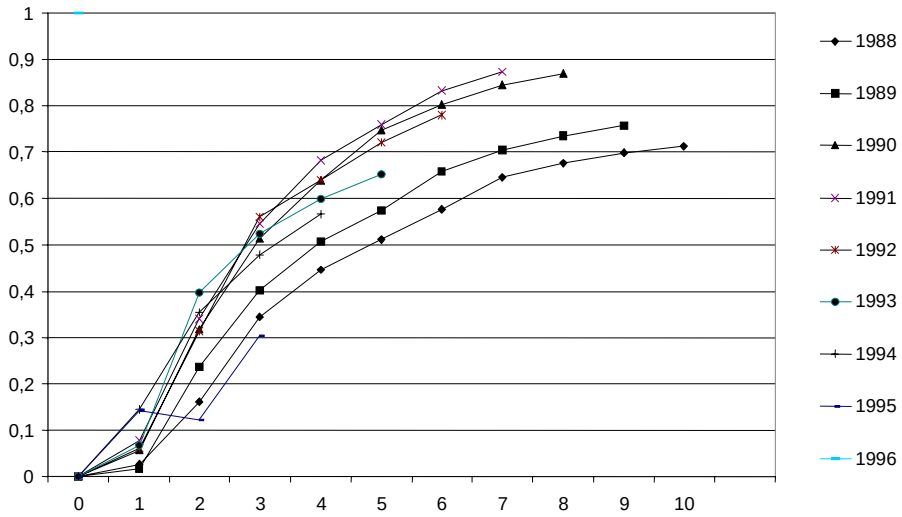

Figure 2: Returning rates to Norway over time for Norwegian citizens emigrating 1988-96 from Norway to all other Nordic countries.

In other words, migration is temporary for a large share of the migrants. 50 per cent of national emigrants return within 3 to 7 years (except to Sweden, where it takes 6 years or significantly longer for the first 50 per cent to return). Similarly the staying rate among immigrants from the other Nordic countries displays an inverse picture of the returning rate for the emigrants, high for the national citizens, low for the other Nordic citizens. However, the differences between the countries are quite visible. Let us use as a benchmark the time elapsed where 50 per cent of the non-national immigrants have returned and the rest are still staying on. This benchmark is 3 years in Denmark, 4 to 7 years (depending on cohort) in Sweden, 5 years or much longer in Norway and 9 years or much longer in Finland. Also noteworthy is the fact that 10 to 20 per cent are recurring migrants: they emigrate from their country of origin, then immigrate back to that country, and then re-emigrate again.

All in all the net flows between the Nordic countries are not dramatic and there is no reason to believe that there is any significant brain drain or gain for the *Nordic* citizens. The contribution from non-Nordic citizens remains to be studied.

Another interesting aspect is the labour market participation of Nordic immigrants in the year after immigration as shown in the figure below (Swedish data were not available):

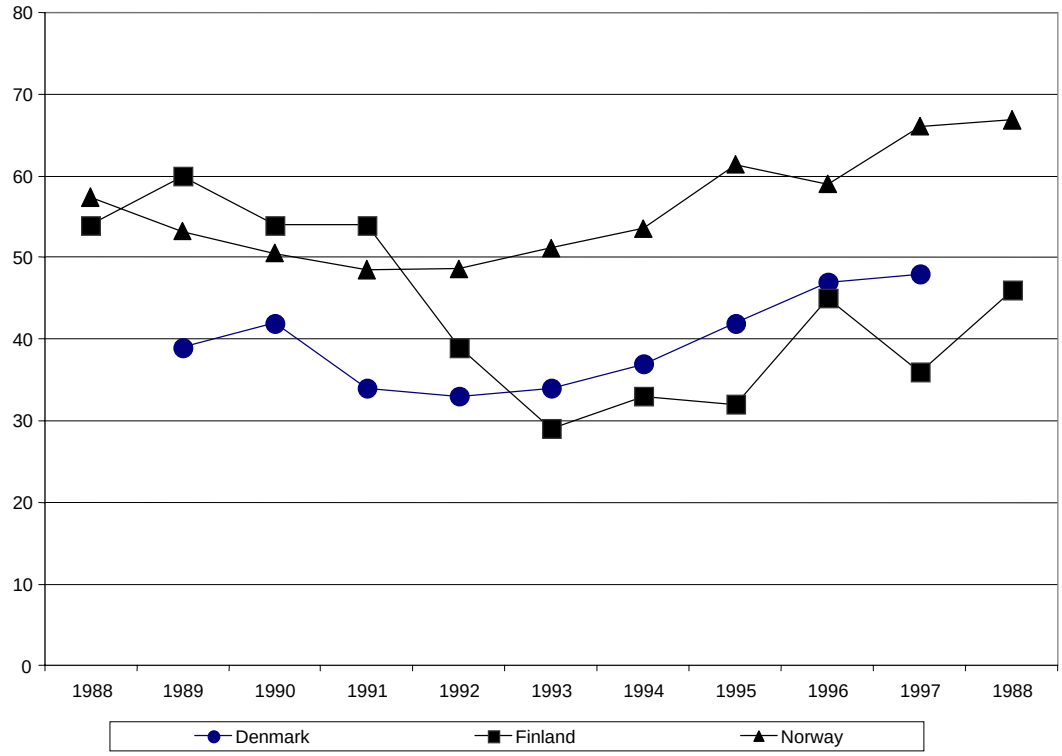

Figure 3: Labour market participation for Nordic immigrants to Denmark, Finland and Norway in the first year after immigration, 1988-98. Per cent.

The main part of the migration report consists of tables and figures, but in order to check our interpretation, to get more precise measurement of the influence of various background characteristics we tested a multiple regression model on Danish data for the 1988 cohorts of emigrants and immigrants. The estimation shows that there is no economic push effect in the emigration from Denmark and no economic pull effect in the immigration to Denmark.

It also shows that

- a minority of the population migrate
- Danish citizens have a lower migration probability to/from Denmark than other Nordic citizens
- men have a higher emigration probability than women (no gender difference in the immigration probability)
- singles and cohabiting have a higher migration probability than the married
- the presence of children in the family decreases the migration probability
- migration probability decreases with age
- migration probability increases with educational levels
- being in education increases the migration rates
- being employed does not matter on average
- the following sectors have a higher emigration probability than the others: ICT, research, private service, public service.

Hence, the probability model supports the indications found in the empirical investigations of the single aspects, namely that the migrating persons are well-educated single young adults and that the net flow may be close to zero, i.e. knowledge circulation instead of drain or gain. This supports the hypothesis of a win-win outcome of Nordic migration.

3 Mobility in the Nordic countries

The **mobility report** (Graversen et al. 2003b) in a way the most fundamental output from the project because of the ubiquitous presence of job changes. This report gives an overview of the mobility in the whole economy, whereas the migration report and the report on researcher mobility cover parts of the economy.

Knowledge circulation between workplaces makes up a significant part of national innovation systems. As acknowledged by the OECD in its Canberra manual for measuring human resources devoted to science and technology activities, "Highly skilled human resources are essential for the development and diffusion of knowledge and constitute the crucial link between technological progress and economic growth, social development and environmental well-being" (OECD 1995).

Mobility of educated or skilled labour is one of the most obvious mechanisms of knowledge transfer. A worker changing jobs is a typical carrier of knowledge, not only knowledge acquired through education but also experience gained at work.[4] Hence, an easily identifiable indicator of knowledge transfer in the economy is the share of employees changing workplaces during a year. This can be measured and summarised by mobility rates or rates for change of jobs, either for the entire labour force or for various defined subgroups. The human stock of innovators is important for a nation's innovative capacity (Stern et al. 2000) and the mobility can be considered a measure of how well this innovative capacity is shared among firms, a factor which again influences economic growth.

Even though raw mobility rates are easy to interpret once measured, however, it is difficult to establish precisely what counts as an optimal mobility rate. Common sense tells us that if it is very low, this may stifle the firms, and if it is very high, it may prevent firms from completing their innovations and also be very costly in its own right. The present study aims at establishing empirical benchmarks for job mobility in the four largest Nordic countries and at understanding their variation.

Several studies of mobility have been performed over the last few years, also in individual Nordic countries. Employee mobility – defined as how large share of the employed workforce that move to a new job in another workplace during a year – is typically measured through labour force surveys (LFS) based on samples of employees. Recently, data based on matching of employer/employee registers have become available for research in several Nordic countries (and Belgium). With these files one can also approach the study of workplace mobility – defined as how large share of all jobs that have new incumbents during a year - although a full understanding of this will require more detailed information (about gross movements in the workforce composition etc.) from employers than what is available.

Our study has focused on job-to-job inflow mobility rates (e.g., the number of job changers from one year to the next divided by the number of stayers in the same workplaces; see Box 1 in Section 5). The data show remarkably high mobility rates in all the four countries. Apparently, there are only a few signs of binding rigidities in the labour markets. The raw rates over time are shown in Figure 4.

[4] Knowledge transfer may also, of course, take place through co-operation, temporary exchange, replacements of staff, hiring of experts and consultants, outsourcing, some types of network, buyer-supplier relationships, R&D collaboration, internal training, etc.

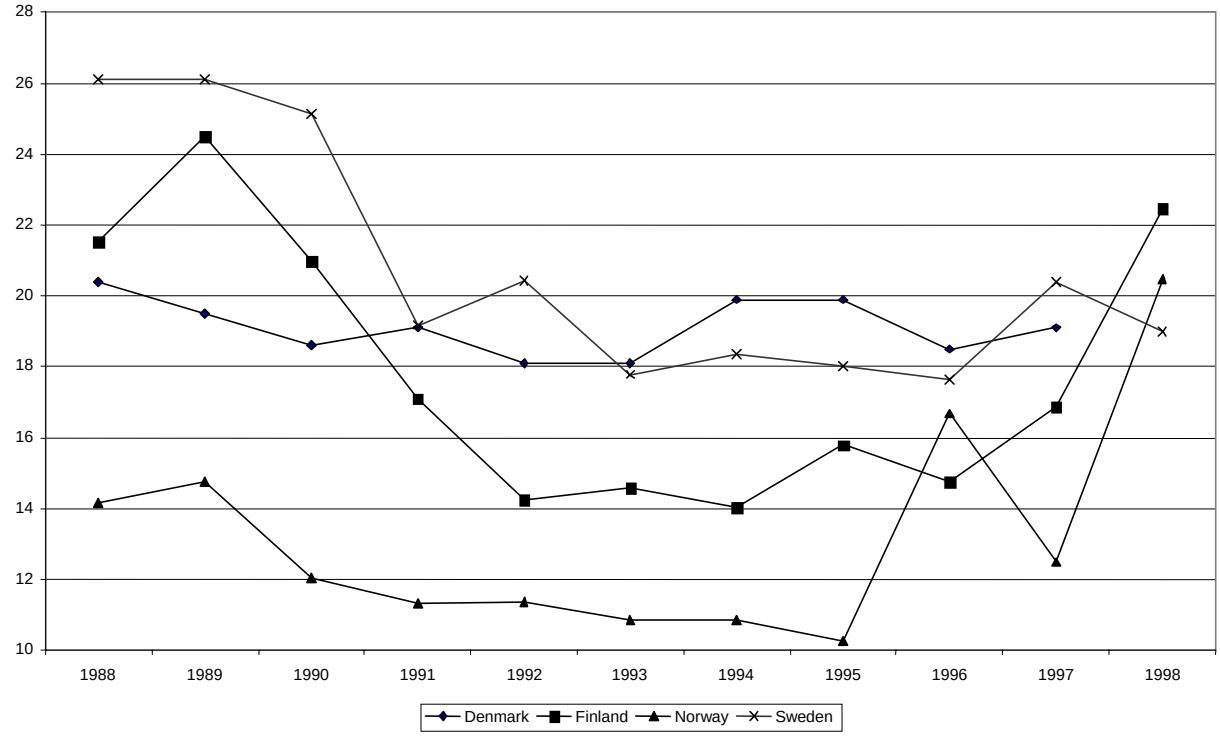

Figure 4: Job-to-job inflow mobility rates for Denmark, Finland, Norway and Sweden, 1988-1998. Per cent.

Variations are great, between 10 and 26 per cent. The rates for Norway are much lower than for the other countries[5] and the rates for Finland and Sweden drop dramatically from 1988 to 1992. Closer scrutiny shows a strong dependence on the business cycle. This is shown in Figure 5, where all the rates have been indexed (each nation's rate in 1991 is set to 100), a trend curve is fitted, and an inverted fitted curve for the average unemployment rate is superimposed in the chart. Using growth in GDP as an indicator of the business cycle yields similar results but occasional signs of countercyclical change in the mobility rates.

[5] The Norwegian rates are artificially high after 1995, due to a change in the system for identification of workplaces.

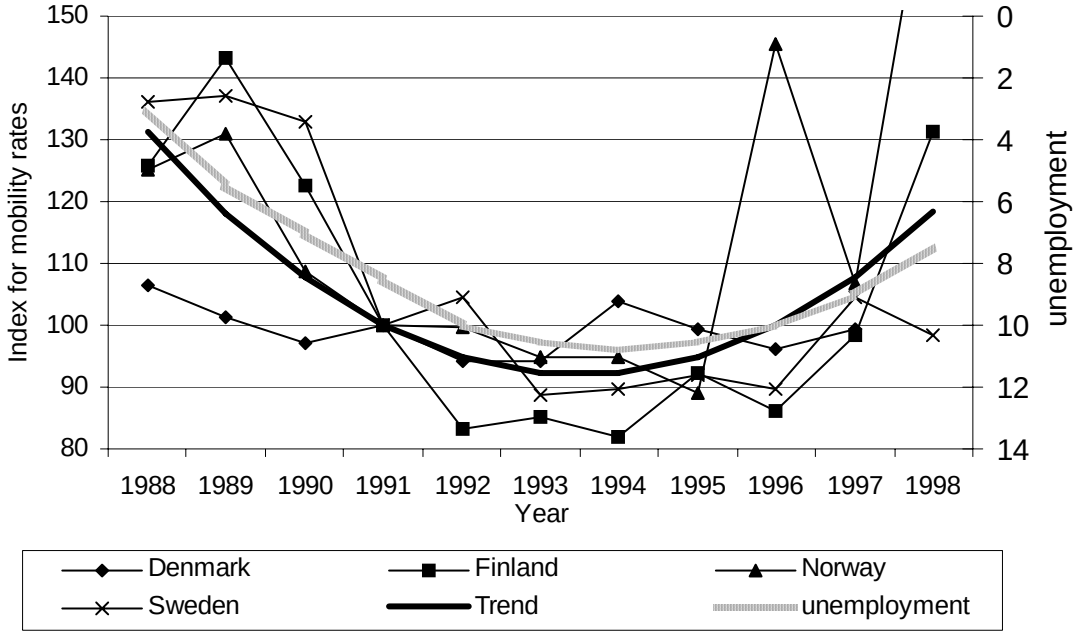

Figure 5: Indexed job-to-job inflow mobility rates (1991=100) for Denmark, Finland, Norway, Sweden and average (fitted), 1988-1998, and fitted curve for average Nordic unemployment rate (per cent).

We have then performed a systematic decomposition of the data according to gender, age group, educational level, sector of the economy and workplace size. In the main report this is illustrated by means of detailed graphs for each country and variable (e.g. educational level) with curves for each of the values of the variable (e.g. low, medium, high and PhD in the case of educational level) over time. We have also analysed the simultaneous impact of these variables and of unemployment rate in a logistic regression where all observations are pooled, regardless of year. The results are clear but the numbers are not directly interpretable. In order to improve readability we have here, in Table 1 below, translated the results of the logistic regression to numbers that have a direct meaning as follows when treated with caution. For each country we have calculated the mobility in per cent for a reference group. This is not the average mobility (which is also included in the table for comparison) but a calculated value when unemployment is 0, for a woman aged 35-44 years with a high educational level who is employed in production in a small workplace (1-9 employees). Then, for each variable, we have shown the calculated effect in percentage points of belonging to another group, for example a different age group. In the case of Finland, for example, the calculated baseline is a mobility of 24 per cent. If the person belongs to the youngest age group instead of the reference group, then the calculated mobility rate is increased by 20 percentage points to 44 per cent. Only one variable at a time can be considered this way. The share of correct prediction is shown as a measure of the quality of these calculations. This table can serve as a collection of stylised facts for job-to-job mobility in the Nordic countries in the 1990s.

Table 1: Variations in job-to-job inflow mobility rates in Denmark, Finland, Norway and Sweden, 1988-1998. Per cent and percentage points. Adapted from a pooled logistic regression for each country.

	Denmark	Finland	Norway	Sweden
Reference group mobility	18	24	31	31
Unemployment rate				
0 per cent	0	0	0	0
each per cent above 0	-0	-1	-4	-3
Gender				
Female	0	0	0	0
Male	3	0	0	2
Age group				
20-24 years	23	20	26	27
25-29 years	12	11	16	15
30-34 years	5	5	8	8
35-44 years	0	0	0	0
45-54 years	-4	-3	-7	-6
55-64 years	-7	-7	-14	-10
65- years	-6	-9	-18	-6
Educational level				
Low	-1	-5	-1	-6
Medium	0	-3	-5	-4
High	0	0	0	0
PhD	3	7	7	2
Sectoral group				
Production	0	0	0	0
HEI and R&D	2	7	1	11
ICT	3	15	6	19
Trade, hotels etc.	2	8	4	12
Community services	4	8	5	14
Workplace size				
1-9 employees	0	0	0	0
10-49 employees	-2	-3	-2	0
50-99 employees	-3	-3	-3	-2
100-249 employees	-2	-3	-4	-3
250- employees	-4	-5	-6	-7
Actual average mobility	21	18	14	18
Share of correct prediction	64	62	55	53

The implications are clear: Mobility

- drops with up to 4 percentage points for each per cent of increase in unemployment
- is slightly higher for men than for women
- decreases radically with age
- increases distinctly with educational level
- is typically higher in the ICT sector
- drops with increasing size of workplace.

Most of these effects are very similar between the four countries, although the sectoral differences are much greater in Sweden than in Denmark. The effects seem partly stronger when not analysed simultaneously, and there are some changes over time as well that cannot be given full justice in this brief summary.

The study has also shown the feasibility of establishing comparable measures of mobility based on employer/employee files in the Nordic countries, and background data used in this study explain 50 to 65 per cent of the variation in the data. This is a very positive result. It should be noted, however, that the actual rates established are up to twice the size of the identically defined

rates established through the Labour Force Survey data from Eurostat and this is a discrepancy that should be addressed through future international collaboration, cf. further comments on this penomena in chapter 5 below.

The optimality of these mobility rates cannot be judged in isolation. For one thing, they would have to be judged against other forms of knowledge transfer and sharing. Further studies relying on the same data sources would be able to look into variations (as opposed to averages) in mobility range within different groups of workplaces and firms. A coupling to qualitative studies of firms' strategies for establishing mobility targets and maintaining them in the face of changing labour market conditions could be extremely instructive. Furthermore, the dependence on the business cycle has only been studied over a single cycle and longer time series will be required to validate this particular finding.

Box 1: Definitions of job mobility terms used in the project.

1. **Inflow mobility**
   - **Job-to-job mobility** is defined as a change of workplace between the previous year and the present, i.e. change between two jobs, MOVERS.
   - **Overall job mobility** is defined as MOVERS and new movements into job from the no-job state, ALL MOVERS = MOVERS + NEWS.
   - **No mobility** is defined as the total number of employees who are employed in the same place both years, STAYERS.

2. **Inflow mobility rate**
   - The **job-to-job inflow mobility rate** is defined as the number of employed movers between two consecutive years divided by the total number of employees who are employed both years, MOVERS / (MOVERS+STAYERS).
   - The **overall inflow mobility rate** is defined as the number of employees not having the same job the previous year divided by the total number of employees this year, ALL MOVERS / (ALL MOVERS + STAYERS).

3. **Inflow and outflow mobility rate**
   - **The job-to-job inflow mobility rate** in year t equals the outflow mobility rate in year t-1, since the number of MOVERS into year t and out of year t-1 are equal and since the stock of STAYERS in year t and year t-1 are equal.
   - The **overall inflow mobility rate** in year t does not equal the outflow mobility rate in year t-1, since the number of NEWS and LEAVERS may be unequal and since the stock of employees (ALL MOVERS + STAYERS) can vary between year t and t-1.

4 Researcher mobility

The background for the **Researcher report** (Ekeland et al. 2003a) is the well-known policy question, "Are the mobility rates from science to industry too low?" The background is the insight that while universities and institutes produce codified knowledge ready for dissemination, the experience gained as a researcher adds to the operative and innovative value of this knowledge and hence the research sector ought to function as a training ground for future industrial innovators. At the same time, academic careers are not promoted by leaving the research sector and the research institutions want to limit the disruptive effects of a high outflow mobility.[6]

The study finds that the classifications of the register data leave some open-ended questions regarding the definition of the research-producing sector, reflecting in part the changing institutional structure of knowledge production. In particular, the fifth digit of the NACE code (which is available for national needs) could be implemented uniformly across the Nordic countries to give a finer classification of research-producing institutions along the lines of more detailed work done outside the project in both Norway and Denmark. There are also some comparability problems because the classification of e.g. Ph.D. students differs between countries.

The report treats universities, other university level educational institutions and R&D institutes as one sector, HEI&RD, also called the research producing sector (RPS). There is of course a lot of research done in private firms, but this is much harder to identify with the data available. Academic research is, so to speak, identified by using the ordinary industrial classification NACE. Using this classification, the overall mobility rates of persons with more than 12 years of education are shown in the table below.

Table 2: Overall inflow and outflow mobility, HEI&RD sector, Nordic countries 1988-1998. Per cent.

	Inflow (HEI&RD is receiving sector)				Outflow (HEI&RD is delivering sector)			
Year	Denmark	Finland	Norway	Sweden	Denmark	Finland	Norway	Sweden
1988		21,2	12,3	26,3		25,4	13,3	26,2
1989	17,4	31,1	14,1	24,3	18,6	25,0	13,4	28,1
1990	13,8	27,1	19,3	22,6	15,9	25,3	16,0	25,7
1991	19,4	24,2	15,8	29,2	19,1	26,0	17,5	29,4
1992	16,7	20,7	15,4	19,6	14,8	20,9	14,9	17,0
1993	16,7	15,7	20,8	20,6	16,5	15,4	20,0	19,2
1994	14,0	15,7	19,4	21,1	15,7	13,5	19,4	22,2
1995	27,4	22,8	22,7	21,3	24,4	23,8	16,5	21,4
1996	20,9	22,7	12,8	21,4	22,0	21,3	13,2	20,8
1997	20,9	21,4	21,4	26,2	20,8	18,0	15,0	26,3
1998		20,1	13,4	19,0		17,7	14,4	20,6
Average	18,6	22,1	17,0	22,9	18,6	21,1	15,8	23,4

Although we have not produced directly comparable statistics for all sectors, the mobility of university educated employees does not seem to be very different in the HEI&RD sector than in the economy as a whole. The national differences are also similar to those we find in general. The variations over time are quite large. Some of them are related to statistical artefacts and more iterations between results, interpretation and statistical refinements are required before the question "are the rates too low?" can be approached in a sensible manner. One important question might be whether too much of the flows are intra-sectoral. "Tales from the field" point to ICT as

[6] A general discussion of the pros and cons of high and low mobility are found in Section 1.

an academic field where mobility is so high that it may be dysfunctional for the capacity of the institutions to produce high quality future innovators for industry. On the other hand, there may be fields of study where the mobility of senior personnel may be very low and hamper the influx of new approaches to the academic department as a whole. The available data will require much work to become useful for analyses at this level of detail.

We have, however, singled out those with an education in science and engineering (as opposed to medicine or social sciences, humanities and others) for closer scrutiny. The report gives detailed distributions of the mobility to other sectors for each of these three main groups of personnel and the former in particular, also split between universities and institutes.

The report uses one coarse - 5 sector - and one more fine grained industrial breakdown with 20 sectors. In the 5 sector breakdown the universities and R&D institutes are considered one sector, ICT is one sector and the rest of the economy is aggregated into some very broad "meta" sectors. The paper then goes on to discuss the differences, for example in the outflow mobility of scientists and engineers to the ICT sector as illustrated below.

Table 3: Outflow mobility from HEI&RD to the ICT sector by country, 1988-1998, science and engineering subgroup. Per cent of outflow to all sectors for each country.

Year	Denmark	Finland	Norway	Sweden
1988		2,5	6,3	9,9
1989	3,5	5,9	3,7	16,5
1990	5,0	5,7	3,3	9,0
1991	2,9	5,5	3,0	5,5
1992	4,5	6,4	1,9	10,1
1993	2,6	11,1	1,9	9,5
1994	6,9	12,3	2,9	11,6
1995	3,6	10,1	5,4	21,4
1996	4,0	11,1	9,1	18,8
1997	4,3	15,8	9,0	23,4
1998		12,3	10,4	

The difference between the share of the mobile researchers that go to the ICT sector in the four countries is striking. To a certain extent this reflects the fact that Sweden has stronger telecom sector, an important part of the ICT sector, but it might also point to the need for a more detailed analysis of why the Danish ICT sectors share is so relatively low. The rapid growth in Finland in 1993 could reflect policy measures to use the research sector to boost Nokia. The low rates in Norway at the same time might reflect the universities' inability to compete with the private sector for candidates. We expect readers to find the detailed tables a rich resource for forming comparative hypotheses worthy of further study.

The report also shows a tentative analysis of mobility of the science and engineering subgroup between all the sectors, relative to the size of each sector. Most of the mobility is intra-sectoral, of course, but in the case of Norway 1997/98, which is most deeply subjected to this analysis, we find that there are higher than random flows of engineers and scientists

- from the producer services sector to the ICT sector
- from the science and technology institutes to ICT, social science institutes, and universities
- from the social science institutes to science and technology institutes and universities
- from the human services sector to other education (non-university)
- from the universities to both types of institutes.

5 Methodological and data issues

These are treated in two separate papers and as appropriate in relation to the three themes. There are of course many questions regarding data collection and/or quality that one would like to have resolved. There are questions of artificial changes in identification numbers of firms - which tend to bias mobility rates upwards, there is the lack of registration of education of immigrants blocking an in-depth study of brain-drain issues. We recommend that one on a Nordic basis implement the fifth "national" digit of the NACE code in order to classify research institutions and firms according to scientific field in a more detailed way than the present division between science and engineering on one hand and social sciences and humanities on the other. We also recommend that immigration records be supplemented with details on educational status.

Another important phenomenon has been the different degree of access to data in the Nordic countries, where the policies in this area are very varying. This has had two major consequences. The very restricted access and high prices for Danish data have made it impossible to re-specify data deliveries as the project discovered discrepancies between the national classifications, reducing the exact comparability of the data. In Sweden – in many respects the pioneering country for this type of research – a change in the privacy policy of Statistics Sweden led to an interruption in the delivery of data for almost two years. This led to a delay in project completion but without access to data for 1999 and onwards. For our explorative purposes, neither of these two events were fatal, but direct comparisons should be done with caution.

Finally, there are two main sources of mobility data, the Labour Force Survey and register data. Unfortunately the two sources give rather different numbers for the level of mobility, although they agree on the trends in the data. A limited illustration is shown below where rates from registerdata are compared with rates calculated from the Labour Force Survey. The huge difference in the level of mobility shows that the data collection and quality issues have not yet been resolved. Such discrepancies just underscore that mobility research is still in an early phase. The only non-Nordic country that have build up register data for research purposes is Belgium. The table shows that the Belgian data has the same "problem" with the difference between registerdata and Labour Force Survey. There is of course possible to check the data on the individuals both in the Labour Force Survey (LFS) and in the registers and find out what causes these differences since both register data and LFSuse the unique person number as an identificator. This detailed research - although technically feasible – is still to be done.

Table 4: Comparing mobility rates from various data source

	1996	1997	1998	1999
Belgium, Eurostat	6,3	6,4	8,1	7,1
Belgium, register	15,5			
Sweden, Eurostat		7,0	10,4	10,2
Sweden, register	15,6	18,1	18,4	20,2
Norway, Eurostat	10,4	9,3	13,3	7,6
Norway, register data	14,6	26,1	21,4	18,1
Finland, Eurostat		9,8	10,4	11,9
Finland, register		15,3	18,7	21,6

The grey lines in the table are Labour Force Survey data from Eurostat, the white lines are national register data. At the time when the table was constructed Belgium had only one pair of years 1995-1996 of register data. The rates are for persons with higher education.

Below is given a table of mobililty rates based on Labour Force Data collected by Eurostat from each country and then harmonised.

Table 5 Mobility rates for higher educacted[7] in European countries 1994 - 1999

	Mobility rates of employed HRST (%)											
	Males						Females					
	1994	1995	1996	1997	1998	1999	1994	1995	1996	1997	1998	1999
B	5.5	5.8	6.3	6.4	8.1	7.4	6.1	6.8	7.1	7.0	9.3	7.8
DK	9.4	11.2	11.2	8.9	10.9	11.8	13.0	11.4	11.3	9.9	11.8	12.6
D	6.5	5.5	6.0	6.1		7.2	6.9	6.5	6.9	6.0		7.8
EL	4.3	3.6	3.9	3.2	4.9		4.4	4.6	4.1	4.4	5.6	
E	11.6	12.6	12.0	12.0	12.0	6.1	16.6	16.2	16.1	17.2	17.2	8.4
F	5.9	6.5	6.5	7.0	7.3	8.0	7.0	6.5	6.5	6.7	7.8	9.1
IRL	7.9	8.1	9.5	9.8			8.9	11.0	11.7	11.8		
I	2.5	2.4	2.7	2.8	4.1	4.4	3.5	3.4	3.5	3.6	5.3	5.4
L	4.8	3.7	4.7	3.8		5.9	5.4	6.3	4.9	5.1		6.5
NL	6.6	6.5	5.8	7.1	9.9	8.8	7.4	7.8	6.8	7.0	11.0	9.6
A		5.6	5.9					5.9	6.3			
P					7.3	7.9					8.8	7.6
FIN					10.4	11.9					12.3	12.3
S				7.0	8.9	10.2				7.2	7.8	8.0
UK	8.9	9.5	10.3	11.7		11.9	10.0	10.6	11.2	11.8		12.2
IS		13.8	10.4	11.9	12.6			10.9	12.1	12.4	15.8	
NO			10.4	9.3	13.3	7.6			11.2	8.2	12.7	8.1
CH			9.3	8.4	10.5	10.6			11.5	10.2	11.2	10.3
CZ					6.6	4.6					5.2	3.7
EE				12.5	13.5	11.8				9.3	8.6	10.3
HU				6.4	6.9	5.7				5.0	5.2	4.7
PL				5.1	5.6	3.5				4.1	3.2	2.5
RO					0.0						0.0	
SI			6.5	6.5					4.7	4.2		
EU-15	**6.7**	**6.7**	**7.0**	**7.5**	**7.9**	**8.1**	**7.8**	**7.7**	**8.0**	**8.0**	**9.3**	**8.9**

We see that Italy according to this table has a the lowest rate for male HRST, but there is little of our knowledge of Italian labour markets that indicate that Italy should have a radically lower rate than France. On the other hand Spain (E) has a very high rate, but that drops sharply in 1999. Spanisch researchers have argued that the very high rates probably measure the very frequent use of temporary contracts and not real mobility. Such unresolved puzzels only shows that there is still a job to be done in order to get realiable comparative data, which of course is a necessary precondition for using mobility as an indicator and input to policy formulation.

[7] The population is the HRST ("Human Resources in Science and Technology") as defined by OECDs "Canberra Manual"

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