

International and Sector Mobility in Norway

A register-data approach

Eric Iversen, Lisa Scordato, Pål Børing and
Trude Røsdal

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Preface

This report is the latest of a series of studies that NIFU has conducted into different dimensions of researcher mobility and its effects (see Annex 5). It features the results of a project on researcher mobility in Norway, conducted for the Norwegian Ministry of Education & Research in 2013-2014. The main output of the project was used in the thematic section of the Ministry's Research Barometer report¹.

The report complements the Ministry's presentation. It is important to note that the interpretation of results and conclusions in this report are NIFU's alone and do not necessarily reflect that of the Ministry that originally funded the exercise. In particular, the report details underlying definitions and elaborates the approach used in the exercise. On this basis, it demonstrates further results in terms of inflows to researcher positions in Norway and of recent intersectoral job-changes undertaken by Norwegian researchers. The changes currently underway at universities and at research-institutes in Norway are enumerated here. The results of recent surveys are used to contextualize these visible flows.

The approach outlined in the report provides a promising way for policymakers as well as the research community to keep abreast of changes in this important part of the labor-market and as a way to better understand factors that affect researcher mobility and its outcomes.

Oslo, June 2014

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¹ <http://www.regjeringen.no/nb/dep/kd/kampanjer/forskningsbarometeret.html?id=635788>. For a presentation by the Ministry, see <http://www.regjeringen.no/nb/dep/kd/kampanjer/forskningsbarometeret/2014/forskningsbarometeret-2014-forord.html?id=758587>

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Summary

In this report, we develop and implement an approach using registry data to improve the way we map and analyze patterns of researcher mobility in Norway. The approach laid out here allows us (i) to compare different dimensions of researcher-mobility between researchers in Norway and those at universities in the other barometer countries, as well as (ii) to provide a reliable picture of inflows to researcher positions from outside of the Norwegian workforce, and to trace job-changes across sectors that involve Norwegian researchers. The report emphasizes the design of the approach and demonstrates some results.

Results of recent large-scale European surveys are used to orient the presentation of researcher mobility in Norway. These surveys indicate that international mobility among Norwegian researchers (not including PhD positions) is higher than the EU27 average, but lower than four out of six 'barometer' countries. These surveys also indicate that international mobility tends to be more oriented towards research visits in Norway, and that Norwegian researchers emphasize more often than colleagues in other European countries the importance of pursuing one's own research topics.

In light of the results of these surveys, the report uses a unique combination of registry data to map (i) inflows to researcher positions in Norway and (ii) cross flows or job-changes across sectors undertaken by Norwegian researchers through the 2007-2012 period. We quantify the apparent expansion of foreign researchers in especially the PhD and postdoc positions and especially in engineering, mathematics and natural sciences. We document a shift from an earlier wave of researchers from the Nordic countries, North America and Western Europe, to a wave of younger researchers from Asia as well as the rest of the world.

Moreover, the report provides fresh insight into sector mobility in the country. On average we find that between 4-6 percent of researchers in the higher education and the institute sector move out of their sector. These movements vary somewhat for the two research sectors. In general, researchers tend to move into the business enterprise sector followed by the public or government sector, while there are signs of inter-flows between the higher education and institute sectors. The indication is that this interflow is asymmetric, with a greater share moving from the institute to the higher education sector than the other way around. This accurate measure of sector mobility is much lower than that reported in the surveys. This finding emphasizes the utility of the approach as designed and demonstrated in the report. The approach of combining survey results and registry data provides a promising avenue to improve what we know about the patterns of researcher mobility and the factors that shape them.

1 Introduction

Current policy stresses the importance of researcher job-changes between institutions, sectors and countries. At the same time, there is a continuing need to maintain an informed overview of current mobility patterns and to improve modes to analyze this activity. This report addresses this challenge. In it, we utilize the strengths of Norway's registry (administrative) data resources to improve the way we map and analyze patterns of researcher mobility in Norway. This unique approach is conducted in correspondence with the complementary results of recent, survey-based studies. The objective is to present a method to size up researcher mobility flows that is (i) more accurate and reliable and that (ii) can complement the results of previous studies in providing valuable comparisons, specifically with the situation in other "barometer" countries².

The mounting interest in this policy area has increased research into different aspects of researcher mobility— the forms it takes in different (geographic and sectorial) contexts, the factors that shape it, the effect it may have. The expanding work has built primarily on international surveys³ as well as some preliminary analysis of researcher CVs (e.g. Nordic Crossing)⁴. This line of inquiry is extended and deepened in this report to focus on sector mobility involving researchers in the growing and evolving Norwegian research system. In particular we develop and implement an approach using registry data that allows us (i) to compare different dimensions of researcher-mobility between researchers in Norway and those at universities in the other barometer countries, as well as (ii) to provide a reliable picture of inflows to researcher positions from outside of the Norwegian workforce, and to trace job-changes across sectors that involve Norwegian researchers.

This approach was designed to inform policy development in the changing context of researcher mobility in Europe. The work reported here was commissioned by the Norwegian Ministry of Education and Research and it provided background for the Ministry's special report on researcher mobility (2014). This report supplements that presentation. A central premise is that an approach that combines current survey results with concurrent register-based analysis can be used as a reliable and non-invasive 'barometer' to understand changing patterns of mobility involving the university and the institute sector. We emphasize the design of the approach in this report and demonstrate some results it can provide by mapping inflows to researcher positions into the country and by tracing job-changes of researchers across the different sectors of the economy. One aspect it helps us to understand is the growing role of foreign nationals in the Norwegian research system.

² "Barometer countries" consist of Denmark, Finland, Sweden, Austria, the Netherlands (as well as Switzerland). These countries are used by The Ministry of Education and Research to measure developments in Norwegian research. See <http://www.regjeringen.no/en/dep/kd/Selected-topics/research.html?id=1427>

³ See MORE (2010), SIM ReC (2012, 2013), MORE 2 (2013)

⁴ See <http://sisobproject.wordpress.com/2013/06/03/nordic-crossing-blog/> and <http://www.nordforsk.org/no/news/akrysse-grenser>.

2 Data and approach

We start by tracing how the report is organized, since this demonstrates to large degree the rationale for the approach. The first section presents the data approach utilized, including the definitions that are used. These are central. On the one hand, the data resources that are used—and the way they are combined— are crucial to the approach. In addition, the definitions of key elements—e.g. what is a researcher, who is ‘Norwegian’, what are the stages of the career-development for researchers in Norway, etc— are instrumental. It is important to be up-front about these, not least when considering cross-country comparisons. So this is addressed in the front section.

The second section goes on to take account of a set of results from recent European surveys on geographic researcher mobility. In that step, the purpose is not –as is too often the case— to use survey results as a way to map mobility patterns; as we know, surveys are prone to selection bias and other issues that skew their reliability in gauging flows with sufficient accuracy across countries. Instead, the aim in this report is simply to establish a comparative baseline of how researchers in different (geographical and institutional) contexts assess researcher mobility—and factors that shape it— differently. This subjective information comprises the main strength of the survey approach. We use it to preface and to contextualize the findings of our detailed study within the single country context of Norway.

In the third step, we pool two main sources of registry data in order to map inflows to researcher positions in Norway and to trace job-changes undertaken by Norwegian researchers during a six-year period, 2007-2012. This follows pioneering work in Norway (see Hauknes & Ekeland, 2002). We rely here as far as possible on established approaches in order to maximize comparability of results with the baselines of existing studies. The mapping exercise provides vistas for analysis that we begin to explore in a final section.

2.1 Survey data-sources

Our approach starts with a review of baselines from existing studies. Two survey-based studies are used. First off, we use the recent results of the MORE 2 mobility survey (“MObility patterns and career paths of Researchers”) to provide background about general tendencies of researcher mobility in Europe. The MORE 2 mobility survey was carried out in 2012 and includes researchers in the higher education sector in the EU27+⁵. A large number of questions related to the careers, working conditions and mobility of researchers were answered by over 11,000 researchers across Europe, yielding 10,547 useable responses. Information associated with the design and the execution of the

⁵ It further includes associated countries: Norway, Switzerland, Iceland and candidate countries: Croatia, Turkey and the former Yugoslav Republic of Macedonia)

sampling procedure are described in the project work⁶. In the present context, the comprehensive MORE 2 survey provides an indication of what drives researcher mobility in general and, thus, an indication of how Norwegian researchers compare with researchers in other settings.

The second step takes a closer look at how mobility choices tend to unfold among researchers in Norway in comparison with those in other barometer countries. We take advantage of a recent SIM ReC survey (“Study on International Mobility and Researchers’ Career Development”) from 2012-2013. This survey focused on mid- to later career researchers in 11 European countries and it provides a basis to also take into account institutional-effects that might be additional to the country and discipline.⁷ The aim of SIM-ReC was to better understand the extent of researcher mobility and the effects it has on aspects such as collaborations, academic performance and career development. Information associated with the design and the execution of the sampling procedure are described in the project material.⁸ In total, the data gathered consists of comparable data for researchers from 11 European countries corresponding to a sample of 6,489 persons. We use it here to compare Norwegian researchers in more detail with their counterparts in Sweden, the Netherlands and Switzerland. These two steps provide the basis on which to focus on the micro-data of real job-changes in the Norwegian research environment.

2.2 Register data

In light of this baseline, we combine two main sets of registry data in order to map inflows to researcher positions in Norway and to trace job-changes undertaken by Norwegian researchers during the six year period, 2007-2012. We then identify structural patterns of inflows and sector flows of the population of Norwegian researchers and analyze factors that contribute to these patterns. The data resources that are mobilized in this effort encompass, on the one hand, a full-count registry of researcher personnel in Norway (NIFU), and, on the other hand, the official full-count micro-data of the Norwegian workforce (Statistics Norway) for the period 2007-2012. This official population data is updated (annually), highly granular (it includes detailed information at the micro-level), and reliable (it is official national data). We rely as far as possible on established approaches in order to maximize comparability of results with the baselines of existing studies. We review some of the important dimensions of these datasets here.

2.2.1 NIFU’s Register on Research Personnel (FPR):

The FPR register is an official national dataset. It is used among other things in conjunction with the periodic compilation of R&D expenditure data in the higher education sector (HES) and the institute sector. It also provided the frame from which the sample for both the academic and the institute sectors were drawn in the SIM ReC dataset. This micro-level database contains comprehensive information⁹ about researchers in Norway. It includes information for researchers and other R&D staff (as scientists, doctors and other professional staff) at universities and colleges, research institutes and other institutions that conduct R&D, as well at health-entities/hospitals in the country.

6 <http://www.more-2.eu>. IDEA Consult and partners (2013) Support for continued data collection and analysis concerning mobility patterns and career paths of researchers. Final Report. Brussels, August 2013.

7 The Study on International Mobility and Researchers’ Career Development (SIM ReC) was a 10-country study carried out for the ERAWATCH Network on behalf of JRC IPTS in 2012. The project aimed to shed some light on the consequences of international mobility on researchers’ patterns of collaboration, academic performance and career consolidation. In 2013, the survey was extended to include a comparable sample of Norwegian researchers active in higher education institutions and in public research institutes. The data set examines international mobility patterns among researchers in the higher education sector from the following 10 European countries: Belgium, France, Germany, Italy, the Netherlands, Poland, Spain, Sweden, Switzerland and the United Kingdom

⁸ See Bassiakos, Y (2012), Methodological Note on estimations in a two stage cluster sampling.

⁹ The register contains information on gender, age, occupation, position and percentage of work, i.e. institution, faculty, department and discipline, in addition to higher degrees (including a discipline, education and place of graduation) and PhD. Information about the researchers collected 1 October and obtained directly from the research-performing units’ central administrations. The latest available year is 2012

A defining dimension of the annual register is that it includes research staff who actively carry out R&D in a given year.¹⁰ One implication for measuring mobility is that the ‘researcher’ in these cases will not be included in the researcher registry data but will appear as employed by the institution in the official employment statistics. We have taken measures to identify cases in which the researcher retains their position while on leave. This allows us to avoid tallying these cases as mobility.

2.2.2 Statistics Norway’s Employment Registry

In this way, we use the FPR to compile a full-count population of researchers who were active researcher staff in one or more years during the period 2007-2012. To trace cross-sector mobility, the researcher-population was then merged with official registry information (SSB Employment dataset) for the full Norwegian workforce during the same period. The Employment Registry (Statistics Norway) provides generic annual data for all tax-active individuals (over 17) in Norway including income, citizenship/country of birth, personal info (gender, age), length of education, field of work, etc.

Information from the merging of the datasets enables us to operationalize several differences that are relevant to our analysis. It provides supplemental information both about the researcher (employee) and about his or her employers at a given time:

- person-information (citizenship, country of birth; as well as salary and full-time versus part-time labor.
- employee information, geographic location, sector affiliation and industry classification (Nace);

We then string together subsequent years of the combined dataset. We are now able trace job-movements between the researcher positions and positions elsewhere in the economy, especially to the government public-sector (non-research sector) and to the business enterprise sector. Furthermore, the approach allows us to observe scientists as they enter into (or exit from) the Norwegian workforce. In cases in which the scientist hails from another country, we can use information from the SSB Employment dataset to analyze the role of foreigners in the stock of active scientists in Norway. The following table provides an overview of the different datasets utilized here.

Table 1 The following table provides an overview of the different datasets utilized here.

| Dataset | Source | Datatype | Timeframe/Reference | Coverage |
|------------------------------|--------|--------------------------|---|---|
| Employment Data | SSB | Registry | 2000-2012: Annual data | All Norwegian Employees |
| Norwegian Research Personell | NIFU | Registry | 2000-2012: Biennial (until 2008, annual thereafter) | Researchers in R&D Performing sectors, excluding private enterprise |
| National R&D statistics | NIFU | Registry | 2000-2012: Biennial | Institutions in R&D performing sectors |
| SIM REC | NIFU | 10 Country Survey (2012) | 2000-2011: executed in 2012 | HEI Sector (Sample) |
| SIM REC Norway | NIFU | Survey | 2000-2012: executed in 2013 | R&D Performing sectors (Sample) |

¹⁰ This means that staff without formal research duties in a given year will not appear as a “researcher” in that year. This is an important distinction when calculating R&D expenditure in the country and it has implications for tallying researcher mobility on a year-to-year basis. There are several reasons why a researcher might not appear as a researcher in a given year. See Annex 1 for details.

2.3 Key definitions and delimitations

Researcher: The definition of ‘researcher’ follows the standard criteria for the sector as implemented in the Register on Research Personnel. This covers researchers and other R & D staff (as scientists, doctors and other professional staff) at universities and colleges, research institutes and other institutions that conduct R & D, as well at health-entities/hospitals in the country (see above and Annex 1 for details). Researchers are active in a research position as defined in the official statistics. These categories of researcher positions used in the HES and PRO sectors in Norway are converted to four standard career-stages introduced in the EU.¹¹ The translation of researcher positions in Norway to these standard categories is provided in Annex 3.

Norwegian and ‘non-Norwegian’ researchers: The next challenge is to operationalize a definition that allows us to gauge inflows of researchers from outside the Norwegian workforce. In line with earlier studies, we distinguish Norwegian versus non-Norwegian researchers based on citizenship. To deal with potential changes during the period, we follow Olsen & Sarpebakken (2011) and define citizenship based on the status per 2007. It is important to emphasize that there are many factors surrounding the entrance of foreign nationals into the workforce. Citizenship is—by itself— a very crude measure on which to define “inbound mobility” from abroad. Therefore, we also included the (registered) duration of the researcher’s residency in Norway to distinguish foreigners that have lived in Norway for a longer period-of-time (and/or arrived at an early age) from those whose arrival is temporally closer to taking up a position as researcher in Norway. The distinction we use is between:

- a. "Long-term foreign researchers": researchers with foreign citizenship who are registered as ingoing to Norway before the age of 16 and or have been in Norway since before 2000.
- b. "Short-term foreign researchers": Other foreign nationals registered as entering Norway after 1999.

Sector classifications: In line with the datasets used, we distinguish between four sectors:

1. Higher education sector (HES)
2. The institute sector (PROs)
3. Business enterprise sector (BES)
4. Public/government sector

The sector definitions that are used here are standard classifications. We can distinguish on the one hand two research sectors: the higher education sector (HES) and the institute sector (PRO) which are implemented in the FPR dataset. The higher education sector, university hospitals included, corresponds to the OECD higher education sector. The institute sector is defined in line with national statistics: business enterprise sector includes the industrial sector as well as non-profit research institutes serving enterprises. In national statistics, the institute sector includes the industrial sector, non-profit research institutes serving enterprises as well as the government sector and private non-profit sector (PNP).¹²

On the other hand, we distinguish these research sectors from other sectors in the economy using standard classifications employed in the national accounts. We distinguish between the business enterprise sector and the public or governmental sector: each of these sectors exclude research institutes as defined above.

¹¹ The career stage model was introduced and defined in the European Commission’s communication “Towards a European Framework for Research Careers” (European Commission 2011, p. 2) has been used. This model distinguishes between four career stages:- R1: First Stage Researcher (up to the point of PhD), - R2: Recognized Researcher (PhD holders or equivalent who are not yet fully independent), - R3: Established Researcher (researchers who have developed a level of independence) and - R4: Leading Researcher (researchers leading their research area or field).

¹² For further information about sector definitions see <http://www.nifu.no/en/statistikk/nokkeltall/fou-lommefolder/>

3 International researcher mobility in Norway and selected European countries

In this section, we utilize selected results from the MORE 2 and the SIM ReC surveys to take stock of international mobility patterns among European researchers. Mobility patterns among Norwegian researchers are compared to researchers in the ‘barometer’ countries earmarked for comparison by the Ministry (Austria, Denmark, Finland, the Netherlands, Sweden and Switzerland)¹³. In addition, we compare the *motives for* and the *effects of* international mobility that European researchers consider important.

3.1 Researcher outflows

We first compare mobility patterns between researchers from Norway and the other Barometer countries. The focus here is specifically on two different forms of mobility:

- *Researcher outflows*: international mobility experience at least once in the research career
- *Research visits*: mobility experience of at least one research visit in another country in the research career

The propensity to engage in these two forms of researcher mobility is known to vary at different career-stages of the researcher. The recent MORE 2 study utilizes the standard European categories of research stages we will employ later (see footnote above). This allows us to ignore researchers at the PhD level for the time-being. It is useful to hold this growing population aside as its mobility choices are shaped by different forces than those at play in the more established research positions. We focus on researchers in R2-R4 positions: ¹⁴

R2: Recognized Researcher (PhD holders or equivalent who are not yet fully independent),

R3: Established Researcher (researchers who have developed a level of independence)

R4: Leading Researcher (researchers leading their research area or field).

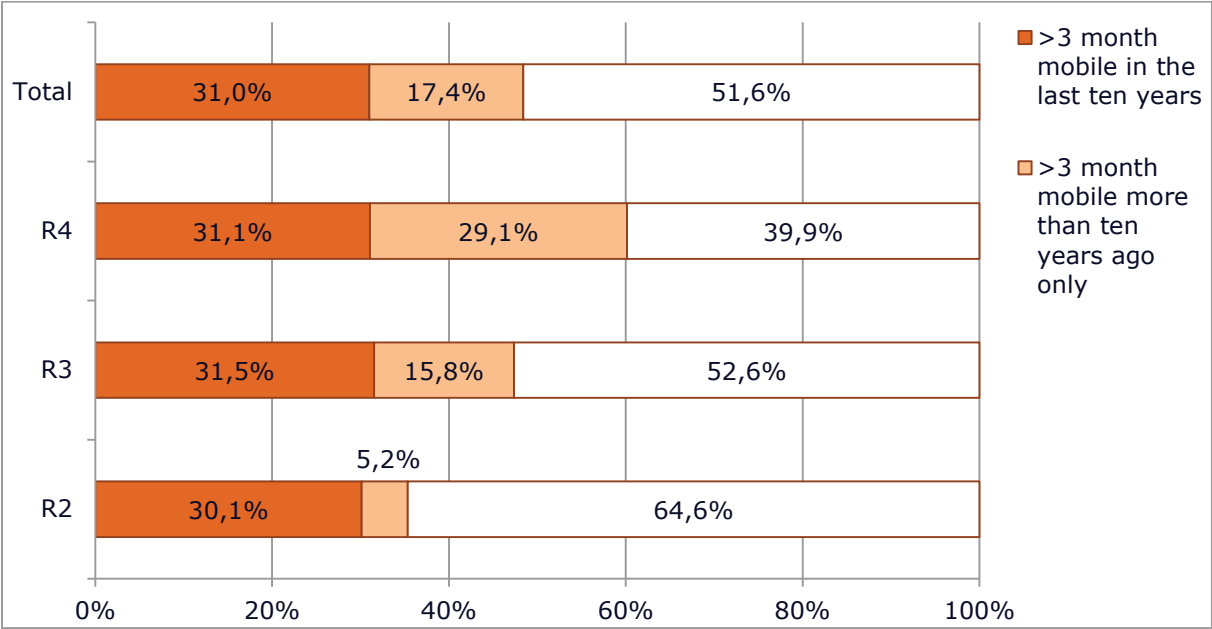
In addition, we use a definition of “international mobility” that is consistent both for MORE 2 and the SIM-ReC study. International mobility involves more than 3 months duration *including* mobility experiences that involves change of employer.

¹³ See footnote 1, above.

¹⁴ The MORE 2 study operationalizes the career stage model. See footnote 11 above.

On this basis, we first look at headline measures of international mobility per career stage and per country based on the results from MORE 2. The first figure illustrates that international mobility varies very little by career stage, but that there is an accumulated effect.

Figure 1 International mobility of more than 3 months in post-PhD career stages per current career stage (EU27)

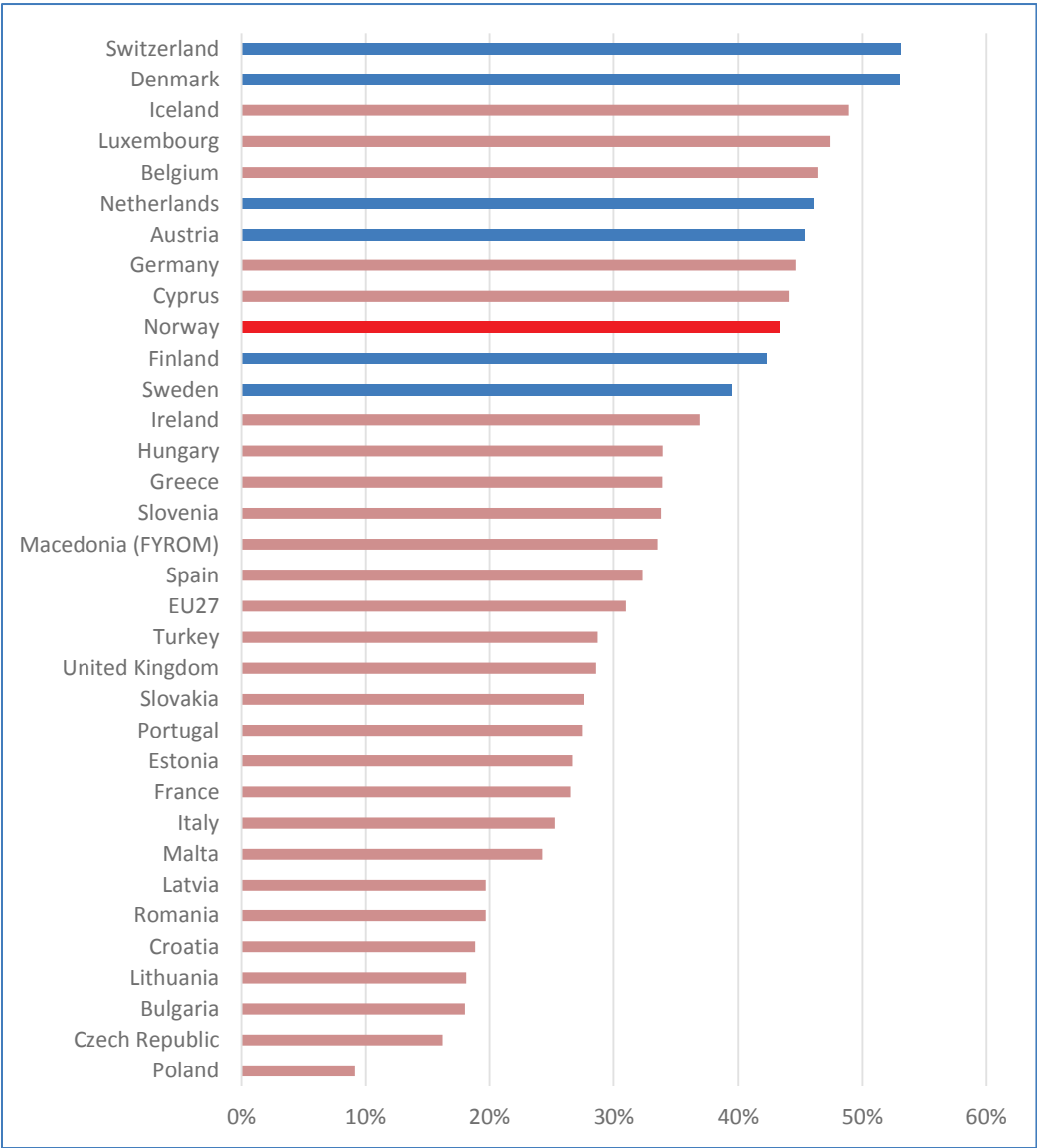


Source: MORE2 Higher Education Survey (2012)

The MORE 2 study provides a useful baseline. A total of about 48 percent of post-PhD researchers reported having been international mobility (more than three months) at least once during their career. In other words, roughly half of the survey respondents reported not having any experience from international mobility during their career after the PhD stage. The figure illustrates (dark green), that this mobility took place during the past ten years. About 30 percent of post-PhD researchers in EU27 reported having been international mobility (more than three months) during the last ten years. Importantly, this share remains the same at each stage of the post PhD career. The white share of the columns denotes non-mobile researchers.

The barometer countries are among those countries that have the highest share of mobile researchers within this category (R2-R4). Figure 2 indicates that Switzerland and Denmark are on the top of the list, with above half (53 percent) reporting spells of researcher mobility during the past ten years. The corresponding figure for Norway was 43 percent, which is above the EU27 average. The figure also illustrates that western European countries have the highest share of R2-R4 researchers reporting recent international mobility.

Figure 2 International post-PhD mobility of more than three month in the last ten year (direct targeted question), per country



Source: MORE2 Higher Education Survey (2012)

We now use the results of the SIM-ReC study to look more closely at researcher mobility among Norwegian researchers. We note that the reported rates of mobility tend to be higher in the SIM-ReC study than in MORE 2 (54 percent versus 48 percent). Although it is difficult to directly compare the results of the two questionnaires¹⁵, the findings nevertheless show similar tendencies. The order of the barometer countries covered by SIM-ReC is however the same in both studies¹⁶.

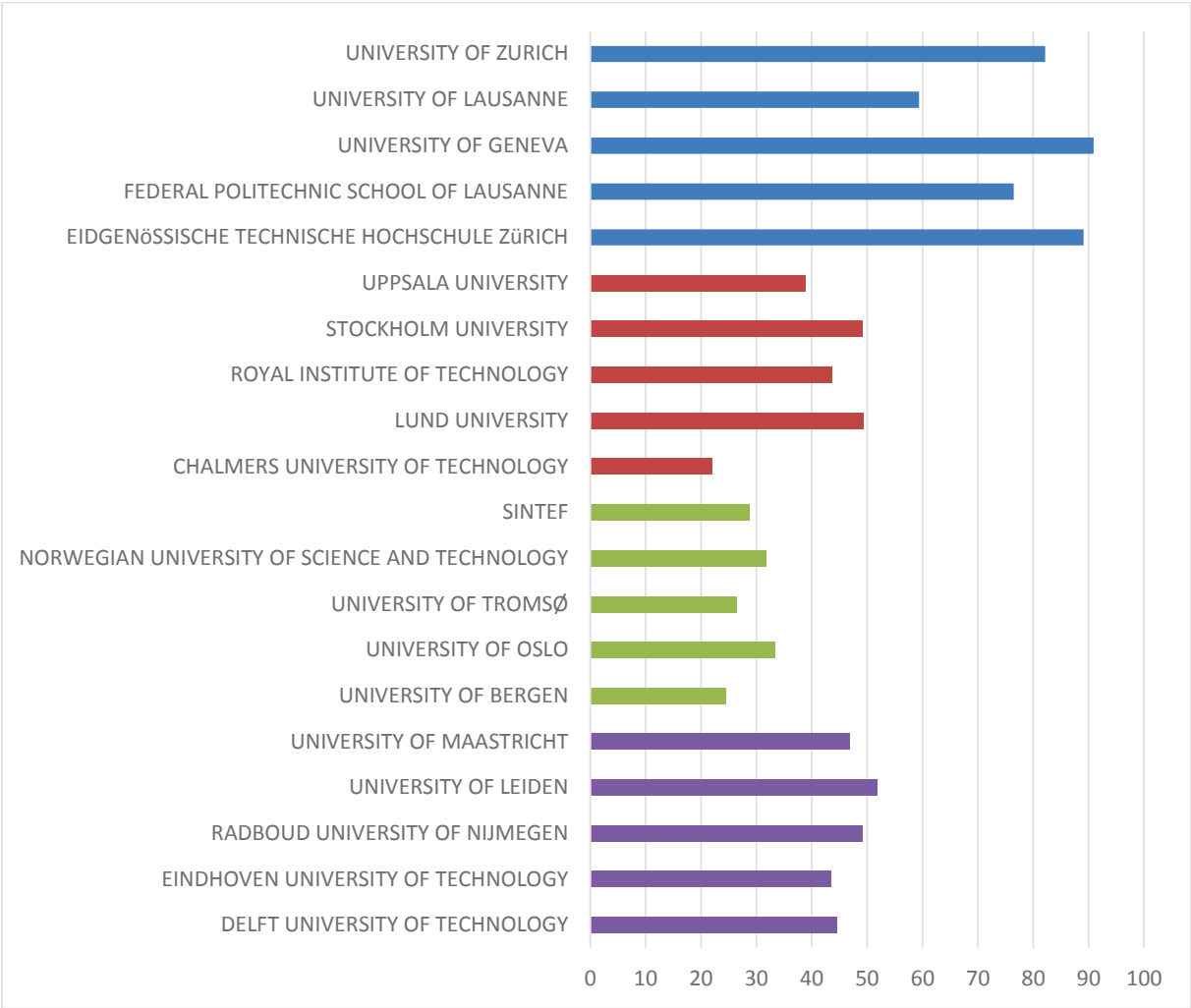
The SIM-ReC survey allows us to take into account the role that institutions may play in affecting the propensity for international researcher mobility to involve the change of employer. Figure 3 presents a preliminary look at the incidence of international mobility among researchers at a selected set of

¹⁵ SIM ReC focuses on academic researchers in 11 countries in the R2-R4 career stages: A researcher is considered to have had an “international mobility experience at least once in their research career” if he/she has held at least one position abroad in a country different from where the highest educational level was completed, or if he/she has had any research visits abroad of at least three months since January 2000 (research visits abroad do not involve a change of employer).

¹⁶ See Annex 3 for the corresponding figure from SIM-ReC.

higher education institutions.¹⁷ There are considerable differences between institutions. In part, this variance reflects the fact that different institutions concentrate on different fields or academic disciplines: we know that some fields are more prone to researcher mobility than others. That said, this disaggregated view reinforces the country level effects that are observed in the MORE 2 results. Compared to the institutions of the barometer countries, Norwegian institutions appear to have a relatively lower level of international mobility. The highest level is found among the Swiss institutions.

Figure 3 Share of researchers in selected higher education institutions in barometer countries with international mobility experience that involve change of employer at least once in the researcher career. n= 6489



Source: The SIM-ReC project and NIFU’s mobility survey of Norwegian researchers.

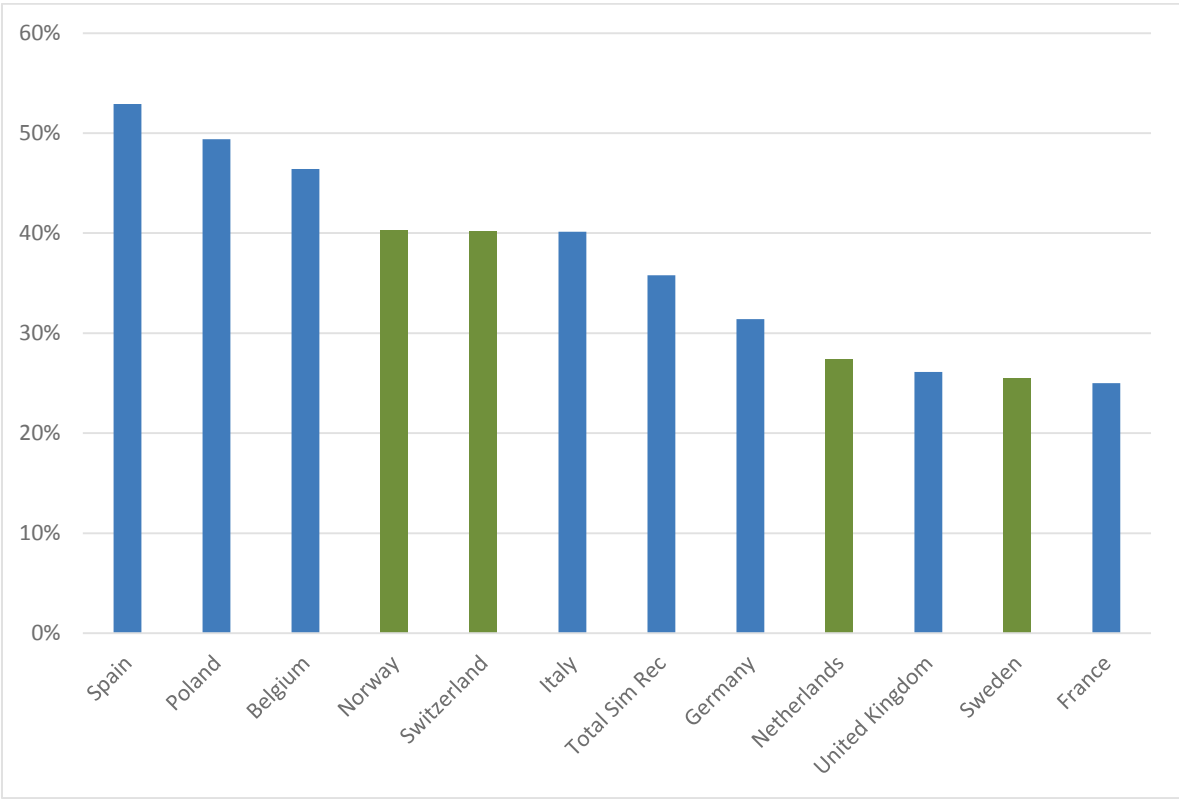
¹⁷ Results are not weighted. For Norway, we present the results for four universities and SINTEF from the institute sector.

3.2 Research Visits

Research visits constitutes another, complementary form of researcher mobility. In this context, a research visit is defined as an international mobility experience that did *not* involve a change of employer. In particular, the respondents were asked in the SIM-ReC survey if they had have experiences of research visits abroad lasting for more than three months.

Figure 4 breaks down the population of internationally mobile researchers to focus on the share reporting having had research visit abroad at least once during their research career. Forty percent of Norwegian researchers report one or more research visit outside Norway (or country of highest education) since January 2000. This is the same share as for the Swiss respondents, and above the SIM-ReC average and above the other two barometer countries; Sweden and the Netherlands.

Figure 4 Proportion of internationally mobile HES researchers in the 11 European countries who have conducted a research visit abroad (3 months or more) at least once during their careers. Estimated shares of all internationally mobile researchers. n= 5,490.



Source: The SIM-ReC project and NIFU’s mobility survey of Norwegian researchers. Note: Barometer countries are marked in grey.

At the national level, we observe marked differences between the tendency to engage in international research visits and the tendency to move abroad to work at another university. Most countries in Europe promote academic exchange through various programmes, while labour market conditions vary from country to country for this sector. One plausible explanation of the differences in mobility patterns across countries and across the type of international mobility experience is simply that these policies are working and that, as a result, we find different patterns of mobility that follow these patterns (either towards research visits or towards international mobility). A related reason is linked to labour-market conditions that are current in the different countries: it becomes more probable to seek a job abroad when the domestic labour-market is tight. Job security and economic conditions may also affect how common it is to take sabbatical as well.

3.3 Motives of international researcher mobility

The literature indicates that researcher mobility is driven by the interaction of personal preferences, local factors, diversity of institutional settings and general economic conditions (MORE WP1, 2010). In addition, other aspects such as politics, efficiency of transmission mechanisms, distribution of funds, social and professional factors and personal preferences are assumed to be systemic in nature (Lane 1991). The complex interaction between these elements constitutes the backdrop of the many factors influencing the decisions of researchers to move between organizations or even crossing regional or national borders (MORE WP1, 2010).

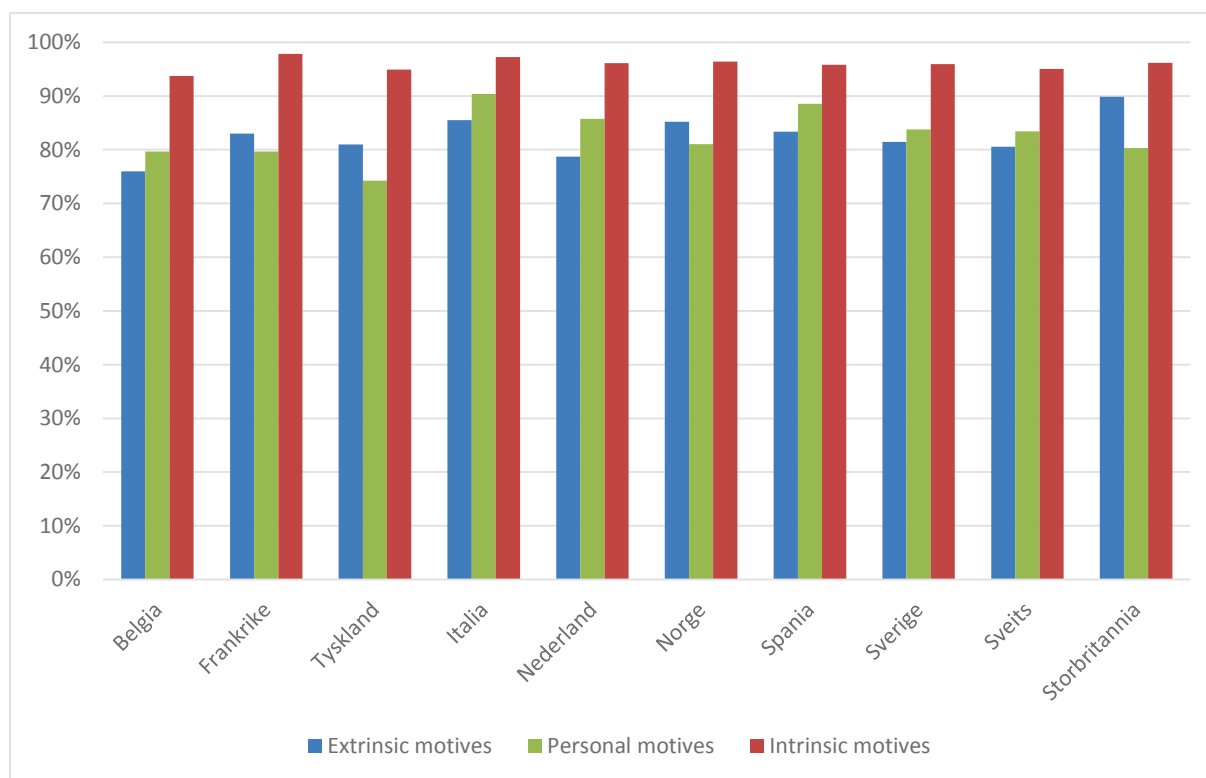
In this section we look closer at how researchers perceive their motivations to pursue career choices internationally. The SIM-ReC study asked internationally mobile researchers about what factors were important when pursuing career options across borders, either through research visits via a change in university. Following the MORE 2 study, these motivations are grouped into:

- Intrinsic motives: possibilities for achieving a permanent position, freedom to choose research focus, sector to which the new position belongs.
- Extrinsic motives: job security, salary package.
- Personal motives: personal factors, characteristics of the country of destination.

The MORE 2 and the SIM-ReC surveys provide similar indications on what motivates international mobility, although we again note the difficulty in comparing the results from the two surveys. In the SIM-ReC survey, researchers reported the importance of different factors in relation to their positions abroad. Figure 5 indicates that there are relatively minor country differences in the way that researchers perceive their motivations for taking up a research position in another country¹⁸. In general, *intrinsic* motives (related to the position itself) prevails as most important to a majority of respondents from both surveys.

¹⁸ See the Annex for a presentation of the corresponding results in the MORE 2 survey. In both surveys, it is possible for the categories to overlap (the shares of researchers within each category will not add up to 100 percent for each country). This is due to the fact that the respondent might consider the different motives or factors to be equally important.

Figure 5 Share of international mobile researchers that consider specific factors/motives as important or highly important in relation to the current position. n= 6,489



Source: The SIM-ReC project and NIFU's mobility survey of Norwegian researchers.

Researchers in different national contexts emphasize different individual factors. Table 3 indicates that internationally mobile researchers in the Norwegian higher education sector are less likely to emphasize salary package or the need to enter into a permanent position than in the other countries. They emphasize more the ability to pursue one's own research agenda and to work in another country.

Table 2 Share of international mobile researchers that perceive each of the following factors as important or highly important, by country. Percent.

| Country | Salary package | Job security | Personal reasons | Entering into a permanent position | Being able to chose my own research topics | Opportunity to work in another country | Opportunity to work in another sector |
|-----------------------------|----------------|--------------|------------------|------------------------------------|--|--|---------------------------------------|
| Netherland | 50 | 71 | 79 | 72 | 89 | 34 | 15 |
| Norway | 52 | 79 | 74 | 58 | 94 | 44 | 11 |
| Sweden | 54 | 74 | 76 | 77 | 86 | 40 | 18 |
| Switzerland | 64 | 71 | 77 | 72 | 90 | 34 | 15 |
| The other SiM-ReC countries | 56 | 80 | 76 | 80 | 90 | 40 | 15 |

Source: The SIM-ReC project and NIFU's mobility survey of Norwegian researchers.

Researchers at Norwegian HES ranked the opportunity to work in another sector lowest among internationally mobile researchers. Against this background of international researcher mobility, we go on to map (i) inflows to researcher positions in Norway and (ii) cross flows or job-changes across sectors undertaken by Norwegian researchers during a six year period, 2007-2012.

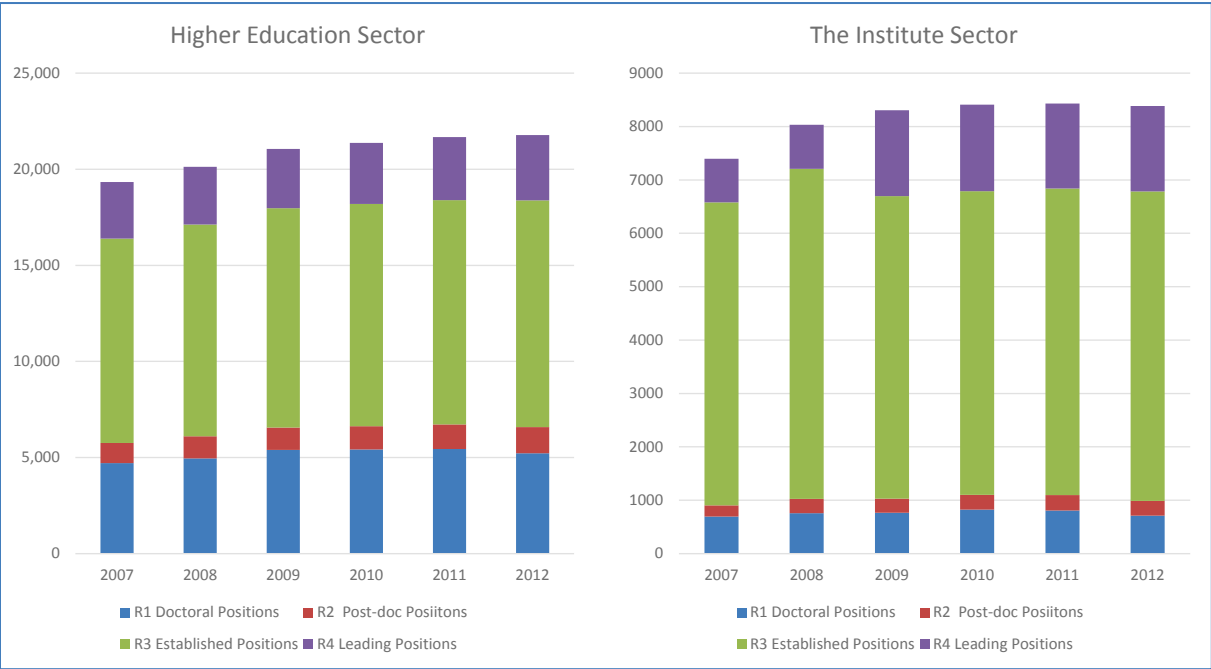
4 Researcher mobility in Norway

In light of this international context, this section looks in detail at researcher mobility in Norway. We take stock of the researchers at the country's institute sector (PROs) and higher education sector (HES) and we map flows into and out of these sectors.

In 2011, there were 30,200 researchers employed in research-active positions in the higher education sector and the institute sector in Norway¹⁹. The majority (21,700) were affiliated with universities or colleges (including university hospitals), while 8,400 were with the country's substantial research institute sector. A further 100 were involved in a doctoral position co-funded with a private company or a government organization. For a detailed breakdown of the researcher population by detailed position categories, see the annex. Annex 2 also provides complete set of tables (in Norwegian) detailing different aspects of the population.

¹⁹ The dimensions of the population are provided in Section 2 (and the annex).

Figure 6 Researcher Stocks in the higher education sector (left) and the institute sectors in Norway by category: 2007-2012



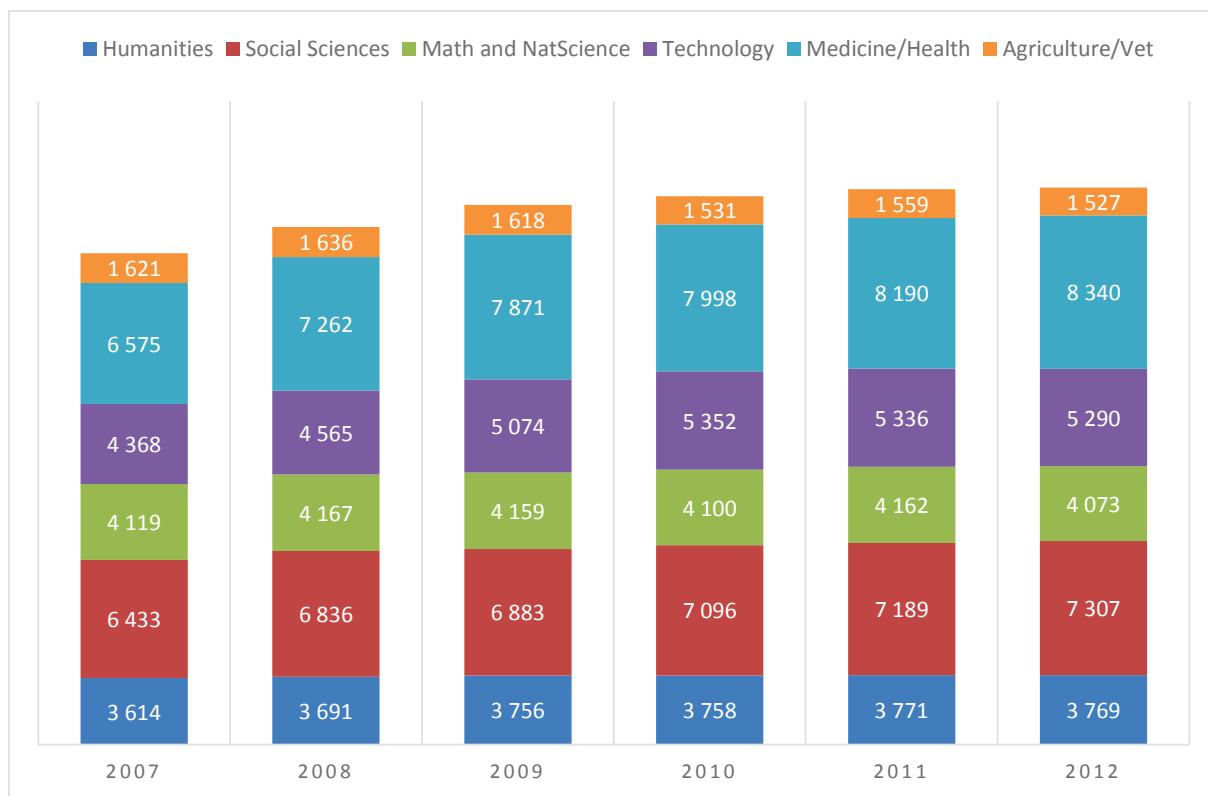
*In the institute sector, leading positions (R4) consists of Senior Researchers. This qualifications for this category may vary from institute to institute. Source: NIFU 2014

Figure 6 introduces several structural aspects of the population of Norwegian researchers. In general, the researcher-populations in both sectors grow through the period. There are roughly 13 percent more researchers in each sector at the end of the period than at the beginning, indicating a substantial net inflow. This growth enters both at the recruitment levels (R1 and R2), with postdocs increasing steadily through the period, ending 30 percent higher. Leading positions rose over trend in the higher education sector (15.5 percent)²⁰, while the middle-tier positions in both sectors grew more slowly.

In net, there were 3,580 more researcher positions in 2012 than 2007 according to this approach. Figure 7 illustrates that the general growth is found first and foremost in a couple of specific fields. Taking the two research sectors together, population increases take place primarily in the fields of medicine & health, of technology & engineering, and of the social sciences. A share of the growth involve an expansion of earlier stage researchers. However, the established and leading positions also grew substantially; by 29 percent in medicine & health, 15 percent in technology, and nearly 13 percent in the social sciences. Figure 7 illustrates that the general growth is found first and foremost in the fields of technology/engineering and medicine and health.

²⁰ By this account, leading positions (R4) almost doubled in the period. However, this is largely an effect of the uneven application of this level. This classification is not standard for the sector and changed during the period also within individual institutes, see also footnote above.

Figure 7 Researchers in Norway’s higher education sector and the institute sector by field: 2007-2012.



To get an idea of the composition of the researchers who enter into these positions, we look to indications of researchers who enter from outside the labor-stock. We are first interested in international mobility into the system.

4.1 International inflow: R&D personnel from abroad

It is common to use citizenship to gauge the inflow of researchers from abroad (e.g. Børing & Gunnes, 2013; Olsen & Sarpebakken, 2012). However, the inflow of foreign nationals to researcher positions faces a chicken-and-egg problem: was the researcher recruited from abroad based on qualifications accrued there or did other factors bring him/her to Norway well in advance of filling a position as researcher here?

The question matters. It involves what contribution foreign nationals are expected to have on Norwegian research. At a basic level, it might say more about the Norwegian workforce than about the additional value of the spillover from abroad. It might be a question of replenishing the domestic workforce from abroad if there are not enough potential researchers at home to fill the positions (for example, because the workforce is tight and domestic candidates are recruited to other productive sectors). In this case, foreign born labor may be interpreted as a means to keep labor costs down rather than as a step to improve the quality of research in Norway.

This labor market efficiency line of reasoning cannot be discounted. However, it does take us away from the hypothesis that researcher mobility represents a qualitative addition to the domestic stock of researchers. This hypothesis is explicitly behind policymaking in the area. Policies that support researcher mobility emphasize the potential (positive) qualities of the foreign-born researcher rather than the potential (negative) qualities of the recruiting workforce.

Foreign-born researchers can be expected to improve the quality of the research environment in a variety of ways. We can distinguish for simplicity between a generic and a specific type of contribution.

In the first case, the foreign-born researcher imports a generic asset (let's call it cultural capital) to the host workforce, and this asset benefits the quality of research there in a general way. In the second case, the individual foreign-born researcher is seen as a carrier (and preferably also a developer) of specific expertise that has been developed abroad, and this asset raises the quality of research in the host workforce and helps bring it to the frontier of research in specific fields (the star recruitment strategy). See e.g. Akers (2005); Mahroum (1998) or Meyer (2001) for relevant discussions.

The question is about what source of spillover foreign nationals is expected to represent in a mobility scenario: (i) a general spillover of cultural capital from abroad or (ii) a more specific spillover of cutting-edge knowledge developed abroad. The two cases are very different in nature. And this difference needs to be appreciated when applying metrics to researcher inflows. In the first case, expectations about the researcher's education or training from abroad are not key because substantial parts of research training could have taken place beside Norwegian candidates without loss of generalization: in the second case, education and other work experience from abroad are instrumental—as these are expected to represent a distinguishing advantage.

The registry data furnishes us with some indication of the original provenance of the researcher. We observe the country of birth and the citizenship(s) of the employee, in addition to a set of personal characteristics (principally age and gender). But we do not observe whether the researcher was recruited to the position from abroad or if he/she had already been in the country. In terms of available metrics, the strategy of using citizenship does not allow us to discern whether the researcher was recruited from abroad or whether there were other factors that brought him/her to Norway before eventually filling a position as researcher here. Current citizenship implies that the researcher is a foreign national (without exchanging foreign for Norwegian citizenship). This fact provides a sufficient basis to pursue the looser expectation that foreign researchers at least represent a general spillover of cultural capital from abroad.

4.1.1 *Rising participation of foreign-nationals across the board*

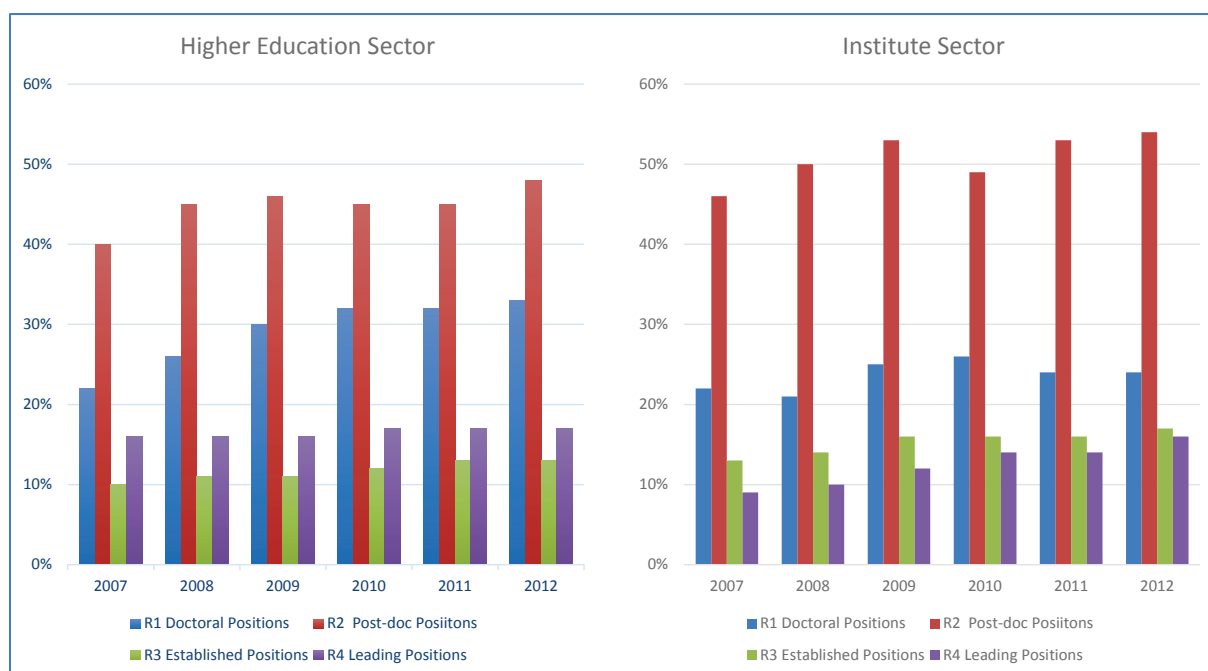
To establish whether the researcher was recruited from abroad to a researcher position based on research training/experience that is new to Norway, would require a more detailed CV information. The registry data does not provide this directly.²¹ We are however able to refine the measure of citizenship to better understand when the researcher entered the Norwegian workforce and to compare that entrance to entry into a position as researcher (before or after education).

Using the citizenship metric²², an average of 18 percent of researchers in Norway were foreign nationals. This share rises substantially during the period. In sum, the share moves from 15 percent in 2007 to more than 20 percent five years later. Figure 8 indicates the bulk of this growth is found both in higher education sector and in the institute sector. This growth is primarily driven by a substantial expansion of foreign nationals in early stage positions. In both sectors, over one in five PhD positions are non-Norwegians and this share rises during the period. It is substantially higher among postdoctoral positions. We see the proportion for the combined sectors rising from 41 percent to 49 percent in the period. The proportion of non-Norwegians among professors (R4) and other established researchers (R3) changes more slowly.

²¹It is however possible in future to link more detailed information about researcher education from the undergraduate level up.

²² Following Olsen & Sarpebakken, 2012, the status of citizenship is frozen at 2007 (in cases where it may subsequently change).

Figure 8 Proportion of foreign nationals in research positions in Norway by career-stage: higher education sector and the institute sector, 2007-2012.



The participation of foreign nationals is not uniform for all fields of science. In 2012, the share of foreign-nationals was highest in math and natural sciences (37 percent of 4,070 researchers) and engineering fields (30 percent of 5,150) and lowest among social scientists (12 percent of 7,300 researchers). Table 3 presents the trend through the period in light of the total researchers in each field as of 2012.

Table 3 Share of foreign nationals among researchers in higher education sector and the institute sector by field: 2007-2012.

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Number (2012) |
|------------------|------------|------------|------------|------------|------------|------------|---------------|
| Humanities | 13% | 14% | 14% | 15% | 16% | 17% | 3,769 |
| Social Sciences | 9% | 10% | 11% | 11% | 11% | 12% | 7,307 |
| Math/Nat Science | 25% | 30% | 33% | 35% | 35% | 37% | 4,073 |
| Technology | 20% | 24% | 27% | 29% | 30% | 30% | 5,152 |
| Medicine/Health | 13% | 13% | 14% | 13% | 15% | 15% | 8,340 |
| Agriculture/Vet | 13% | 13% | 14% | 13% | 15% | 15% | 1,527 |
| Total | 15% | 17% | 18% | 19% | 20% | 20% | 30,168 |

Almost 25 percent of the foreign nationals working as researchers in Norway (2012) had been in the country more than 20 years. Many of these had become Norwegian citizens by this time. Figure 10 demonstrates that a majority of foreigners who held recruitment level positions (postdoc or doctoral positions) were relative newcomers to the country, with over 75 percent having arrived within the previous 7 years. The number of researchers in established and leading positions who were recent arrivals from abroad was relatively small. However, we are unable to observe the number of years a give researcher has been active in Norway at the current time.

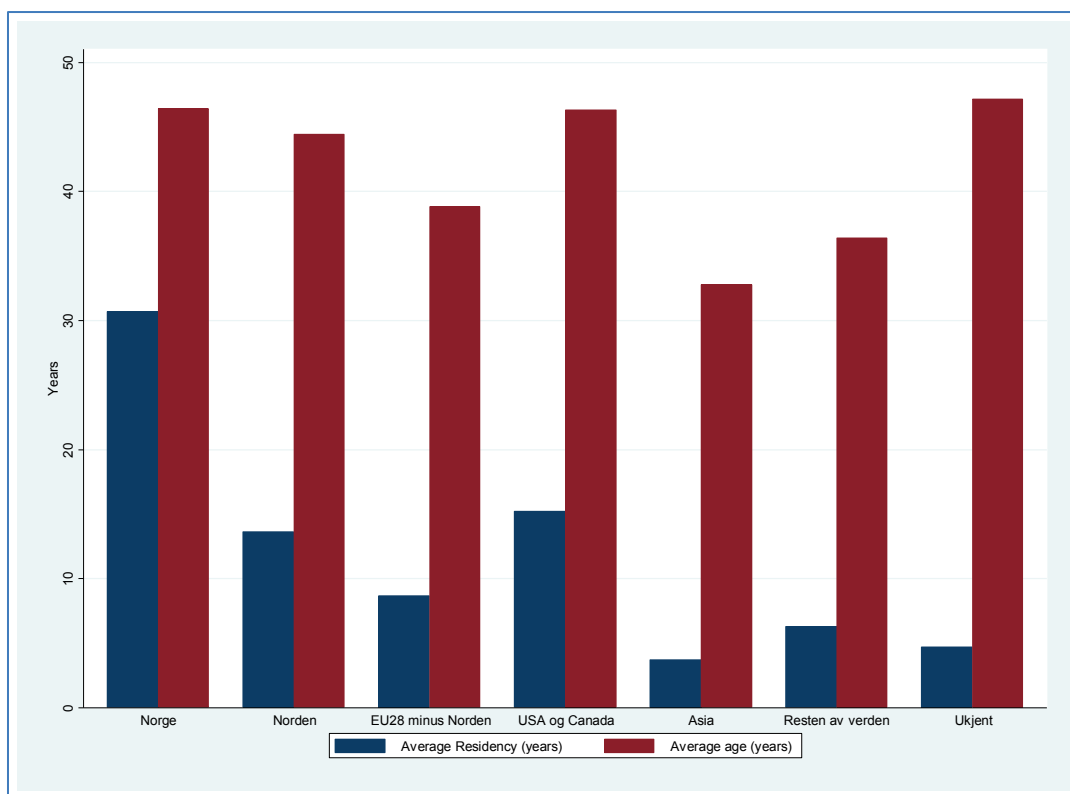
Figure 9 Foreigners in Norwegian research (HES and PROs) in 2012 at different career-stages by duration of residency*



* SSBs calculation of residency (or “botid”).

Further analysis of the changing of patterns in inflows of researchers are possible in this material. One last example is that the provenance of foreign researchers seems to be shifting. Figure 10 presents the mean duration of residency of foreign researchers based on current citizenship. We find that foreigners who currently hold Norwegian citizenship have on average been in Norway for 30 years and are on average 48 years old. This population originate from different parts of the world and are naturalized Norwegian citizens. On average, this category of long-term foreign researcher arrived in Norway at the age of 18, indicating that they were educated in Norway. This category falls outside the interest of this study but may act as a useful benchmark to consider different waves of researchers from abroad.

Figure 10 Foreign researchers from different regions (2012): by average age and average duration of residency.



* Note that foreign nationals can become Norwegian citizens after 7 years.

Nationals from other Nordic countries and from North America represent an older wave of inflows into the country with average residency of over 12 years. The figure suggests that more recent inflows of researchers are coming from other regions. Researchers from other European countries have on average been in the country for 7 years and are on average 38 years old. These researchers from elsewhere in Europe are by and large found in established positions in Norway. Researchers from Asia are the youngest and most recent arrivals: over half were in PhD positions in 2012, predominantly in mathematics, natural sciences, and engineering.

4.2 Sector mobility

We go on now to examine the propensity of researchers to change position from one sector to another. The phenomenon of sector mobility involves a number of different transitions that are of interest. Sector mobility is assumed to have a positive effect on the diffusion of knowledge in the economy: the diffusion of useful knowledge is enhanced when individuals carrying that knowledge focus on work in another sector.²³ Mobility between the research sectors and the business enterprise sector is seen as particularly important. The flows between these sectors is expected to improve university-industry links and thus contribute to industrial renewal.

We focus on three sectors: the research sector (where we distinguish the higher education sector from the institute sector), the business enterprise sector, and the government or public sector. The focal point is on movements in and out of the research sector. The types of incoming and outgoing transitions can be summed up in this way.

²³ See MORE1 (2010) and MORE2 (2013) for a discussion

Moving into a position:

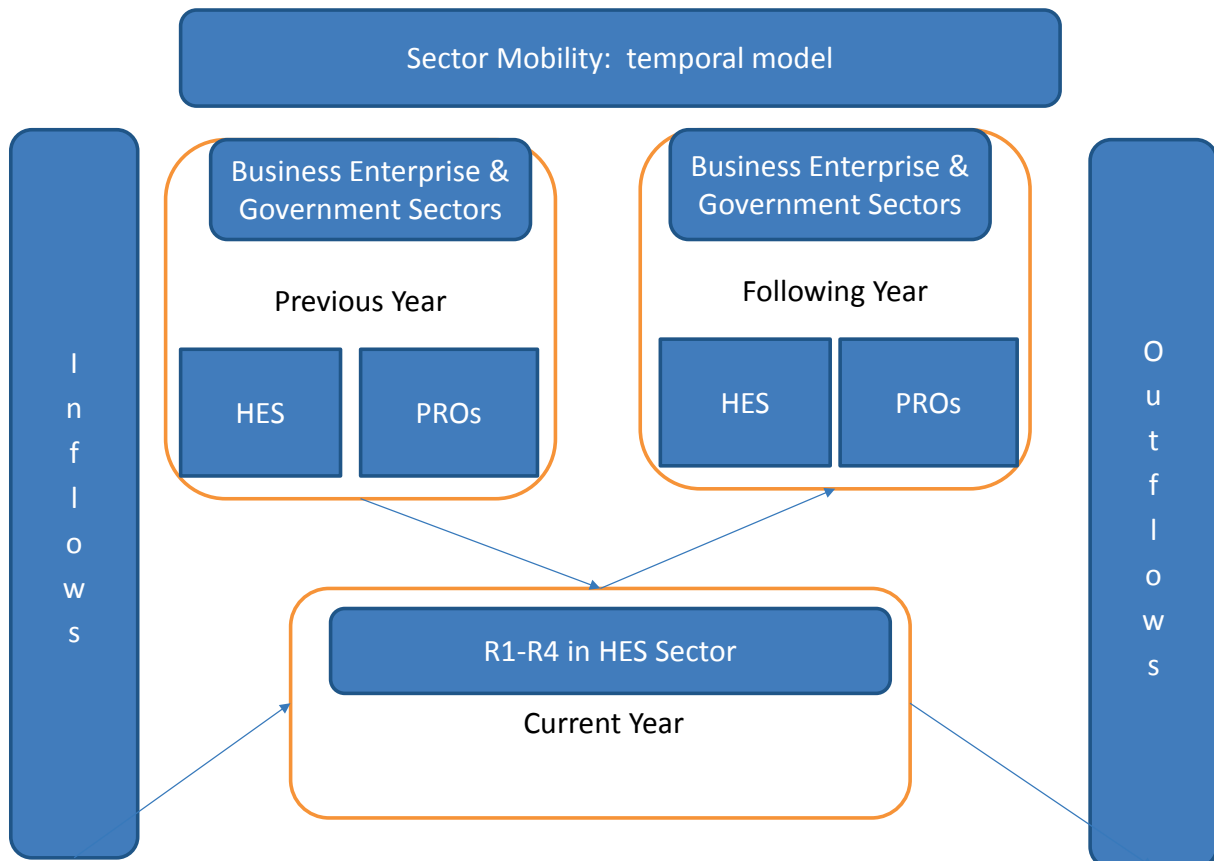
- From outside the labor-force (i.e. entry from abroad or entry in terms of first job)
- From another position in the same sector (most common)
- From a position in another sector

Moving out of a position:

- To outside the labor-force (e.g. entry)
- To another position in the same sector
- To a position in another sector

Using the registry data, we are able to observe the 'before' and 'after' of a researcher's career: we observe the position (if any) a researcher had prior to taking a researcher position in the higher education sector or institute sector; and we observe his/her position whether or not (s)he changes positions in the subsequent year. Figure 12 provides a schematic overview of the relevant flows into and out of a researcher position. The active research position at a university in a given year is the focal point (box "R1-R4 in higher education sector sector") from which we look back a year and forward a year.

Figure 11 Schematic Presentation of sector mobility: 2007-2012

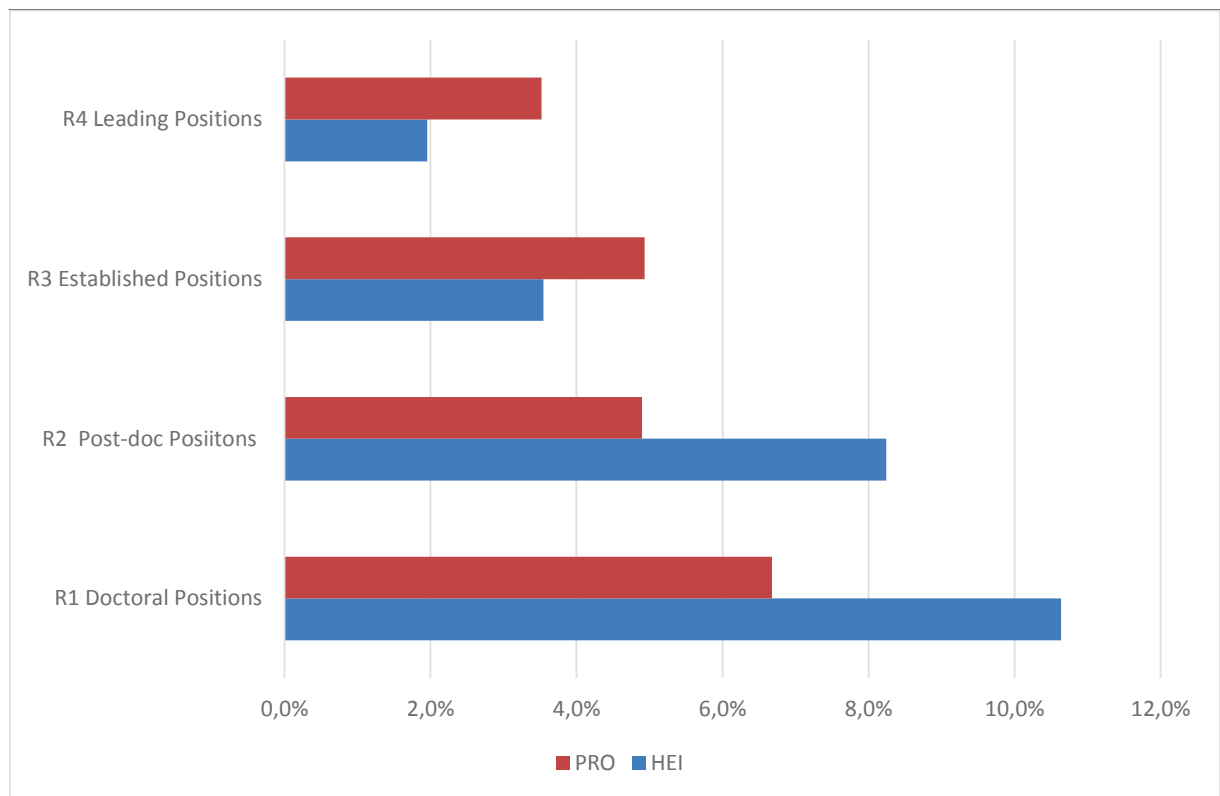


A population of 44,129 individuals held a researcher position in a research sector (either in higher education sector or the institute sector) for one or more years between 2007 and 2012. Many (36 percent) were researchers in all six years of the panel, while most that entered into a research position in the period remained in the sector: 2,200 researchers (2,000 researchers) entered in 2008 (in 2009) and remained throughout the rest of the period. Other patterns of mobility abound, including exit from the research sector (also when excluding those at retirement age) as well as exit followed by reentry into research sectors.

4.3 Inter-sectorial researcher by position

Sector mobility is strongly related to career development. In this section we examine this relationship in terms of the career stages introduced above. Of the 27,700 in research positions in 2011, five percent (1,480) were registered to have changed to another sector in the subsequent year. This tally excludes research-doctors and other medical positions. Figure 13 indicates that nearly 2 percent professors (or 65) moved from a position in the higher education sector to another sector. This involved just over 60 professors, up from fewer than 30 in 2007. A larger share (3.5 percent) but smaller number of research professors in the institute sector changed sectors.

Figure 12 Percent of researchers in 2011 that changed sectors in 2012: by sector (2011) and career stage

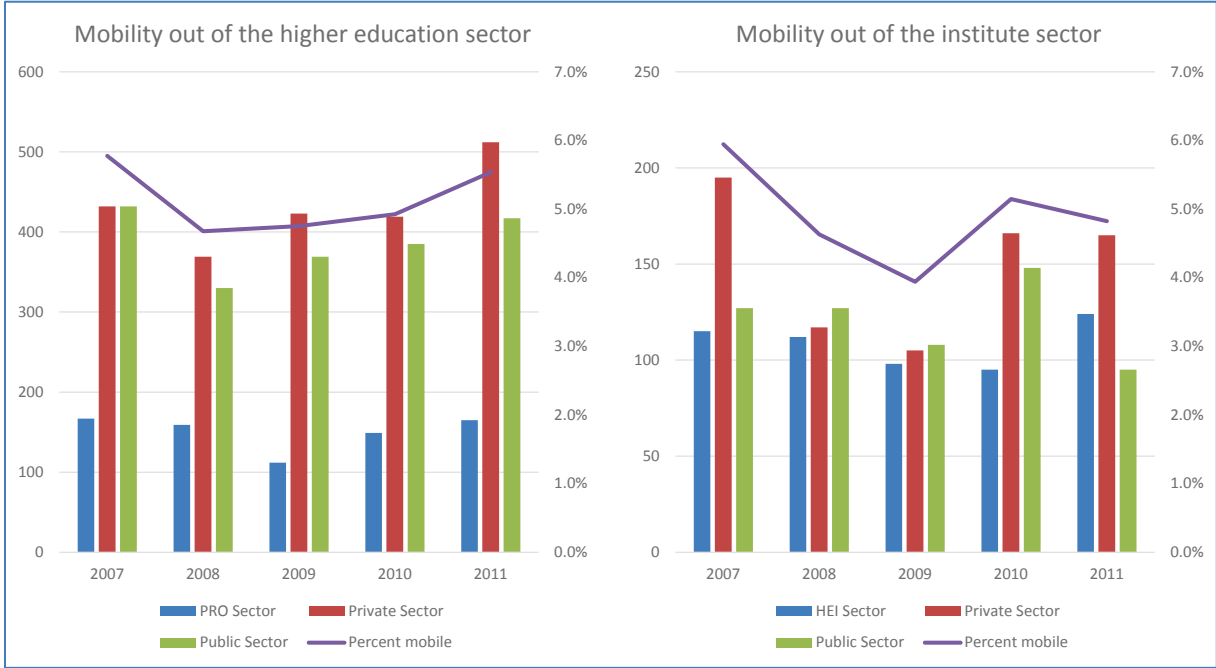


* Sector mobility involving medical positions (doctors, psychologists etc) are not included.

Figure 12 demonstrates a tendency for sector mobility to be higher among researchers in the higher education sector at early career positions (R1 and R2), and higher for researchers in the institute sector for more established positions. This is consistent with expectations as is the general tendency for sector mobility to be higher at earlier stage positions. We find that 580 (10.5 percent) of those holding doctoral positions at an academic institution in 2011 moved to another sector in the workforce in 2012. There was a higher propensity of researchers in postdoc positions to remain in the same sector (position) the next year. There was an equivalent rate of sector mobility out of the institute sector both for postdoc and for more established positions (5 percent).

The relative flows of researchers between the higher education sector and the institute sector are roughly on par with each other. The outward flow from higher education sector to the institute sector however accounts for a much smaller proportion of total outflow to other sectors than that flowing from the institute sector to the higher education sector. Figure 13 indicates the total annual share of researchers that change sectors for the two research sectors (lines, right axes), as well as the overall numbers of researchers that change sector by recipient sector (bars, left axes).

Figure 13 Number (and percent) of researchers in given year that moved to another sector in the next year: outward from higher education sector (left) and from the institute sector (right) by recipient sector.



* Sector mobility involving medical positions (doctors, psychologists etc) are not included.

** Researcher mobility (base in 2007) coincides with a redefinition of some institutions in the research sector. The elevated level (particularly for the institute sector to the business enterprise sector) is off trend and is possible linked to this change.

The annual outflow from the research sectors varied within a band of 4-6 percent during the period. The figure indicates that this share is in general increasing, at least in the last three years. The tendency is clearest when we look at the outflow of higher education sector researchers. Principally, the sector mobile higher education sector researchers –whom we found were predominantly early stage researchers— move into the business enterprise as well as the government sectors. Flows out of the institute sector are less clear-cut. A substantial but variable share involves mobility flows with the higher education sector. In addition, we find a general upward tendency among researchers moving to the business enterprise sector²⁴. A weak inverse U trend however appears when the two figures are overlaid. When we take into account the potential that restructuring might account for some of the observed mobility, this observation emphasizes that a period of five years is a short period in which to reliably establish a trend.

At between 4-6 percent, this real measure of inter-sector mobility is substantially lower than the evidence presented in the surveys reviewed above. Around 20 percent of European respondents to the SIM-ReC study reported some form of sector-mobility in the past 10 years (see NordForsk, 2014). Moreover, results from that survey suggested that Norwegian researchers reported the highest level of intersectoral mobility among the 12 countries, at roughly one of three researchers. The register data measures –which reflect real changes within the domestic labor market—are not immediately comparable with to the survey-results:

- Sim ReC records only later career researchers (whereas we use the registry to report on all career stages)

²⁴ Outflows at the beginning of the period may be affected (elevated) by restructuring of the sector.

- Sim ReC is reported from the point of view of researchers currently in the higher education sector (whereas we use the registry to report outward flows from the sector).
- Sim ReC records accumulated changes during the past 10 years by researcher (whereas the registry data measures year on year changes by sector)
- Sim ReC includes positions abroad.

That said, the substantial discrepancy indicates that there a fundamental difference in these two measures. It indicates a probable selection bias in that survey (e.g. non-response bias) and it emphasizes the more general caveat to be cautious when using survey results as a measuring stick for a phenomenon such as sector mobility. The identification of this inconsistency between Norwegian respondents and real labor market transitions also underlines the importance of the approach laid out in this report, to combine datasets to better understand researcher mobility. The combination of datasets can be used to address underlying weaknesses in the survey approach while it can also be used to add important contextual information to the interpretation of patterns of researcher mobility identified in the registry data.

5 Conclusions

To meet the requirements for evidence-based policymaking in addressing researcher mobility in Europe, the most should be made of the growing body of available empirical information. This report illustrates an approach that uses different data sources—survey and registry—to this end and it demonstrates how this approach can be used to better understand central dimensions and recent trends of researcher mobility in Norway.

The approach presented here was designed to inform policy development. The context surrounding researcher mobility is changing in Europe. A central premise is that an approach that combines current survey results with concurrent register-based analysis can be used as a reliable and non-invasive basis for comparison that keeps pace with the changing landscape. In order to understand changing patterns of mobility involving the university and the (research) institute sector. The report uses the results of recent surveys in order to establish a comparative baseline of how researchers assess researcher mobility—and factors that shape it—differently in different geographical (and institutional) contexts. Specifically, it uses results recently published by the MORE II study of HES researchers. This comparison points out differences in mobility patterns in Norway from those in a basket of control ('barometer') countries on questions related to why mobile researchers tend to be mobile. Complementary, it uses the more detailed results of the SIM ReC study to study mobility patterns in Norway in more detail, including at the level of university faculties. This illustrates that researcher visits is a more common vehicle for mobility in Norway than elsewhere.

In light of this comparison of general dimensions of researcher-mobility between researchers in Norway and those at universities in the other barometer countries, the report then employs a novel combination of data to look more into researcher mobility in Norway. The combination of registry data is used to explore in new detail (i) inflows to researcher positions in Norway and (ii) cross flows or job-changes across sectors undertaken by Norwegian researchers during a six year period, 2007-2012. It illustrates inter alia the growing role that foreign nationals are playing in the Norwegian research system as well as the changing composition of these inflows.

This combination of survey and registry data is unique and points towards avenues that draw on the relative strengths of each approach. Evidence from the surveys show that several sets of factors—e.g. intrinsic, extrinsic tend to influence the mobility decisions of a researcher. A preliminary analysis of the registry data indicates that career stage affects sector mobility in Norway. In addition it reveals apparent temporal and institutional effects associated with sector mobility. Further analysis into these aspects would need to account for these fixed effects, given the time-series nature of the data. In addition, future studies could more broadly seek to align what the surveys reveal about factors that motivate (and hinder) researcher mobility with what registry can reveal about changing patterns of researcher mobility between institutions, sectors and countries.

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Annexes

Annex 1: Details of the datasets

I. About NIFU's Register on Research Personnel (FPR):

The FPR register is a micro-level database that contains comprehensive information²⁵ about researchers in Norway. It includes information for researchers and other R & D staff (as scientists, doctors and other professional staff) at universities and colleges, research institutes and other institutions that conduct R & D, as well at health-entities/hospitals in the country.

A defining dimension of the annual register is that it includes research staff who actively carry out R&D in a given year. This means that staff without formal research duties in a given year will not appear as a "researcher" in that year. This is an important distinction when calculating R&D expenditure in the country and it has implications for tallying researcher mobility on year-on-year basis. There are several reasons why a researcher might not appear as a researcher for a given year:

- Employed at hospitals that did not participate in R & D in a given year
- Persons on maternity leave (did not participate in R & D in a given year)
- People in long, unpaid leave - including leave to take public office (mayor, members of parliament, etc.), leave to take up another position (both public and private) or leave to move abroad in which case the researcher does not continue to receive a salary from previous employer.
- Part-time teaching staff or candidates who have completed their qualifications and are working on temporary teaching positions at the institution in expectation of a full-position. Similarly, qualified fellows have administrative positions while waiting for formal recognition of dissertation, etc.

One implication for measuring mobility is that the 'researcher' in these cases will not be included in the researcher registry data but will appear as employed by the institution in the official employment statistics. We have taken measures to identify cases in which the researcher retains their position while on leave (see below). In cases of dual-affiliations, a researcher is assigned to a primary institute.

II. About the Population :

In this light, this study uses the FPR to compile a full-count population of researchers who were active researcher staff in one or more years during the period 2007-2012. To trace cross-sectoral mobility, the researcher-population (above) was then merged with official registry information (SSB Employment dataset) for the full Norwegian workforce during the same period. This step provides further information about the population: employee information, including location, sector affiliation and industry classification (Nace), location; person-information (citizenship, country of birth; as well as salary and full-time versus part-time labor.

Information from the merging of the datasets enables us to operationalize several differences that are relevant to our analysis. Firstly, it allows us to trace job-movements between the researcher positions and positions elsewhere in the economy, especially to the public-sector and to the private-sector.

²⁵ The register contains information on gender, age, occupation, position and percentage of work, ie institution, faculty, department and discipline, in addition to higher degrees (including a discipline, education and place of graduation) and PhD. Information about the researchers collected 1 October and obtained directly from the research-performing units' central administrations. The latest available year is 2012

Secondly, it allows us to observe scientists as they enter into (or exit from) the Norwegian workforce. In the cases in which the scientist hails from another country, we can use information from the SSB Employment dataset to analyze the role of foreigners in the stock of active scientists in Norway.

III. Specific definitions used

1. Norwegian and 'non-Norwegian' researchers

Citizenship and further distinctions of Non-Norwegian researchers: In line with earlier studies, we distinguish Norwegian versus non-Norwegian researchers based on citizenship. To deal with potential changes during the period, we follow Olsen & Sarpebakken (2011) and define citizenship based on the status per 2007. It is important to emphasize that there are many factors surrounding the entrance of foreign nationals into the workforce. Citizenship is—by itself— a very crude measure on which to define “inbound mobility” from abroad. Therefore, we also included the (registered) duration of the researcher’s residency in Norway to distinguish foreigners that have lived in Norway for a longer period-of-time (and/or arrived at an early age) from those whose arrival is temporally closer to taking up a position as researcher in Norway. The distinction we use is between:

- c. "Long-term foreign researchers": researchers with foreign citizenship who are registered as ingoing to Norway before the age of 16 and / or have been in Norway since before 2000.
 - d. "Short-term foreign researchers": Other foreign nationals registered as ingoing to Norway after 1999.
2. Sector - definition : The sectors are divided into four standardized categories
- a. higher education sector (HES)
 - b. the institute sector (PROs)
 - c. the business enterprise sector
 - d. the public/government sector

The sector definitions that are used here are standard classifications. We can distinguish on the one hand two research sectors: the higher education sector (HES) and the institute sector (PRO) which are implemented in the FPR dataset. The higher education sector, university hospitals included, corresponds to the OECD higher education sector. The institute sector is defined in line with national statistics: business enterprise sector includes the industrial sector as well as non-profit research institutes serving enterprises. In national statistics, sector includes the industrial sector, non-profit research institutes serving enterprises as well as the government sector and private non-profit sector (PNP). See also <http://www.nifu.no/en/statistikk/nokkeltall/fou-lommefolder/>

Sector affiliation of individual institutions is subject to change (fusion, fission, reassignment). If this change affects the sector affiliation (ie from college to university), the institute is assigned to the sector in the latest year.

On the other hand, we distinguish these research sectors from other sectors in the economy using standard classifications employed in the national accounts. We distinguish between the private enterprise sector and the public or governmental sector: each of these sectors exclude research institutes as defined above.

3. Research positions: definitions and classifications: The positions are divided into four categories of seniority based on an interpretation of the R1-R4 categories. These are defined in the European Commission’s communication “Towards a European Framework for Research Careers” (European Commission 2011, p. 2) has been used. This model distinguishes between four career stages:- R1: First Stage Researcher (up to the point of PhD), - R2: Recognized Researcher (PhD holders or equivalent who are not yet fully independent), - R3: Established Researcher (researchers who have developed a level of independence) and - R4: Leading Researcher (researchers leading their research area or field). See http://ec.europa.eu/euraxess/pdf/research_policies/Towards_a_European_Framework_for_Research_Careers_final.pdf.

The two-tier table below breaks down the population by sector and position category (in the upper tier): the lower part of the table details the type of positions held.

4. Table 4 Researchers by sector and position: 2011

| | R1 Doctoral Positions | R2 Post-doc Posiitons | R3 Established Positions | R4 Leading Positions | Total |
|--|-----------------------|-----------------------|--------------------------|----------------------|---------------|
| HEI Sector | 5,444 | 1,274 | 11,674 | 3,277 | 21,669 |
| PRO Sector | 809 | 286 | 5,746 | 1,591 | 8,432 |
| Adjunct Position* | 106 | | | | 106 |
| | | | | | |
| 1 Professor / Senior Researcher | | | | 4,868 | |
| 2 Docent | | | 85 | | |
| 3 Physician | | | 1,579 | | |
| 4 Associate Professor | | | 3,117 | | |
| 5 Researcher | | | 3,351 | | |
| 6 Lecturer | | | 836 | | |
| 7 Academic Director | | | 394 | | |
| 8 Postdoctoral | | 1560 | | | |
| 9 Researcher | | | 3,662 | | |
| 10 Assistant Professor | | | 116 | | |
| 11 Special positions | | | 78 | | |
| 12 Assistant Doctors | | | 457 | | |
| 13 Psychologists | | | 186 | | |
| 14 Univ - and college lecturers | | | 3,559 | | |
| 15 PhD fellow | 5941 | | | | |
| 16 Research assistant | 418 | | | | |
| | | | | | |
| Total | 6359 | 1560 | 17,420 | 4,868 | 30,207 |

Annex 2: Stocks and distribution tables from the registry-data analysis

ANNEX 2 PRESENTATION OF RESEARCHERS STOCKS OVER TIME
DELIVERY TO THE MINISTRY OF EDUCATION AND RESEARCH.

Leveranse KD
Stata 13

> --
Part 1: Stock of researchers (Norwegian and non-Norwegian nationals) in UH and I sectors by discipline in the period 2007-2012

//Del 1: Generelle beholdningstall for forskere i UH og I-sektorene per hovedfagområdet i perioden 2007 - 2012.

*Tabell 1: Vitenskapelig personale i UoH og Instituttsektoren; Oversikt 2007-2012:

| Aar | SEKTOR | | Total |
|-------|------------|------------------|--------|
| | UoH-sektor | Institutt-sektor | |
| 2007 | 19336 | 7394 | 26730 |
| 2008 | 20125 | 8032 | 28157 |
| 2009 | 21055 | 8305 | 29360 |
| 2010 | 21368 | 8411 | 29779 |
| 2011 | 21669 | 8432 | 30101 |
| 2012 | 21783 | 8385 | 30168 |
| Total | 125336 | 48959 | 174295 |

Tabell 2: Forskere i UoH-sektor etter fagområder: 2007-2012:

| fagomraade | Aar | | | | | | | Total |
|------------------------------|-------|-------|-------|-------|-------|-------|--------|-------|
| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | | |
| 0 Humaniora | 3104 | 3082 | 3123 | 3115 | 3090 | 3090 | 18604 | |
| 200 Samfunnsvitenskap | 5031 | 5385 | 5409 | 5633 | 5797 | 5928 | 33183 | |
| 400 Matematikk og naturviten | 2857 | 2918 | 2859 | 2803 | 2858 | 2793 | 17088 | |
| 500 Teknologi | 2195 | 2241 | 2705 | 2876 | 2848 | 2781 | 15646 | |
| 700 Medisin og helsefag | 5783 | 6132 | 6622 | 6638 | 6758 | 6875 | 38808 | |
| 900 Landbruk/fisk/veterinær | 366 | 367 | 337 | 303 | 318 | 316 | 2007 | |
| Total | 19336 | 20125 | 21055 | 21368 | 21669 | 21783 | 125336 | |

Tabell 3: Forskere i Instituttsektor etter fagområder: 2007-2012:

| fagomraade | Aar | | | | | | | Total |
|------------------------------|------|------|------|------|------|------|-------|-------|
| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | | |
| 0 Humaniora | 510 | 609 | 633 | 643 | 681 | 679 | 3755 | |
| 200 Samfunnsvitenskap | 1402 | 1451 | 1474 | 1463 | 1392 | 1379 | 8561 | |
| 400 Matematikk og naturviten | 1262 | 1249 | 1299 | 1297 | 1304 | 1280 | 7691 | |
| 500 Teknologi | 2173 | 2324 | 2369 | 2420 | 2382 | 2371 | 14039 | |
| 700 Medisin og helsefag | 792 | 1130 | 1249 | 1360 | 1432 | 1465 | 7428 | |
| 900 Landbruk/fisk/veterinær | 1255 | 1269 | 1281 | 1228 | 1241 | 1211 | 7485 | |
| Total | 7394 | 8032 | 8305 | 8411 | 8432 | 8385 | 48959 | |

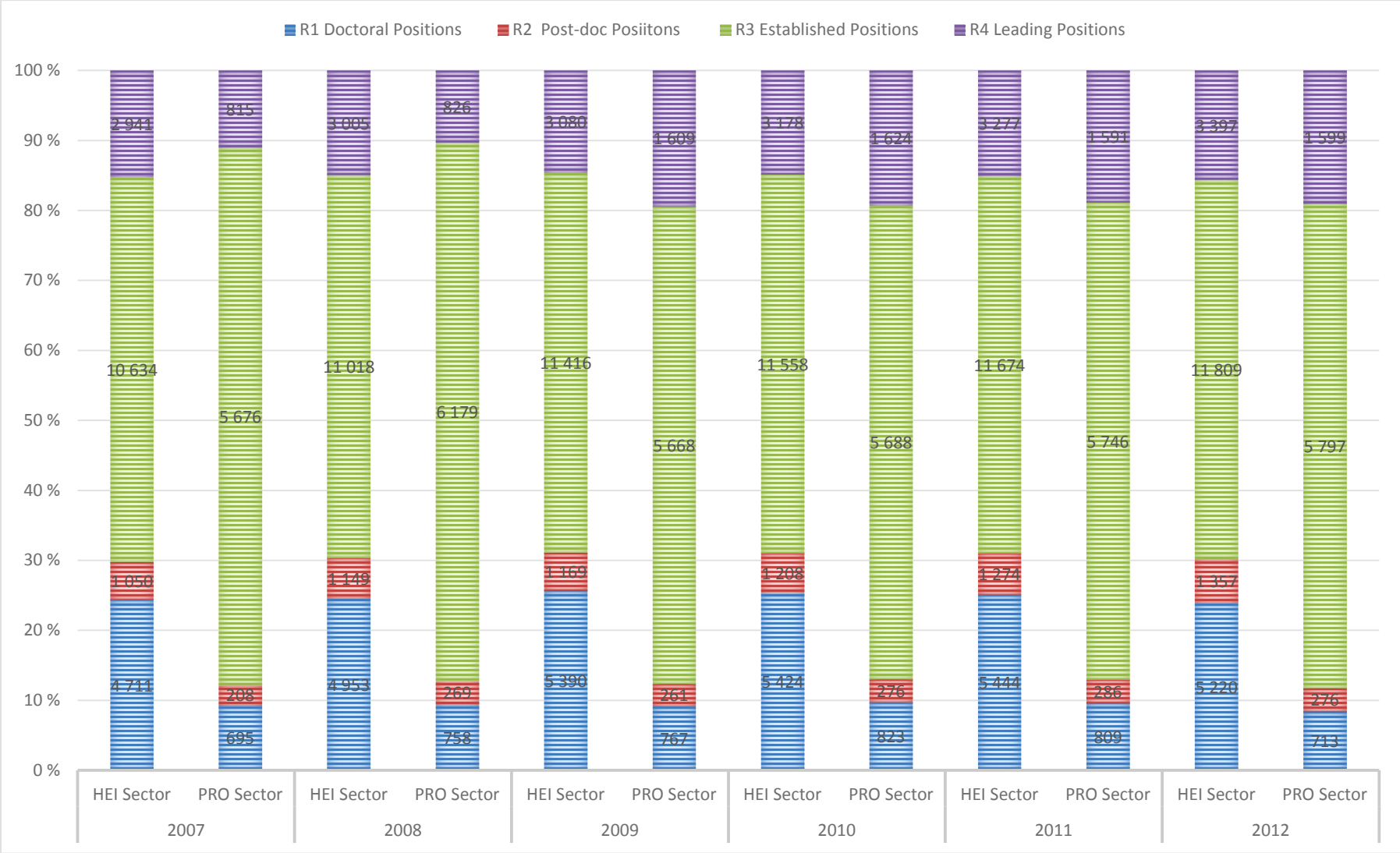
Forskere etter statsborgerskap og hovedfagområdet i perioden 2007 - 2012:

Tabell 4.0: Forskere i UoH og Instituttsektoren: oversikt over statsborgerskap etter region: 2007-2012

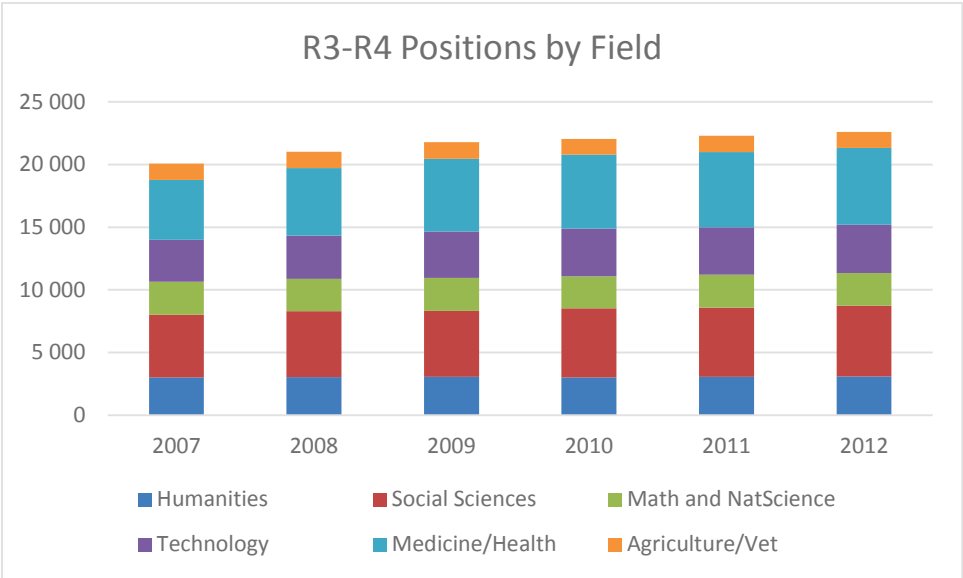
| Nationalitet_ extend | Aar | | | | | | | Total |
|----------------------|--------|--------|--------|--------|--------|--------|---------|-------|
| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | | |
| Norge | 22.426 | 23.205 | 23.728 | 23.880 | 23.942 | 23.801 | 140.982 | |
| Norden | 954 | 1.047 | 1.095 | 1.104 | 1.122 | 1.170 | 6.492 | |
| EU28 minus Norden | 1.682 | 1.976 | 2.221 | 2.359 | 2.529 | 2.624 | 13.391 | |
| USA og Canada | 338 | 362 | 397 | 413 | 409 | 411 | 2.330 | |
| Asia | 539 | 706 | 918 | 1.007 | 1.031 | 1.019 | 5.220 | |
| Resten av verden | 473 | 572 | 683 | 719 | 766 | 786 | 3.999 | |
| Ukjent | 318 | 289 | 318 | 297 | 302 | 357 | 1.881 | |
| Total | 26.730 | 28.157 | 29.360 | 29.779 | 30.101 | 30.168 | 174.295 | |

*nb: "statsborgerskap ukjent" omfatter ikke oppgitt og et lite antall "statsløse"

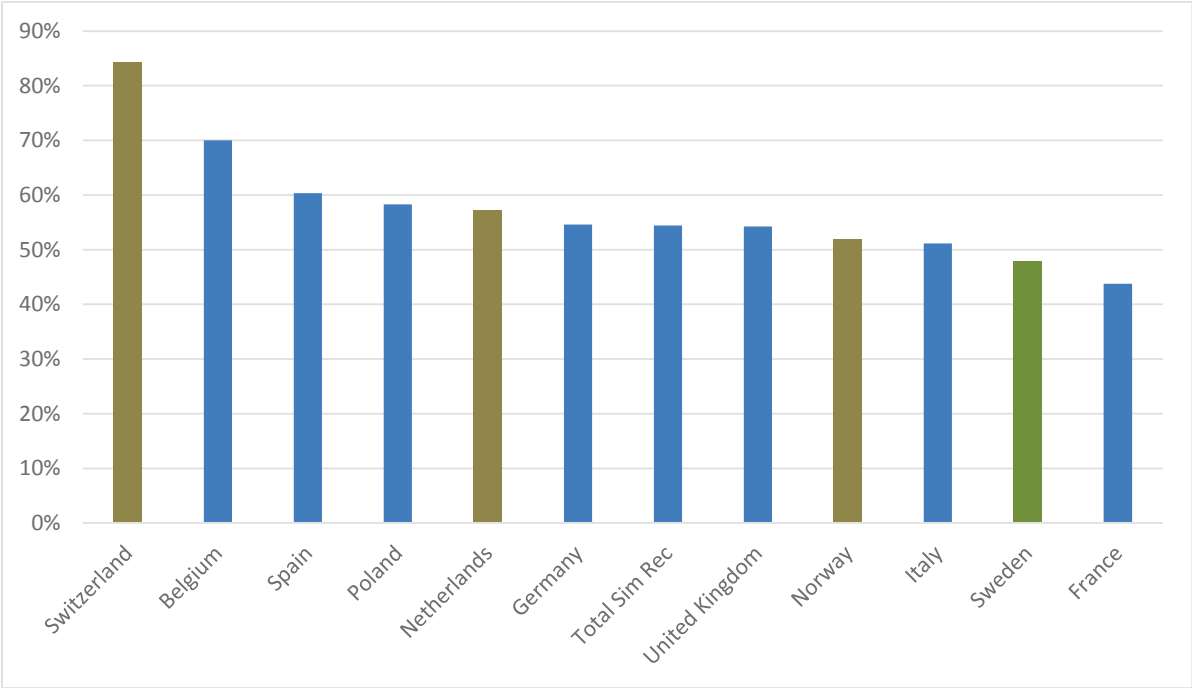
Annex 3: Survey Tables



Established and leading positions in the research sector (HES and PRO) by field of science: 2007-2012.



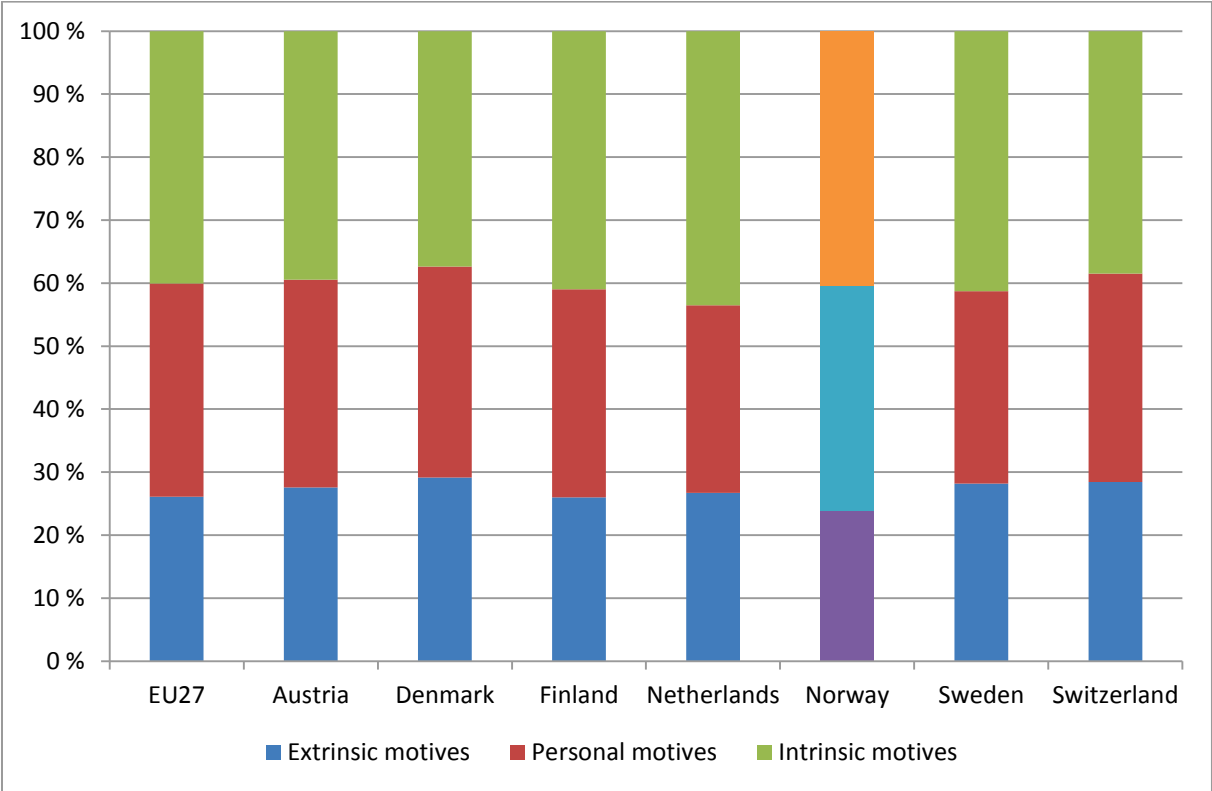
Share of internationally mobile researchers in the higher education sector in 11 selected European countries if this has involved change of employer at least once in their research career²⁶. N=6, 489



Source: The SIM-ReC project and NIFU’s mobility survey of Norwegian researchers. Note: Barometer countries are marked in grey.

²⁶ Note to figure 3: Weighted results of the respondents among researchers in 11 selected European countries. A researcher is considered to have had an “international mobility experience at least once in their research career” if he/she has held at least one position abroad in a country different from where the highest educational level was completed, or if he/she has had any research visits abroad of at least three months since January 2000 (research visits abroad do not involve a change of employer).

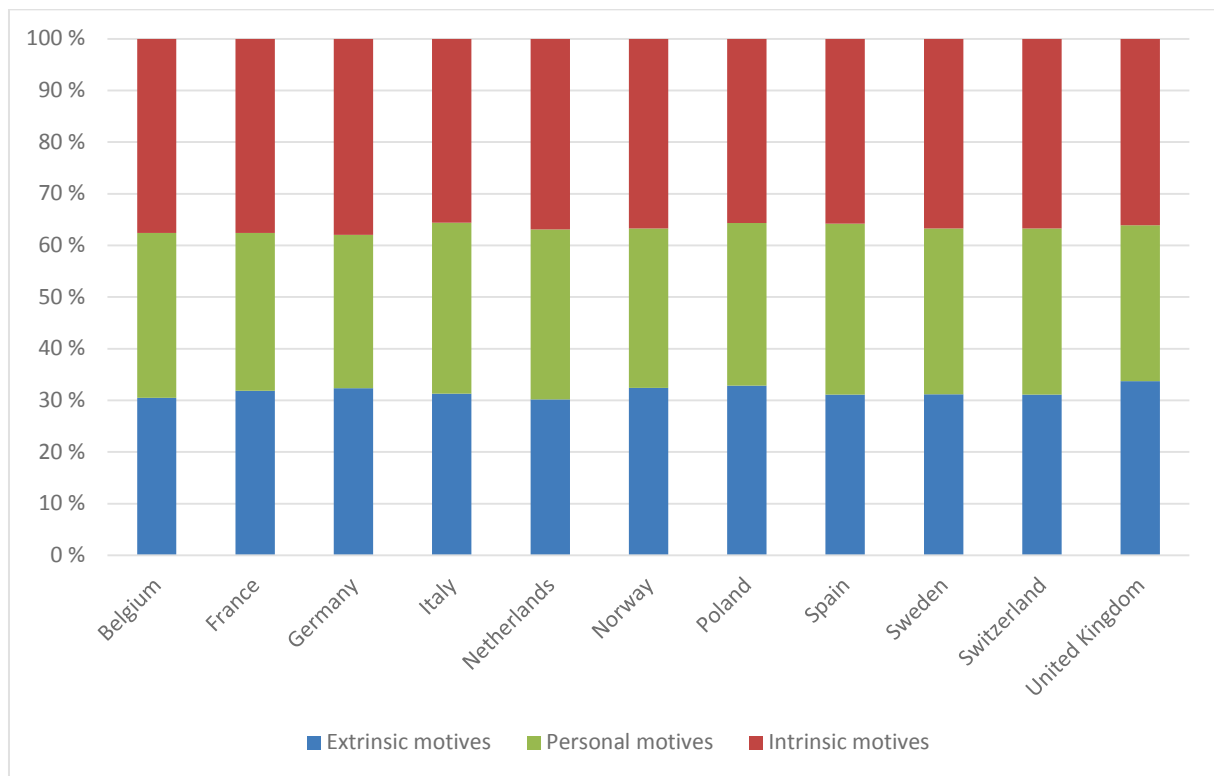
Importance of extrinsic, personal and intrinsic motives among R2-3-4 researchers in the barometer countries for international mobility for periods of 3 months or more in the post-PhD career, by panel country. ²⁷ Percent.



Source: MORE2 Higher Education Survey (2012)

²⁷ On a 0 - 1 scale with equal weights for all aspects: if important for every aspect then aggregate score = 1, if Not important for every aspect then aggregate score = 0.

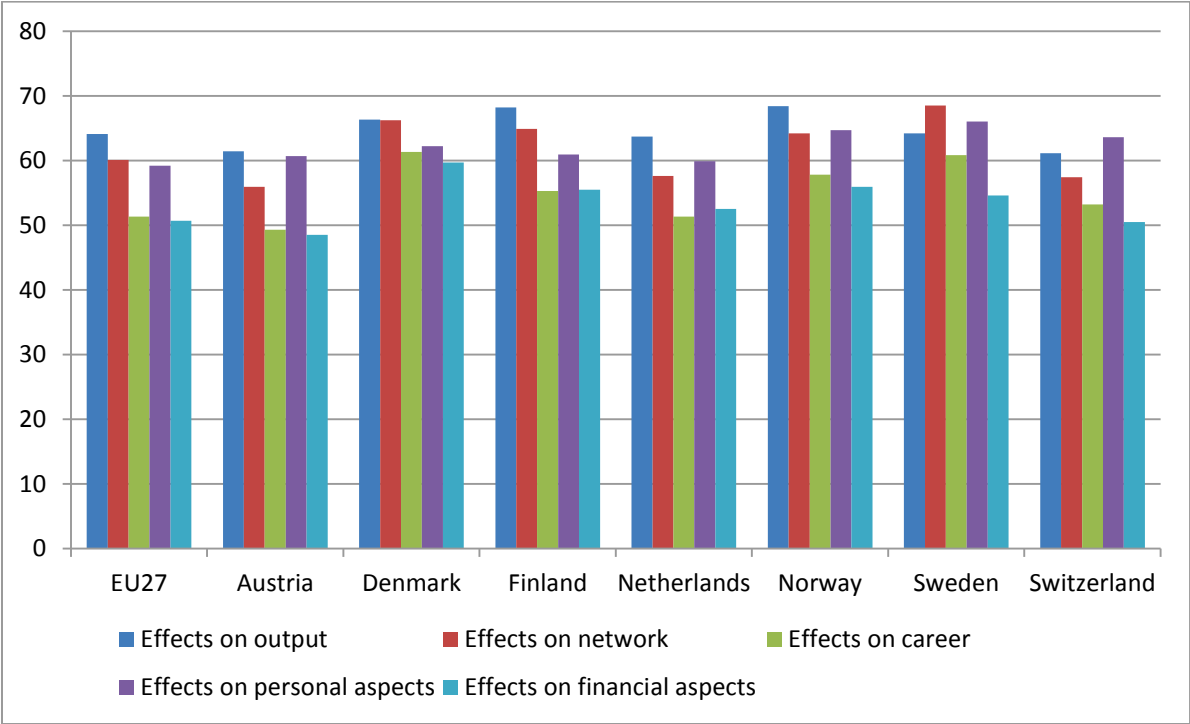
Figure More 2: Effects ²⁸ of different motivations on propensity for international mobility



Source: MORE2 Higher Education Survey (2012)

²⁸ Output effects are effects on: advanced research skills, quality of output, number of patents, citation impact of publications, number of co-authored publications. Network effects are effects on: international networks, recognition in the research community, national networks. Career-related effects are effects on: overall career progression, job options in academia, job options outside academia. Personal effects are effects on: quality of life. Financial effects are effects on: ability to obtain national research funding, ability to obtain international research funding, progression in salary and financial conditions.

Figure: Effects on different aspects of the working conditions of a researcher due to the mobility experience, indicated by R2-3-4 mobile researchers (by panel country), per barometer country.²⁹



Source: MORE2 Higher Education Survey (2012)

²⁹ On a 0-1 scale with -1=strongly decreased; -0.5=decreased; 0=unchanged; +0.5=increased; +1=strongly increased; all aspects have equal weights.

Annex 5: NIFU work research mobility

Data-resources used to approach researcher-mobility

Researcher Mobility: Overview of data resources:

- I. Registry (administrative) data:
Employment Data (source Statistics Norway)³⁰
The Researcher-Personnel Register (source NIFU)
R&D Data for the academic and research-institute sectors (source NIFU)³¹.
- II. Survey data:
More I (possibility to supplement with MORE II results will be investigated).
SIM ReC data, with extension to Norway.
- III. Supplemental data and links:
CV data as collected for the Nordic Crossing project.
NIFU Doctorate Registry <http://www.nifu.no/en/research/doktorgrader/>

Mobility Projects

National work

Researcher Mobility and the Research Barometer, Ministry of Education & Research. Registry data.
KD Project: 2014

Terje Bruen Olsen and Dag W. Aksnes (2011). CDH-statistics for Norway. Report on the Norwegian collection of data on the Career of Doctoral Holders. NIFU STEP.

Nerdrum, Lars; Sarpebakken, Bo (2006): Mobility of foreign researchers in Norway. Science and Public Policy, Volume 33, Number 3, April 2006, pp. 217-229(13)

Lars Nerdrum, Inge Ramberg og Bo Sarpebakken (2003): Inngående forskermobilitet til Norge. Omfang og erfaringer. NIFU skriftserie nr. 10/2003, Oslo

Johan Hauknes and Anders Ekeland (2002) Mobility of researchers – policy, models and data”Kompetanse, mobilitet og verdiskapning” <http://survey.nifu.no/step/reports/Y2002/0402.pdf>

Bugge, M & A Ekeland 2002. The mobility from the research sector – The Norwegian case 1987 – 2000,. Step Report 03/2002. <http://survey.nifu.no/step/reports/Y2002/0302.pdf>

Bo Sarpebakken (1998): Mobilitet i det norske forskningssystemet i perioden 1989-1995. NIFU skriftserie 3/1998, Oslo

Hauknes, J 1994. “Modelling the mobility of researchers”, STEP-report, 9-94, <http://survey.nifu.no/step/reports/Y1994/0994.pdf>

Nordic projects

Nordic Crossing: Mobility of Researchers and Knowledge Transfer in the Nordic Region: Patterns, Framework Conditions, Incentives, and Trends. CVs and SIM-Rec Survey. . CVs and SIM-Rec Survey NordForsk 2012-2013

³⁰ http://www.ssb.no/a/publikasjoner/pdf/notat_201008/notat_201008.pdf

³¹ <http://www.nifu.no/en/statistics/databaser-og-registre/4897-2/?lang=en>

Lead partner of “Flows of human capital in the Nordic countries” (“Kompetansestrømmer i Norden”) for the Nordic Industrial Fund. <http://survey.nifu.no/step/reports/Y2002/0402.pdf>. Publications in STEP Report Series.

NORFA (2002) Nordic research training – international quality.

European projects, other

1. Risis 2014-2020
2. SIM_ReC: 2011-2012. Project leader: Specific contract for a study on international mobility and researchers’ career development (SIM-ReC), a ten-country comparison.
3. MORE 1: Work-package leader: Study on mobility patterns and career paths of EU researchers
 - a. MORE (2010a), Study on mobility patterns and career paths of EU researchers, REPORT 2: Second (final) update of IISER Indicators (deliverable 5), Report from the MORE project, Work package 2, EU Commission Report, April 2010.
 - b. MORE (2010b), Study on mobility patterns and career paths of EU researchers, TECHNICAL REPORT 2 – Part I: Mobility Survey of the Higher Education Sector, Report from the MORE project, Work package 3 & 4, EU Commission Report, April 2010.
 - c. MORE (2010c), Study on mobility patterns and career paths of EU researchers, TECHNICAL REPORT 2 – Part III: Mobility Survey of the non-university research institutes sector, Report from the MORE project, Work package 3 & 4, EU Commission Report, June 2010. MORE (2010d), Study on mobility patterns and career paths of EU researchers, FINAL REPORT (deliverable 7), Report from the MORE project, EU Commission Report, June 2010.
4. Rindicate: Contract DG-RTD-2005-M-02-01 Multiple Framework Service Contract for Expert Support with the Production and Analysis of R&D Policy Indicators
 - a. Rindicate (2008), Evidence on the main factors inhibiting mobility and career development of researchers, Contract DG-RTD-2005-M-02-01, Final Report, European Commission.
5. European network on human mobility – ENMOB led by STEP under the 5th Framework Programme (FP5): 2001-2004.
 - a. Ekeland, A. ENMOB - European Network on Human mobility: Final Report. <http://ec.europa.eu/research/social-sciences/pdf/finalreport/hpse-ct-2001-50002-final-report.pdf>

OECD and Eurostat

OECD work on National Innovation Systems in the so-called “Focus Group on Human Mobility” in 1997-1998:

OECD work on Mapping Careers and Mobility of Doctorate Holders (CDH) and KnowINNO.

Annex 4: Selected institution in the barometer countries

| Country | University/Institution name | Academic/research staff (HC) |
|------------------------|---|------------------------------|
| Austria* | University of Vienna | 3 267 |
| | University of Graz | 1 277 |
| | University of Innsbruck | 1 394 |
| | University of Salzburg | 909 |
| | Vienna University of Technology | 2 037 |
| Denmark | Københavns universitet | 3563 |
| | Danmarks tekniske universitet | 2298 |
| | Aarhus universitet | 1091 |
| | Syddansk universitet | 1081 |
| Finland | VTT | 2450 |
| | Helsingfors universitet | 3 807 |
| | Åbo Universitet (Turku) | 1 477 |
| | University of Oulu | 1 082 |
| | Aalto universitet | |
| The Netherlands | Netherlands Organisation for Applied Scientific Research (TNO) | 3 000 |
| | Stichting Katholieke Universiteit (Radboud University Nijmegen) | 1 519 |
| | Technische Universiteit Delft | 2 645 |
| | Universiteit Utrecht | 2 939 |
| | Technische Universiteit Eindhoven | 1 694 |
| | Universiteit van Amsterdam | 2 236 |
| | Stichting Dienst Landbouwkundig Onderzoek | |
| | Wageningen Universiteit | 1 314 |
| Sweden | Uppsala Universitet | 2 036 |
| | Lunds Universitet | 2 205 |
| | Göteborgs universitet | 2 256 |
| | Stockholms universitet | 1 878 |
| | Umeå universitet | 1 607 |
| | Linköpings universitet | 1 333 |
| | Karolinska institutet | 1 576 |
| | Kungliga tekniska högskolan | 1 242 |
| | Chalmers tekniska högskola | 853 |

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