

International mobility: Findings from a survey of researchers in the EU

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International mobility of researchers is increasingly constructed both as a science policy problem to be solved and as a goal to be pursued. Yet evidence on the experience of mobility and the factors associated with propensity to mobility remains patchy. We analyse comprehensive survey data on the mobility experience of university and non-university research institute researchers in the EU. Our results both confirm and challenge assertions about mobility made in the literature and in policy debates. We find that 57% of university respondents and 65% of institute respondents have experienced international mobility at least once in their research careers. We find that research visits are the most commonly experienced form of international mobility but that job migration (cross-country changes of employer) is also surprisingly common. International student mobility, and also industrial placement experience, seems to be a good predictor of subsequent mobility during the research career.

Keywords: international mobility; migration; research careers; internationalisation; universities; research institutes.

1 Introduction

The movement of researchers across national borders is a phenomenon of continued academic and policy interest. Science has long aspired to universalism and the notion of the wandering scholar predates the modern internationalised scientific enterprise (Musselin 2004; Kim 2009). However, the nature and purposes of mobility have changed over time as the sciences have professionalised. Mobility is more purposive and more directly motivated by research objectives rather than by more general considerations of ‘scholarship’ (Heffernan and Jöns 2013). Furthermore, in recent decades we have seen the international mobility of researchers actively constructed either as a problem to be resolved by policy

action, as in fears about ‘brain drains’ (Davenport 2004; Balmer et al. 2009; Godwin et al. 2009), or as an opportunity to make ‘brain gains’. Both of these views treat mobility as a zero-sum competition for limited scientific human resources, with the policy implication that talent must be fought over and lost brains repatriated through incentive schemes (Fahey and Kenway 2010; Cañibano and Woolley 2010).

Latterly, the focus has shifted to ‘brain circulation’ as a means of knowledge creation and diffusion and a policy goal to be pursued (Fahey and Kenway 2010; Ackers 2008). This is perhaps best exemplified by the policies of the European Commission to promote researcher mobility within the EU (Morano-Foadi 2005; Fernandez-Zubieta

and Guy 2010). The international mobility of researchers thus presents a complex and contested science policy phenomenon, much discussed in a variety of scholarly literatures and in policy debates but with surprisingly little consensus as regards definition, conceptualisation or impact (Ackers and Gill 2008).

The aim of this paper is to contribute to our understanding of the experience of the international mobility of researchers by analysing comprehensive survey data on researchers working in university and the non-university public or quasi-public research institutes across Europe (defined as the 27 members of the EU before the accession of Croatia (EU27)). We investigate their experience of both international mobility involving a move to a new employer in another country and of substantial international research visits not involving a change of employer. We explore whether a range of individual characteristics that are identified in the literature (such as gender, age and field of education) affect the probability of our respondents being internationally mobile. Thus, our aim is not only to estimate the ‘stock’ of researchers working in European research-performing organisations who have experienced international mobility during the course of their research careers, but also to strengthen our understanding of which factors influence propensity to mobility.

1.1 What do we already know about researcher mobility?

Researchers and scientists constitute a particular group of highly skilled workers who may be influenced by a range of different factors in their decision to become internationally mobile. OECD (2008) reports that the international mobility of highly skilled workers is increasing in scale and complexity as more economies participate in research and development (R&D) and innovation activity.¹ The international job mobility of researchers, that is, moving to another country to take up a new post—what Ackers (2013) calls ‘moves for positions’—must be considered as part of this wider phenomenon. In addition to international job mobility there is also the phenomenon of cross-border working in which a worker commutes from the country of residence to a place of work in another country. One further factor that sets scientists apart from most other highly skilled professionals is that they also have significant opportunities to work in another location without a change of employer—what Ackers calls moves ‘within positions’. These research visits range from very short (and perhaps repeated) stays to periods of a year or more.

1.2 Explaining mobility

The literature tends to make distinctions between ‘temporary’ and ‘permanent’ migration and/or between long and short stays. However, the former distinction is problematic

(at what point should we consider the migration of an individual to be ‘permanent?’) and the latter insufficiently granular. We suggest that the more useful distinctions are between mobility with and without a fixed duration in the mind of the individual, on the one hand, and between job migration and forms of mobility not involving a change of employer, on the other.

International job migration is not confined to researchers, and the movement of scientists from a position in one country to one in another should be seen as part of a broader phenomenon of the migration of highly skilled professionals. There is some debate about the extent to which academic labour markets have transcended national boundaries. For instance Musselin (2004) argues that language differences and differences in regulations, norms and practices from country to country mean that a true European academic labour market is not yet in place. Rather, there may be a two-tier system emerging with an international labour market open to elite scholars and promising young researchers, whilst national labour markets continue to operate as the norm.

Non-job mobility, in contrast, although not unique to academic or scientific professionals, is very much bound up with the practice of science. Such mobility may be driven by the need to access research collaborators, acquire new skills and techniques, gain access to materials or samples, or to specialised research equipment. It is often supported by research funders, through normal project grants or via special mobility or secondment initiatives such as the European Commission Marie Curie Programme (Ackers 2005a,b), or through institutional support such as the sabbatical policies of sending institutions (Heffernan and Jöns 2013) and the hosting schemes of receiving ones. Such mobility is clearly intended to be time-limited in the sense that a return to the place and country of employment is necessary at some point. However, such research visits need not be short stays. They can be of long duration or involve repeat visits, perhaps formalised through some kind of honorary or visiting position which will often carry symbolic value to both the institutions concerned and to the mobile scholar, whose prestige and social capital is enhanced in their research community and home institution (Ackers 2008). Expectations regarding the need for such mobility may vary from discipline to discipline and from national context to national context (Ackers 2005a).

In the broader literature on job mobility, decision models have been proposed which draw on insights from industrial and organisation psychology (Nicholson 1984; Nicholson and West 1989; Arthur et al. 1989). This stream of research links job mobility with career and personal development and emphasises three macro-dimensions of mobility: status, functions and the organisation/employer. In particular, this school of thought links job mobility to personal aspirations, supporting a narrative whereby mobility is the realisation of a search for

novelty, while personal development is mostly linked to desire for control, all embedded within one or more organisations providing feedback on the choice or performance of the (mobile) employee. Mobility is studied in a context of macro-level factors (such as general economic conditions, societal characteristics, public policy and legislation, general wage levels and industry differences, and staffing and organisation policies) and a personal dimension linked to characteristics including career perspectives, ambitions and preferences (Ng et al. 2007).

Much of the literature specifically dealing with the mobility of scientists or academics is also concerned with push and pull factors influencing mobility decisions (Thorn and Holm-Nielsen 2008). Mahroum (2000) suggests technicians and engineers may be particularly sensitive to labour market factors, with mobility tending to be towards places where their skills are needed and/or higher wages can be negotiated. Harvey (2011) finds that British scientists migrating to the USA tend to be motivated by job opportunities whilst migrants from India tend to migrate at an earlier stage, as students. However, economic and social/familial considerations were important in the case of scientists from both countries. Further, as already noted above, scientists and researchers may attribute a great deal of value to research-related considerations, not least as these are likely to be closely bound up with future career prospects. As a consequence, pull factors such as a reasonable salary structure, while important in explaining job mobility in general, may not explain the mobility of researchers. Factors such as research environment, professional reward structure, presence of competitive funding programmes and access to leading-edge research equipment may be more important in explaining researcher mobility, consistent with the structural and individual perspective outlined by Ng et al. (2007).

Thus, a wide range of scientific, personal family, career and other factors may interact to affect the attitude of highly skilled scientists and engineers towards mobility. Kannankutty and Burrelli (2007) found that the primary reasons that immigrant scientists and engineers gave for moving to the USA were family-related, followed by educational opportunities, and job or economic opportunities. Ackers and Gill (2008: 232), looking at the movement of university scientists between two 'sending' countries (Poland and Bulgaria) and two 'receiving' countries (the UK and Germany), emphasise:

... the impact that personal and family relationships and obligations have on migration behaviour. Personal relationships both generate resistance to the 'pull' of economic considerations or, in other contexts, lubricate mobility.

It is likely that personal relationships and family or caring commitments and other work/life balance issues will affect decisions about mobility and these factors may be experienced differently by males and females (Ackers and

Gill 2008; Jöns 2011). Finally, it may be that mobility at an earlier stage of the life course of the researcher may be associated with greater likelihood of mobility as a researcher. Findlay et al. (2012), exploring the mobility of students between the UK, Ireland, Australia and the USA, found that UK students enrolled in foreign universities often had prior life experience of living abroad and that those students often saw student mobility as contributing to a longer term goal of an international career following graduation. Similarly, Harvey (2011) found that Indian scientists who migrated to the USA as students often made the decision to seek a US education in the context of longer term career plans.

1.3 Measuring mobility

Gathering data on the population of researchers, a small subgroup of the larger group of highly skilled workers, is difficult, not least because 'researcher' is not a standard occupational category for statistical purposes. In the light of this, quantitative studies of mobility have tended either to focus on the population of doctorate holders or doctoral candidates² (Davis and Moore Patterson 2000; Grimes et al. 2004; Auriol 2007; Integrated Information System on European Researchers 2007; Finn 2012), or have used the analysis of researcher CVs or similar data sources (e.g. the special issue of *Research Evaluation* edited by Cañibano and Bozeman 2009). There are relatively few large-scale surveys, important recent exceptions being the work presented in this paper and the recent work by Franzoni et al. (2012, 2014).

Sandstrom (2009) analyses curriculum vitae to suggest that mobile researchers are, on average, better performers in their research fields than non-mobile researchers. Van Heeringen and Dijkwel (1986) and Yano and Tomita (2006) argue that mobility is a characteristic of excellent researchers (rather than mobility effecting productivity) and that the performance of researchers is positively linked with achieving a position in 'better' universities. However, Franzoni et al. (2014) find evidence that migrant scientists outperform non-migrant scientists in terms of publication impact, even after controlling for selection effects. Nonetheless, it seems clear that the productivity of mobile researchers may be conditioned as much by the environment in which they work as by personal characteristics (Gibson and McKenzie 2014). More broadly, the idea that excellence and mobility go hand-in-hand ignores the fact that much mobility may be forced by poor prospects or conditions in the home country (Ackers 2008).

Bekhradnia and Sastry (2005) explored the volume and pattern of academic mobility between the UK and the rest of the world. Their main finding is that the vast majority of movement takes place among junior post-doctoral staff, and that the majority of the senior academics spent time

abroad in post-doctoral positions—this is associated with early career development.

The study by the [Integrated Information System on European Researchers \(2007\)](#) used doctorate holder and doctoral candidate data to examine the circulation of researchers within Europe and ‘flows’ of researchers into and out of Europe. Fresh data was collected to update the indicators used by the Integrated Information System on European Researchers in 2010 ([MORE 2010a](#)). This showed that: first, 7% of the doctoral candidates in the EU27 in 2007 held the citizenship of another member state. Second, the EU member states Germany, Italy, France, Romania, Spain, the UK, Greece and Bulgaria were among the top-30 countries of origin for holders of doctorates awarded in the USA in 2008. Third, in 2007 China was the most important sender of doctoral candidates to the EU27 with around 6,500 doctoral candidates, whilst Mexico and the USA followed with 4,000 and 3,600 doctoral candidates, respectively.

The [Rindicate study \(2008\)](#) was primarily concerned with factors inhibiting transnational/cross-border mobility of academic researchers, particularly in science, technology, engineering and mathematics departments in universities and research institutes across Europe, and asked about future intentions as well as past experiences of mobility. An interesting finding was that respondents considering international mobility in the future expressed greater concern about the potential lack of recognition of, and lesser opportunities for, further career progression.³ Not surprisingly, funding support for mobility was of great importance for those who were considering future mobility, but was also seen as a significant potential obstacle by those researchers who were not currently considering future mobility.

Franzoni et al. ([2012a,b](#)) have surveyed corresponding authors from 16 ‘core’ countries of articles published in biology, chemistry, materials and earth and environmental sciences during 2009 to explore their national origin. They found that, for immigrant researchers, research/research career related factors were most important as pull factors to a new country, whilst personal or family factors seemed to be the most important factors influencing a decision to return home.

Differences between disciplines, institutions and national contexts may lead to different observed mobility patterns. For instance, [Jöns \(2007\)](#) argues that the degree of abstraction from place-specific realities inherent in the research work of different disciplines, the standardisation of the practices involved and their materiality (e.g. in terms of equipment intensity) all imply different spatial relations, thus affecting the degree to which research is place-specific or conducted in a variety of locations. This approach has been further elaborated by [Ackers \(2013\)](#), who describes a continuum from more contextualised disciplines, such as anthropology or history, to highly standardised disciplines such as mathematics.

2 Approach

2.1 Operationalising mobility

As the brief review above illustrates, the literature shows a variety of approaches towards attempts to measure and explore the international mobility of researchers. Although a number of studies have attempted to estimate the extent of researcher mobility, as well as exploring the drivers and factors that might influence mobility, these studies have been limited in scope. The MORE surveys, from which our data comes, aimed to fill this gap.⁴ The MORE project generated new information on international and intersectoral (science–industry) researcher mobility and career development in Europe, by collecting data, developing indicators and carrying out analysis.⁵ In particular, the data used in the present paper comes from two surveys, of researchers in the higher education (university) sector and of researchers in the non-university public or quasi-public research sector across the EU27. This study is documented in detail in two technical reports ([MORE 2010b,c](#)).

The focus on researcher mobility necessitates an operationalisable definition of ‘researcher’. Researcher is not an official employment category, and whilst data on people holding advanced qualifications such as doctorates is available, not all researchers hold doctorates (nor are all doctorate holders researchers). The *Frascati Manual* ([OECD 2002](#)) defines researchers as:

... professionals engaged in the conception or creation of new knowledge, products, methods and systems and also in the management of the projects concerned.

We operationalised this by requiring survey respondents to confirm their involvement in one or more of these activities.

As noted earlier, researchers demonstrate not only the international job mobility (migration) seen in other highly skilled professions, but also non-job international mobility associated with the conduct of research. This phenomenon is often driven by the need to work with research collaborators, acquire new skills and techniques, gain access to materials or samples, or to specialised research equipment. Our survey considered both job mobility/migration and substantial (of three months duration or more) international ‘research visits’ not involving a change of job.

Because doctoral researchers are paid employees in some countries and because the Frascati definition classes doctoral students as ‘researchers’, we defined the ‘research career’ to begin at the start of the period of doctoral research or, if not applicable, first employment as a researcher. We required respondents to identify whether they had experienced either job mobility/migration or research visits during the course of their research career. A major difficulty in measuring stocks and flows of mobile researchers is establishing a point of origin: what is a respondent’s home country? Respondents may hold multiple nationalities or may have been born in a different

country from that in which they hold citizenship. To determine a meaningful point of origin in keeping with our approach to defining the research career, we opted to set as the home country the country in which the respondent obtained their highest educational qualification. With this approach a UK citizen graduating with a PhD in the USA would be considered internationally mobile not only if they moved to a third country after graduation, but also if they had moved to the UK. This choice of reference point necessarily represents a compromise between different possible visions of national identity and belonging for highly skilled, highly mobile knowledge workers.

In this paper we will consider data from both the survey of the higher education sector and of the non-university research institutes sector. In the remainder of this section we describe the implementation of each mobility survey. Section 3 presents key characteristics of the respondents from each survey, with a focus on their international mobility patterns, while the effects of these characteristics on the mobility patterns are examined in Section 4. Section 5 gives our conclusions.

2.2 Surveys

For the higher education sector the sample of researchers was developed in three steps. The sampling method used for the survey of the higher education sector was a two-stage stratified cluster sampling with a specific number of stratification variables. For the first step, a database was created containing the universities that are members of the European Universities Association in all EU27 countries. This list of universities was enriched with information on higher education institutions (HEIs) found in a variety of sources, including the national HEI associations, websites of national ministries of education and national statistical offices. In a second step the websites of all HEIs identified were searched in order to identify constituent faculties/departments. We identified a total of 22,648 units for the 27 member states, constituting the basis for cluster sampling. In the third step, a sample of 1,660 HEIs units (clusters) as the cluster sample was selected from the list of HEIs created in the second step by using simple random sampling. From these selected clusters, all researchers were then counted and identified based on the information available on the websites. The following information about the researchers was gathered: name of researcher, email address of researcher, telephone number of researcher, and title/position. In total, 47,097 names and email addresses were collected. The list of email addresses was checked by a software tool, and bad or inactive email addresses were removed, resulting in a final list of 41,857 addresses. The survey of the higher education sector was launched on 26 June 2009 and closed on 1 October 2009. After a quality check, cleaning of bad entries and duplicate submissions, 4,538 completed and valid responses remained. Respondents older than 70 years were excluded

from the sample. The response rate for the total sample of EU27 researchers was 11%.

The sample of researchers in the non-university research institutes sector was also developed in three steps. In the first step, a list of research institutes was developed.⁶ The primary source was the EC-funded RPO database⁷ compiled by IDEA Consult. We selected this dataset for its EU27 coverage and because it was systematically compiled and exhaustively validated.⁸ Other sources of data were used to help flesh out the RPO list. The selection principle was a pragmatic definition of institutes at the ‘academic’ or ‘quasi-academic’ end of the research continuum of non-university institutes which could reasonably be considered to be ‘national’ in role and ambition. In the second step, the websites of all organisations were searched to identify the constituent departments. This process identified 1,377 units for the EU27 as a whole. Finally, in the third step, the web pages for these units were screened to identify the researchers working within them. The following information was gathered: name of researcher, email address of researcher, and title/position. In total, 50,151 names and the respective emails were collected. The list of email addresses was checked, and non-valid or inactive addresses were removed, resulting in a final list of 48,359 email addresses. The mobility survey of the non-university research institutes sector was launched on 4 March 2010 and closed on 29 March 2010. After a quality check and cleaning, 5,103 completed and valid responses remained. The response rate for the total sample of researchers was 11%. As with the higher education sector survey, respondents older than 70 years were excluded from the sample. In the analysis we therefore use a sample of 5,050 researchers for the non-university research institutes sector.

3 Key characteristics of the respondents and descriptive statistics

3.1 Experience of international mobility

International mobility proves to be a fact of life for many researchers working in EU27 research-performing institutions.⁹ We found that 61% of our respondents have experienced international mobility at least once in the course of their research career (i.e. they have worked, including research visits of three months duration or longer, in a country other than the country where they attained their highest educational degree). Of those researchers, more than half have experienced international mobility during the past three years. Experience of mobility is somewhat more common in the non-university sector, although the experience of non-job international mobility (research visits of three months or more) is greater in the higher education sector (see [Table 1](#)).

Our respondents overwhelmingly viewed the career impacts of international mobility in a positive light,

Table 1. Mobility experience of respondents by sector

	Higher education sector	Non-university research institutes sector	Combined
Number of respondents	4,538	5,050	9,588
Number of internationally mobile researchers	2,586	3,284	5,870
Number of internationally non-mobile researchers	1,952	1,765	3,717
Number of researchers with unknown mobility status	0	1	1

regardless of whether or not they have experienced mobility. As can be seen from Table 2, almost three-quarters of the previously mobile respondents declared that they had experienced positive or significantly positive career impacts, while the same proportion of respondents without previous experience of mobility felt that being internationally mobile in the future would have positive or significantly positive impacts upon their career. Interestingly, researchers without experience of mobility are even more likely to feel that significantly positive impacts would accrue from mobility than those who had previously been mobile and this finding is statistically significant at the 1% level.

3.2 Gender, age, marital status and children

The share of male respondents is about the same in the two sectors: 63% in the higher education sector and 61% in the non-university research institutes sector. Experience of international mobility during the research career is greater for male respondents than for female respondents (see Table 3). The proportion of males and females who have experienced international mobility in the last three years is broadly similar, but even for this kind of international mobility we find that the proportion of males is significantly higher than the proportion of females (at the 5% level).

Respondents are somewhat younger in the non-university research institutes sector (42 years on average) than in the higher education sector (45 years on average), a difference that is statistically significant.¹⁰ The share of respondents in the age range 25–34 years is much higher in the non-university research institutes sector (31%) than in the higher education sector (21%), and the shares of respondents in the age groups 45–54 years and 55–64 years are relatively lower in the non-university research institutes sector, differences which again are statistically significant.¹¹ Not surprisingly, across both sectors, older researchers are more likely to have previously experienced international mobility, although the proportion that have

Table 2. Perception of career impacts of mobility (combined for both sectors)

Mobility has had/would have...	% with previous experience of mobility	% without experience of mobility
...significant negative impacts on my career progression***	1%	2%
...negative impacts on my career progression	3%	3%
...no impact on my career progression	22%	22%
...positive impacts on my career progression***	50%	47%
...significant positive impacts on my career progression***	24%	27%
...positive or significant positive impacts to my career progression	74%	73%

We test whether difference between proportions in each row is statistically significant. Method is based on two-proportion z-test.

***significant at 1% level.

experienced international mobility in the last three years is similar for almost all age groups (see Table 4).

The share of co-habiting or married respondents is somewhat greater in the higher education sector (75%) than in the non-university institutes sector (70%). Of the respondents from the higher education sector, 62% have children, whilst only 55% of those in the institutes sector have children.¹² Table 5 shows that, across both sectors, single respondents are more likely to have experienced mobility in the last three years than married or co-habiting respondents (40% versus 30%). Similarly, respondents without children are more likely to have been mobile in the last three years than those who do have children (41% versus 26%).

3.3 Education and training

Table 6 shows that 80% of the respondents across the two sectors hold a doctoral degree or equivalent as their highest educational attainment, whilst 19% hold a master degree or equivalent as their highest qualification. The share of respondents with a doctorate or equivalent is higher in the higher education sector (84%) than in the non-university research institutes sector (76%). Almost a quarter of respondents have been ‘exchange students’ at some point during their post-secondary education, whilst a similar proportion has spent time in industry on a formal placement, internship, apprenticeship or similar.

Table 7, for both sectors, shows some disciplinary differences in experience of mobility, with respondents with their highest educational attainment in the natural sciences or the humanities having the highest incidence of mobility followed by agricultural sciences, medical and health

Table 3. Experience of mobility by gender (combined for both sectors)

Gender	Experienced mobility during career	Recent experience of mobility (last 3 years)	No experience of mobility during career	% of total having experienced mobility during career***	% of total having recent experience of mobility (3 years)**
Male	3,814	1,976	2,125	64%	33%
Female	2,056	1,143	1,592	56%	31%
Total	5,870	3,119	3,717	61%	33%

We test whether difference between proportions in each row is statistically significant. Method is based on two-proportion z-test.

***significant at 1% level, **significant at 5% level.

Table 4. Experience of mobility by age group (combined for both sectors)

Age group	Experienced mobility during career	Recent experience of mobility (last 3 years)	No experience of mobility during career	% of total with previous experience of mobility	% of total having recent experience of mobility (3 years)
Less than 25 years	15	15	30	33%	33%
Aged 25–34 years	1,344	1,106	1,170	53%***	44%
Aged 35–44 years	1,847	945	1,018	64%***	33%***
Aged 45–54 years	1,472	563	870	63%	24%***
Aged 55–64 years	953	395	547	64%	26%
Aged 65–70 years	239	95	82	74%***	30%
Total	5,870	3,119	3,717	61%	33%

We test whether difference between proportions in each row is statistically significant. Method is based on two-proportion z-test.

***significant at 1% level.

Table 5. Experience of mobility by marital and family status (combined for both sectors)

Marital and family status	Experienced mobility during career	Recent experience of mobility (last 3 years)	No experience of mobility during career	% of total having experienced mobility during career	% of total having recent experience of mobility (3 years)
Married or co-habiting	4,290	2,078	2,654	62% **	30%***
Single	1,346	907	924	59%	40%
Prefer not to disclose and missing values	234	134	139	63%	36%
Have children	3,426	1,470	2,143	62%	26%***
No children	2,444	1,649	1,574	61%	41%
Total	5,870	3,119	3,717	61%	33%

We test whether difference between proportions in each row is statistically significant. Method is based on two-proportion z-test.

***significant at 1% level, **significant at 5% level.

sciences, social sciences, and engineering and technology. The pattern is broadly similar for recent mobility, except that respondents with a humanities background are more likely to have experienced mobility in the last three years than researchers with backgrounds in other disciplines. The difference seen between the humanities and the natural sciences for recent mobility is only statistically

significant at the 10% level whilst the difference between the humanities and the other disciplines is statistically significant at the 1% level.¹³ This, and the lack of granularity regarding disciplinary background in our data, make it difficult to use these results either to support or refute the conceptualisation of disciplinary differences in modes of mobility of Jöns (2007) and Ackers (2013).¹⁴

Table 6. Educational history of respondents by sector

	Higher education sector	Non-university research institutes sector	Both sectors combined
Highest educational attainment (per cent)			
Postgraduate degree (PhD or equivalent)***	84	76	80
Graduate degree (masters degree or equivalent)***	15	22	19
Undergraduate degree (bachelor degree or equivalent) or secondary education***	1	2	1
Total	100	100	100
Share of respondents who have been 'exchange students'	23	23	23
Share of respondents who have spent time in industry as a student***	28	24	26

We test whether difference between proportions for the two sectors in each row is statistically significant. Method is based on two-proportion z-test.

***significant at 1% level.

Table 7. Experience of mobility by field of highest educational attainment (combined for both sectors)

Field of highest educational attainment	Experienced mobility during career	Recent experience of mobility (last 3 years)	No experience of mobility during career	% of total with previous experience of mobility	% of total having recent experience of mobility (3 years)
Natural sciences	3,062	1,572	1,355	69%	36%
Engineering and technology	725	379	694	51%	27%
Medical and health sciences	318	152	271	54%	26%
Agricultural sciences	259	113	188	58%	25%
Social sciences	888	518	832	52%	30%
Humanities	618	385	377	62%	39%
Total	5,870	3,119	3,717	61%	33%

Table 8. Experience of mobility during research career by previous experience of mobility as an exchange student (combined for both sectors)¹⁴

Experience of mobility as an exchange student	Experienced mobility during career	Recent experience of mobility (last 3 years)	No experience of mobility during career	% of total with previous experience of mobility***	% of total having recent experience of mobility (3 years)***
Yes***	1,668	1,007	526	76%	46%
No***	4,198	2,109	3,175	57%	29%
Total	5,870	3,119	3,717	61%	33%

We test whether difference between proportions is statistically significant. Method is based on two-proportion z-test.

***significant at 1% level.

Finally, [Table 8](#) shows that, across the two sectors, 76% of respondents who have experienced mobility as an exchange student have subsequently experienced mobility during their career as a researcher, with 46% having experienced mobility during the past three years. The differences in proportions are statistically significant at the 1% level. This is an interesting finding and in line with the suggestion from [Findlay et al. \(2012\)](#) that student

mobility and mobility during the later career are often closely connected.

3.4 Career status

From [Table 9](#) we see that about half of our respondents across the two sectors hold an open-ended (tenure-type) contract, with most of the rest holding a fixed-term

Table 9. Contractual status of respondents by sector

	Higher education sector	Non-university research institutes sector	Both sectors combined
Employment contract status (%)			
Fixed-term contract, less than 1 year	4	4	4
Fixed-term contract, 1–2 years***	8	14	11
Fixed-term contract, more than 2 years	23	24	24
Open ended (tenure) contract***	57	47	52
Self-employed service provider	1	0	0
Other***	8	10	9
Total	100	100	100
Share of total having a part-time contract***	8	6	7

We test whether difference between proportions in each row is statistically significant. Method is based on two-proportion z-test.

***significant at 1% level.

contract ranging from a few months to over two years in duration. A small proportion of our respondents in either sector hold a part-time contract.

We find that 13% of the respondents in the higher education sector are doctoral students and 34% are post-doctoral researchers. Among the respondents in the non-university sector, the share of doctoral students is 16%, and the share of post-doctoral researchers is 31%. We found that 53% of the respondents in each sector placed themselves in the ‘other researcher’ category. The differences in the proportions of doctoral students and post-doctoral researchers between the two sectors are statistically significant at the 1% level, while the proportions of respondents in the ‘other researcher’ category between the two sectors are not statistically significant.¹⁵ Across both sectors 41% of doctoral students have previously experienced international mobility, whilst 63% of post-doctoral researchers and 65% of other researchers have previously been mobile (see Table 10).

4. Effects of the key characteristics on the international mobility patterns

Table 11 presents the estimation results of the effects of the key characteristics on the international mobility patterns. The results are based on binary logistic regressions. Three variables are used as the mobility patterns (i.e. as the dependent variables) in the table: first, whether or not a respondent has been internationally mobile (i.e. whether he/she has worked in or made a research visit of three months

or more in a country other than the country where he/she attained his/her highest educational qualification). Second, whether a respondent among internationally mobile researchers has experienced at least one research visit to another country during the course of his/her researcher career. Third, whether a respondent among internationally mobile researchers has experienced at least one move to a new employer in another country during the course of his/her researcher career. And finally, whether the respondent experienced mobility (either kind) during the last three years.¹⁶ We use as reference categories the following profile: male; single; no children; postgraduate degree (PhD or equivalent); not been ‘exchange student’; not worked in industry; highest attainment in natural sciences; where country of principal employer and residence is the same (i.e. not a cross-border worker); employed for more than 10 years by current (principal) employer; having an open-ended (tenure) employment contract; having worked more than 10 years under his or her contract status; in the ‘other researcher’ role category; and employed in the higher education sector.

4.1 Effects of gender, age, marital status and children

Table 11 shows that female respondents are less likely to have experienced international mobility at some point in their research career than male respondents. Female respondents also have a lower probability of having moved to a new employer in another country compared with male respondents among all those who have been internationally mobile in the past, but are no less likely than males to have experienced a research visit. However, we find no significant difference between the likelihood of female and male researchers having experienced international mobility in the last three years. This finding points towards the possibility that the gender gap with respect to job mobility may be closing, though previous studies, including those of Jöns (2011) and Ackers and Gill (2008), suggest that different lengths of stay may be attractive or feasible for those with family or caring responsibilities and that this is very likely to have a gendered dimension. Having said that, however, having children proves not to be a statistically significant predictor of whether or not our respondents are likely to have previously been mobile.

Not surprisingly, the likelihood of having been internationally mobile in the past increases with age, and this key characteristic also has a positive effect on both the probability of having experienced a research visit to another country and the probability of having moved to a new employer in another country for those who have been internationally mobile in the past. More interestingly, increasing age has a negative effect on the likelihood of having experienced mobility in the last three years. This suggests that opportunities for and/or propensity to be mobile are greater in the earlier part of the research career and life course. We find no significant effect of

Table 10. Experience of mobility by career status (combined for both sectors)

Current status as a researcher	Experienced mobility during career	Recent experience of mobility (last 3 years)	No experience of mobility during career	% of total with previous experience of mobility	% of total having recent experience of mobility (3 years)
Doctoral/PhD student	574	468	813	41%	34%
Post-doctoral researcher	1,954	1,218	1,143	63%	39%
Other researcher category	3,342	1,433	1,761	65%	28%
Total	5,870	3,119	3,717	61%	33%

Proportions are all significantly different from each other at 1% level, except for proportions of post-doctoral researchers and those in 'other researcher' category in column '% of total with previous experience of mobility' which are significantly different from each other at 5% level. Method is based on two-proportion z-test.

marital status on experience of international mobility but respondents with children have a relatively lower likelihood of having been internationally mobile in the past and in the last three years. However, as noted above, neither research visits nor cross-country changes of employer are significantly affected by having children.

4.2 Effects of education and training

The highest educational attainment of respondents has a significant effect on international mobility experience.¹⁷ We see that respondents with a master degree or equivalent, or an undergraduate degree, as their highest educational attainment are less likely to have been internationally mobile at some point in their career than respondents with a doctorate or equivalent. Among those who have been internationally mobile in the past we also find that respondents with an undergraduate degree as their highest qualification have a lower probability of having experienced a research visit to another country, while respondents with a master degree or equivalent have a lower probability of having moved to a new employer in another country, as compared with respondents with a doctorate or equivalent.

Interestingly, experience of international mobility as a student and experience of an industrial placement or apprenticeship as a student both increase the probability of a respondent having experience of international mobility during the course of their research career—but only industrial placement experience increases the probability of a respondent having been mobile in the last three years. International mobility as a student increases the probability of having experienced a research visit to another country at some point during the career, while student industrial apprenticeship increases the likelihood of having moved to a new employer in another country at some point, but not vice versa.

Field or discipline has a significant effect on international mobility patterns. Respondents who received their highest educational attainment in the broad domain of the natural sciences are more likely to have been

internationally mobile at some point during their career than those with their highest qualifications in other domains. Though the granularity of our disciplinary categories makes it difficult to draw firm conclusions, this seems to be in line with the suggestions of Jöns (2007) and Ackers (2013) that natural science disciplines are more abstract and less context dependent than many humanities disciplines. However, interestingly, we find that those with social sciences and those with humanities qualifications are more likely to have been mobile in the last three years, suggesting that these fields have become more internationalised in recent years. Among those who have been internationally mobile during the course of their research career we find that respondents qualified in the natural sciences are more likely to have experienced international job mobility, although those qualified in the other domains are more likely to have experienced non-job mobility in the form of a research visit.

4.3 Effects of researcher status/role

Table 11 shows that international mobility experience is significantly affected by the respondent's current status/role. Not surprisingly, respondents who are doctoral students or post-doctoral researchers are less likely to have been internationally mobile in the past compared with those who placed themselves in the 'other researcher' category, and if they have been mobile are most likely to have been mobile in the last three years. Among those respondents who have been internationally mobile in the past we find that doctoral students and post-doctoral researchers are relatively less likely to have moved to a new employer in another country, while doctoral students are relatively more likely to have experienced a research visit to another country. In the group of respondents who have previously been internationally mobile, there are no significant differences between post-doctoral researchers and those in the 'other researcher' category with respect to the likelihood of having previously engaged in an international research visit.

Table 11. Binary logistic regressions

	International mobile researcher			Research visit			New employer			Internationally mobile - last three years		
	Coeff.	Sig.	St.err.	Coeff.	Sig.	St.err.	Coeff.	Sig.	St.err.	Coeff.	Sig.	St.err.
Constant	-0.584	***	0.192	1.327	***	0.281	-0.569	**	0.239	0.775	***	0.240
Female	-0.330	***	0.048	0.057		0.069	-0.196	***	0.061	-0.120	*	0.063
Age	0.031	***	0.003	0.010	**	0.005	0.010	**	0.004	-0.021	***	0.004
Marital status												
Married or co-habiting	-0.019		0.064	0.043		0.089	0.063		0.080	-0.135		0.085
Prefer not to disclose	0.178		0.134	-0.082		0.178	0.040		0.160	-0.055		0.165
Having children	-0.274	***	0.061	-0.132		0.085	-0.023		0.074	-0.380	***	0.074
Highest educational attainment		***			**			***				
Graduate degree (master degree or equivalent)	-1.274	***	0.077	-0.226		0.147	-0.695	***	0.126	-0.147		0.129
Undergraduate degree (bachelor degree or equivalent)	-1.833	***	0.232	-1.040	**	0.407	0.482		0.414	-0.833	*	0.474
Been 'exchange student'	1.111	***	0.061	0.241	***	0.074	-0.005		0.065	0.120	*	0.067
In industry as student	0.116	**	0.054	-0.052		0.076	0.134	**	0.067	0.156	**	0.070
Field of education		***			***			***			***	
Engineering and technology	-0.663	***	0.070	0.058		0.101	-0.500	***	0.091	0.052		0.094
Medical and health sciences	-0.533	***	0.098	-0.038		0.141	-0.318	**	0.127	-0.103		0.134
Agricultural sciences	-0.375	***	0.110	0.842	***	0.201	-1.005	***	0.144	-0.180		0.144
Social sciences	-0.701	***	0.067	0.742	***	0.109	-0.919	***	0.088	0.278	***	0.091
Humanities	-0.445	***	0.082	0.554	***	0.124	-0.815	***	0.101	0.618	***	0.103
Current status as a researcher		***			**			***			***	
Doctoral/PhD student	-0.297	***	0.091	0.448	***	0.167	-0.582	***	0.141	1.108	***	0.153
Post-doctoral researcher	-0.297	***	0.056	0.122		0.080	-0.308	***	0.069	0.297	***	0.068
Country of principal employer and residence not same	1.235	***	0.180	-0.212		0.156	0.405	***	0.157	1.005	***	0.184
How long have you been employed by your current (principal) employer?		***			***			***			***	
2 years or under	0.422	***	0.105	-1.178	***	0.146	1.610	***	0.130	1.099	***	0.131
3-6 years	0.213	**	0.094	-0.779	***	0.136	0.958	***	0.114	-0.181		0.114
7-10 years	-0.006		0.091	-0.403	***	0.140	0.496	***	0.111	-0.048		0.111
Employment contract status		**						**			***	
Fixed-term contract, less than 1 year	-0.189		0.125	0.237		0.188	-0.255		0.172	0.265		0.188
Fixed-term contract, 1-2 years	0.052		0.087	-0.183		0.113	0.141		0.112	0.317	***	0.119
Fixed-term contract, more than 2 years	0.103		0.063	0.009		0.088	-0.003		0.077	0.311	***	0.078
Self-employed service provider	-0.557	*	0.324	-0.032		0.548	-0.472		0.500	-0.675		0.536
Other	0.173	**	0.086	0.112		0.123	-0.240	**	0.102	0.029		0.104
How long have you been working under your employment contract status?		**						***				
2 years or under	0.259	**	0.101	-0.223		0.150	0.250	**	0.124	0.039		0.125
3-6 years	0.294	***	0.094	-0.272	*	0.142	0.380	***	0.114	-0.132		0.114
7-10 years	0.228	**	0.094	-0.090		0.150	0.283	**	0.115	-0.095		0.116
Employment contract which involves part-time work	-0.398	***	0.091	-0.044		0.143	0.030		0.129	-0.253	*	0.138
Employed in non-university research institutes sector	0.301	***	0.050	-0.181	**	0.071	0.109	*	0.061	0.040		0.063
Nagelkerke R Square		0.200				0.123			0.174			0.239
Cox and Snell R Square		0.147				0.082			0.130			0.179
-2 Log likelihood		11238.637				5955.990			7273.737			6950.536
Number of respondents		9,564				5,865			5,865			5,865

*** significant at 1% level, ** significant at 5% level, *significant at 10% level

Interestingly, we find that respondents currently engaged in cross-border working are also more likely to have been internationally mobile in the past than those who are currently working for an employer located in their current country of residence. Among researchers

who have been internationally mobile in the past, we also find that those engaged in cross-border working have a higher probability of moving to a new employer in another country compared with those having a principal employer located in their country of residence, but we find

no significant differences between these groups with respect to the probability of experiencing a research visit to another country.

International mobility patterns are significantly affected by the length of time that a respondent has been employed by his/her principal employer. It is logical that long-serving employees are likely to have changed jobs less frequently, and those with more than 10 years with the current employer are more likely to have experienced a research visit than to have moved to a job in another country (and vice versa).

In terms of contract status, researchers with fixed-term contracts are more likely to have experienced mobility recently than those with an open-ended contract. Respondents who have been working under their current contractual status for 10 years or less have a higher probability of having been internationally mobile in the past compared with respondents who have been working under the same status for more than 10 years. Those who have been previously mobile and who have worked for 10 years or less under their current contractual conditions are more likely to have experienced job mobility than those who have been working under their contractual conditions (or 'such conditions') for more than 10 years, but there are no significant differences in the probability of having made a research visit (at the 5% level). Duration of contract has no significant effect on experience of recent mobility.

Those currently working on part-time contracts have a relatively lower probability of having been internationally mobile at some point during their research career. Respondents on part-time contracts with previous experience of mobility are not significantly more or less likely to have experienced a research visit than a change of job to an employer in another country.

4.4 Differences between the sectors

We have already noted that the share of respondents in the non-university research institutes sector who have been internationally mobile in the past (65%) is higher than the corresponding share in the higher education sector (57%). Table 11 shows that we still find a relatively higher international mobility intensity in the non-university research institutes sector, even if we account for several key characteristics of the sample of researchers in the two sectors. It is interesting to speculate why this might be the case. It could be due to a compositional difference in the range of subjects covered by non-university research institutes compared to universities, with a greater emphasis on subjects in which mobility is more common. It could also reflect the fact that universities have the option to retain recent doctoral graduates whilst non-university research institutes will generally have to recruit doctoral graduates from outside.

Respondents in the higher education sector who have previously been mobile have a higher probability of having experienced research visits to another country than respondents in the non-university sector (at the 5% level). This is likely to reflect a different opportunity profile (availability/absence of paid sabbaticals or study leave) and research culture. We find no significant differences between the two sectors in the probability of having experienced international job mobility among those who have been internationally mobile in the past (at the 5% level).

5 Discussion and conclusions

This paper focuses on international mobility patterns among researchers in the higher education sector and the non-university research institutes sector in the EU27 based on two of the largest and most systematic surveys on the topic. We examine the extent to which researchers from the two research sectors have experienced mobility in the past, and whether there are differences between these sectors. Further, for those researchers who have been internationally mobile, we examine whether there are differences between the two sectors in terms of job mobility (migration) versus research visits of three months or more (non-job mobility). We also examine how a number of individual characteristics affect international mobility as experienced by our respondents. Existing evidence on patterns and intensity of mobility is patchy, though there is a diverse literature discussing motivations and potential impacts. Our findings confirm some assertions made in the literature whilst challenging others. They also raise questions about policy in this area.

Perhaps contrary to the expectations of European policy-makers, international mobility is a fact of life for many researchers working in EU27 research-performing institutions. 57% of the respondents in the higher education sector, and 65% of those in the research institutes sector, have either experienced international job mobility or a substantial research visit to another country at least once during their career as a researcher. Among those with experience of mobility, we find that experience of international research visits is the most common form of international mobility (though respondents in the non-university research institutes appear to have fewer opportunities for substantial research visits, and this may reflect different norms and expectations in such institutes). However, experience of international job mobility (migration) is also a surprisingly common phenomenon, suggesting that, in contrast to the view of Musselin (2004), an international labour market for researchers has emerged, albeit alongside national labour markets which continue to play a dominant role.

In line with the predictions of Findlay et al. (2012), who argued that mobility choices and experiences at different

stages of an individual's life course may reflect a broader motivation towards a transnational or international life/career, we find that having been internationally mobile as a student, or having experienced an industrial placement or similar whilst a student, has a positive effect on the likelihood of a respondent having been internationally mobile at some point during their later research career. Interestingly, for those who have been internationally mobile, we find that experience of student mobility increases the probability of having experienced a research visit but has no statistically significant effect on the probability of international job mobility. On the other hand, experience of an industrial placement as a student increases the likelihood of job mobility later in the life course, but has no significant effect on the likelihood that an individual will demonstrate non-job mobility.

National research policy-makers are paying increasing attention to mobility as both a problem and an opportunity. *Cañibano and Woolley (2010, 2012)* identify two alternative traditions in research and policy discourse about mobility: a 'nationalist-pessimistic' tradition associated with 'brain drain' fears and an 'internationalist-optimistic' tradition associated with more recent notions, popularised by *Saxenian (2005)* of the benefits of 'brain circulation'. In the policy discourse, 'brain drain' concerns take on something of the flavour of a moral panic (*Davenport 2004*) whilst the 'brain circulation' perspective takes on the flavour of a moral crusade. European policy-makers, in particular, are preoccupied with removing perceived barriers to mobility (such as problems associated with transferring pensions, access to childcare etc.). Results presented above show that having children proves not to be a predictor of whether our respondents are likely to have previously been mobile, whilst other data from our surveys (*MORE 2010b,c*) suggest that personal, family, financial and other problems do not seem to act as significant disincentives to mobility. Of course, such problems are often experienced as difficulties in the course of mobility. However, this experience is not confined to researchers, and it is unclear to us why special policy measures should be taken for this specific group of potentially internationally mobile professional workers.

Our results show clearly that international mobility is a common phenomenon in the research systems of the EU and our respondents demonstrate an overwhelmingly positive attitude towards past and prospective international mobility. A wide range of push and pull factors may operate to create the incentive to be mobile, including positive features in the receiving system and negative features of the home system (*Ackers 2008*), and we strongly agree with *Ackers* and others that the tendency of some policy-makers and analysts to conflate high levels of mobility with increased excellence is unwise. However, our results suggest that, if European policy-makers wish to further raise the intensity of researcher mobility in Europe,

increasing support for student mobility and industrial placement schemes may be a cost-effective way of doing so.

More broadly, mobility—whether job or non-job mobility—is a complex event in the personal, family and social life of the individual researcher. It also has impacts on the content and direction of the individual's research, on their career, and on the research-performing organisations, disciplinary and problem-oriented networks and national research systems in which they work. A better understanding of the patterns we have detected in our surveys will be essential in order to inform better policy and practice in this area. In particular, research visits not involving a change of employer are the form of international mobility most commonly experienced by our respondents (and our surveys do not measure stays shorter than three months, so would tend to underestimate the overall level of such mobility). Yet we would argue that research visits remain poorly understood, especially where they are not supported by formal sabbatical requirements or mobility schemes. Gaining a deeper understanding of this kind of mobility, the roles it plays in the research process in different disciplines and its significance to the careers and lives of the individuals concerned—and how this may be changing with changing science dynamics and new possibilities for communication offered by information and communications technologies (*Davenport 2004; Ackers 2013*) should help policy-makers, funders and employers to better understand what support may be required.

Finally, a small caveat. Though our surveys represent the first comprehensive efforts to understand the mobility of researchers across the EU27, they have certain limitations. The use of a reference or home country (the country in which highest educational qualification was achieved) to measure mobility is a potential limitation. The diffuse nature of the non-university research institutes sector and the pragmatic strategy used to sample that sector is also clearly a limitation.

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Notes

1. OECD (2002: 13) emphasises that the capacity to analyse the international mobility of highly skilled workers is severely limited by the lack of internationally comparable data that capture the flows of such workers.
2. It should be noted that not all doctorate holders become researchers, and not all researchers are doctorate holders.
3. Melin (2005) highlights the negative effect of internationally mobile post-doctoral researchers especially in connection with their return to the home country.
4. MORE stands for Mobility and career paths Of Researchers in Europe. The MORE project was funded by the European Commission (Directorate General Research), and was carried out by a consortium led by IDEA Consult and including the present authors. This project started in 2008 and ended in 2010. The final report was published in June 2010. See the Acknowledgements section for further information.
5. The final report can be downloaded from the EURAXESS website <http://ec.europa.eu/euraxess/pdf/research_policies/MORE_final_report_final_version.pdf> accessed 13 Mar 2015.
6. There is no standard definition of ‘non-university public or quasi-public research institute’ and this ‘sector’ could potentially comprise an enormous number of large and small basic, applied and mission-oriented organisations ranging from large national laboratories and academies of science to small and specialised units (Georghiou et al. 2003). Although largely ignored by research policy studies, even after an unprecedented wave of reforms over the past decade or so, this sector remains responsible for a large number of publicly funded researchers and for a large proportion of public research funding. The same reforms mean that it is often difficult to clearly classify research institutes as ‘public’ or ‘private’. Given the difficulty of systematically defining the sector from first principles, existing lists were used as a starting point.
7. For further information, see <http://ec.europa.eu/research/era/areas/urpo/rpo_en.htm> accessed 13 Mar 2015.
8. Validation was based on the criterion that it should cover research organisations responsible for 80% of government expenditure on R&D in 2006.
9. Furthermore, a small number of our respondents across the two sectors (3%) are cross-border workers, living in one country and working for a (principal) employer in another.
10. Based on the method of comparing the means of two populations using either pooled variance or inferences from large samples, we can conclude that the average age among the respondents is significantly higher in the higher education sector than in the non-university research institutes sector (at the 1% level).
11. Based on the two-proportion z-test, we find that all these differences between the higher education sector and the non-university research institutes sector are significant at the 1% level.
12. The differences in the share of co-habiting or married respondents and the share of respondents who have children between the higher education sector and the non-university research institutes sector are found to be significant at the 1% level, using the two-proportion z-test.
13. Based on the two-proportion z-test.
14. Missing values from total count are: experienced mobility during career: 4; recent experience of mobility (last three years): 3; no experience of mobility during career: 16.
15. Based on the two-proportion z-test.
16. All the key characteristics (i.e. the explanatory variables) in Table 11 are dummies, except for the age variable which is a continuous variable. Due to redundancies (which cause reduced degrees of freedom for one or more variables), we have excluded respondents with missing values for key characteristics as student industrial apprenticeship (‘worked in industry’) and employment contract status from the regressions, and also those with unknown mobility status. Among respondents with missing values for student industrial apprenticeship, we find all those with a secondary education (i.e. high school, gymnasium, grammar school, lycee/lyceum or equivalent) as their highest educational attainment.
17. Highest educational attainment type has no significant effect on recent experience during the last three years (at the 5% level).

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