



Destination choices of mobile European researchers: Europe versus North America

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Abstract^{1,2}

Using a sample of 998 European-born researchers who obtained their PhD in Europe, we study the differences in personal characteristics, motivations and perceived external influencing factors between researchers who are internationally mobile within Europe or internationally mobile to North America. We find that career motivations are more strongly related to mobility to North America, which suggests that Europe is indeed losing its most motivated (and best?) researchers to the United States. However, researchers with previous mobility experience as students within Europe are more likely to remain internationally mobile within Europe, due to their different perception of external influencing factors. Personal influencing factors, which includes things like obtaining a work permission for a spouse, availability of adequate schools for children and the quality and cost of accommodation, are linked to mobility to North America, suggesting that it is easier for researchers to move a family to North America than within Europe .

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1 Introduction

Many world regions, including newly emerging markets like China, have raised their ambitions to become knowledge based economies. To realize these ambitions, the search for scientifically skilled talents has become a global war. Europe has firmly rooted its ambitions into its EU2020 and Innovation Union Flagship. It recognizes the supply of scientific talents as a potential bottleneck for its ambitions. It is important to not only improve the formation of new accumulation of human capital through higher education, but also to gain insight in the motivations and influencing factors that drive international mobility decisions of researchers. This holds particularly as highly skilled workers are more internationally mobile than other layers of the working population (Docquier and Marfouk, 2006).

International mobility has been common among scholars for centuries. Whereas Europe has long been the center of intellectual and cultural life, the second half of the twentieth century saw the rise of the United States as the leading power, both economically and scientifically. As an illustration, 54 universities in the top 100 of the Shanghai ranking are in the US, as well as 17 out of the top 20. Hence the US has become the preferred destination for students and researchers from across the globe. The US receives almost 19% of all foreign students worldwide (OECD, 2010) and hosts the majority of foreign top researchers in various fields (Hunter et al., 2009; Maier et al., 2007; Laudel, 2003).

Although Europe has recently overtaken the United States in sheer volume of scientific publications (Veugelers, 2011), policy makers still voice concerns that Europe is being beaten in the global war for talents, losing its best brains to the US while failing to attract the best scientific talent from abroad. Although intra-EU mobility is being stimulated by diverse policy initiatives at the European level (European Commission, 2003), a much more sensitive issue in the global war for talent is the international mobility of European researchers to and from the US. The perspectives on this issue are, however, clouded by a lack of good data. We know very little about the size of the outgoing and return flows between the EU and the US and the motivations and impediments underpinning these mobility decisions.

This paper contributes to our understanding of the factors that drive intra-EU and EU-US researcher mobility. Using unique survey data on internationally mobile European researchers, we compare the differences in personal characteristics, motivations and external influencing factors of researchers who are mobile within Europe and researchers who choose to become mobile to the United States or Canada. We find that intra-EU mobility experience as students motivates researchers to remain mobile within the EU, whereas mobility to North America is driven to a larger extent by career motivations. The remainder of the paper is organized as follows: section 2 reviews the literature on researcher mobility, analyzing both the statistical sources for mobility and the existing literature on the motivations and influencing factors that drive mobility. Section 3 presents the data, while section 4 presents the results, both descriptive and econometric. Section 5 concludes.

2 Literature review

Although it is widely recognized that mobility is instrumental in the development and dissemination of new ideas and technologies (Goldin et al., 2011), there is still a lack of comprehensive indicators on international mobility of the highly skilled and of researchers in particular. An exception to this is international student mobility. Several sources provide information on the international movements of tertiary students. The OECD in its latest 2010 Education at a Glance Edition reports that 6.7% of all tertiary students in the OECD are international students. In advanced research programs this proportion is even higher, at 18.2%. Student mobility has increased with 70% between 2000 and 2008; the total number of foreign students enrolled outside their country of origin stood at 3.3 million in 2008. The US receives almost 19% of all these foreign students. 11.2% of all international students in the US are from Europe. By contrast, the ten most popular European countries³ together receive about 35% of all foreign students. Within Europe, the UK and Germany are the most popular destinations for student flows. Switzerland boasts the highest foreign-to-native student ratio.

Studies on researcher mobility often focus on PhD students, as they are very likely to be internationally mobile and their education involves a heavy research component. In a study of inward, outward and intra-EU mobility of PhD students, IISER (2007) reports that 5.5% of doctoral candidates are studying in a member state of which they do not hold the nationality, whereas 16.9% come from outside the EU. Asia and Africa are the largest regions of origin of these extra-EU PhD students. For the United States, the National Science Foundation (NSF) collects detailed information on incoming foreign PhD students, especially through its Survey of Earned Doctorates (SED). In its latest Science and Engineering Indicators report, the NSF reports that 33% of all doctoral students in science and engineering fields were temporary residents. The proportion is more than half in fields like engineering, mathematics, computer sciences and economics (NSF, 2010). The majority of foreign PhD students studying in the US come from Asia: between 1987 and 2007, 82% of all foreign PhD recipients in the US were from Asia, versus 17% from Europe (NSF, 2010). Black and Stephan (2007) report that the increased inflow of foreign students in the 1980s and 1990s have fueled much of the growth of US PhD and postdoc programs, and consequently the proportion of foreigners in PhD programs has increased dramatically: in 1981, 20% of all doctoral students held a temporary visa, compared to 38.4% by 1992 (Black and Stephan, 2007). By 2006, this proportion had risen to almost 1 in 2 PhD students (Stephan, 2011).

Though a large number of foreign researchers enter their destination country as students and stay (temporarily) to work, a significant number also move after finishing their PhD education (Stephan and Levin, 2007). Keeping track of postdoctoral researchers and foreigners in more senior research positions is harder because they can work in a multitude of institutions in academia, the private sector or the government. In the US, 35% of all faculty at four-year colleges, universities and medical schools in 2003 are known to be foreign born, although this number is probably an upper bound of the real proportion of foreigners as it also includes faculty who may have migrated to the US as children (Stephan, 2011). The National Survey of College Graduates reports that 33.1% of foreign PhD holders in the US are

³ United Kingdom, Germany, France, Italy, Spain, Austria, Switzerland, Belgium, the Netherlands and Sweden.

foreign-educated (NSF, 2010). The Association of American Medical Colleges reports that in 2000, 18% of the faculty at US medical schools were foreign-educated (AAMC, 2003). For some countries, the outflow of faculty constitutes a considerable loss: about 20% of Israeli economic faculty were residing in the US, compared to only 10% for Canada, the country with the second-to-highest proportion of faculty in the US (Ben-David, 2007). Bekhradnia and Sastry (2005) study the in- and outflows of academic researchers in the UK using, among other sources, data on staff movements in higher education institutions from the Higher Education Statistics Agency. They find a substantial net immigration of academic staff, particularly among the younger researchers: over the 1995-2003 period, 2.6% of academics immigrated whereas 1.9% emigrated. Moreover, controlling for immigrants' and emigrants' publications records reveals that the immigrants perform better than the emigrants, so the UK gains in terms of quality of researchers.

Small-scale studies which consider a small subpopulation of researchers also shed some light on international mobility at later stages in the career. In a study of 10 top economics departments in the US, Oswald and Rahlsmark (2008) find that 62% of their assistant professors had moved to the US after their bachelor's degree, and 13% after their PhD. Gaulé (2010) studies the return decisions of foreign chemistry faculty who hold a faculty position in the US and finds that 53% of the foreign faculty come to the US as PhD students, 34% as postdocs and 13% as faculty.

Though gathering data on the size and direction of migration flows is an important first step in understanding international researcher mobility, it is also important to study the factors that drive mobility decisions at various career stages. Especially from a policy perspective it is important to know which motivations and influencing factors play an important role in mobility decisions.

A growing literature addresses the factors and motivations that drive student mobility. Many macro-studies emphasize the importance of 'classic' migration factors such as relative market size, geographic and cultural distance, colonial and trade ties, relative economic strength and income differences (Lee and Tan, 1984; Cummings, 1984; Agarwal and Winkler, 1985; McMahon, 1992; Bessey 2007). Obtaining a degree in an industrialized country is often a first step for migration into that country for many students (Borjas, 2002; Tremblay, 2001). Other factors are more specific to student mobility. Many students go abroad in search of a higher-quality education than they could have obtained at home (Van Bouwel and Veugelers, 2011; Alberts and Hazen, 2005). A lack of availability of places in the desired program is also a push-factor for students to seek education abroad (Van Bouwel and Veugelers, 2011; Lee and Tan, 1984).

There are few studies that address the motivations and influencing factors of mobility of researchers at later stages in their research career. Rindicate (2008) performed a survey among academic researchers in 8 European countries asking whether researchers had been internationally mobile before or were willing to become mobile, and what factors were perceived as barriers to mobility. They found that 46% of their sample had been mobile and another 35% were interested in becoming mobile in the future. There is, however, a broad array of factors that are perceived as inhibitors to mobility: lack of funding for mobility, salary concerns, lack of open recruitment, misalignment in social security benefits, personal relationships, and practical things such as concerns about accommodation and health insurance.

Researchers who had not yet been internationally mobile expressed most concern about the lack of recognition of mobility for career progression and the lack of funding for mobility (Rindicte, 2008). A study carried out in the context of the 7th Framework Program on 'European Careers for Researchers' in 8 European countries asked respondents, among other things, about their experience with and motives for international mobility. Of the researchers included in the study, 59% indicated having participated in an international mobility program in the past. The researchers indicated that the possibility for future career development, working on an interesting research topic and participation in a collaborative research project were among the most important motives for mobility, although the reputation of the host institutions also plays a significant role. Major obstacles for mobility are family and other personal connections, as well as the complex administration of relocation and lack of support from the home institution (Ivancheva and Gourova, 2011). De Grip et al. (2009) study the factors that influence European science and engineering graduates to become internationally mobile right after their studies and 5 years later. They find that a strong R&D sector is a key attractive factor of destination countries, and that previous experience with mobility is a strong predictor of future mobility, especially for intra-EU mobility. This indicates that EU initiatives that aim to increase student mobility, like the Erasmus programme, have the desired policy effect.

3 The data: the MORE survey

3.1 Data collection

This paper is based on survey data from the MORE project's pilot study on the EU-US mobility of researchers, which collects information on the mobility of EU-born researchers who move to the US on a series of subjects, e.g. their motives to go to the US, the administrative or practical barriers to their mobility, the effects of this mobility on their career, etc. The survey has been designed and implemented in the context of a project funded by DG Research of the European Commission⁴. This survey initially targeted

- a. researchers who have graduated in the EU and have later been mobile to the US, and
- b. researchers who have graduated in the US and have later been mobile to the EU.

The survey extended its coverage addressing also

- c. researchers who have moved between any other regions in the world except from the two combinations above-mentioned, and
- d. researchers who have not been mobile after their graduation.

For the purposes of this survey respondents were considered as researchers if they were carrying out or supervising research and/or improving or developing or supervising the improvement or development of new products, processes and/or services. The survey has been carried out in 2010. The total net sample of the survey accounts for 5,544 observations.

⁴ The project on 'Career paths and mobility for EU researcher was funded by Directorate-General of the European Commission and was carried out in 2008-2010 by a consortium of European organizations led by IDEA Consult in Brussels. For more information, please visit: www.researchersmobility.eu.

3.2 Target groups for this paper

The present paper focuses on European-born⁵ researchers in the MORE survey. We retain only researchers who have obtained a PhD, to keep our sample as homogeneous as possible with respect to educational attainment. Although the original survey included non-mobile researchers as well, the questions on motivations and external influencing factors for mobility, which are our primary explanatory variables of interest, are not comparable with the mobile groups, and the non-mobile researchers are therefore omitted from the sample for this paper. We retain only those researchers who obtained their PhD in Europe, be it in their birth country (EU0) or in another European country (EU1), and who become mobile as researchers within Europe (EU0-EU2 or EU1-EU2) or to North America (EU0-NA or EU1-NA).

Figure 1 illustrates the breakdown of our sample into the various mobility groups. The number of respondents in each group and subgroup is included.

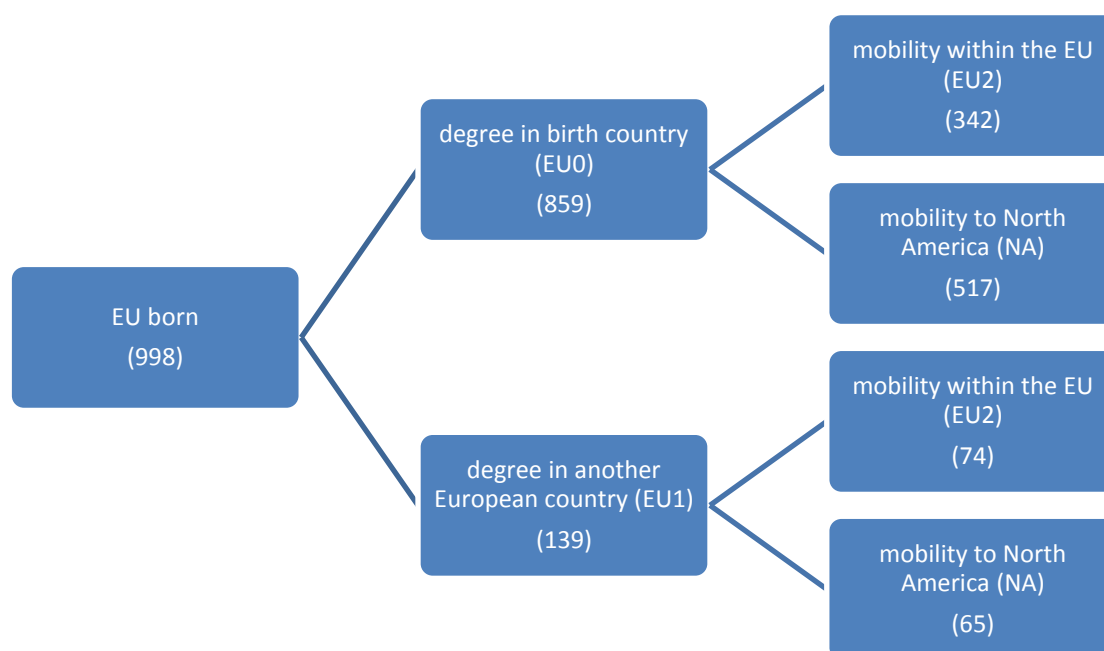


Figure 1: Mobility groups in the sample

Note, however, that since the survey specifically targeted researchers with mobility experience between Europe and the US, that this sample is not representative of the population of mobile European researchers. To gauge how much our sample is biased towards US mobility, we compare the researchers in our sample who are currently residing in Belgium to the Belgian sample of the Careers of Doctorate Holders survey, which was conducted in 2006 in several European countries in cooperation with the OECD, Eurostat and UNESCO Institute of Statistics. The Belgian part of the survey targeted all PhD holders in Belgium based on census data, and should thus be representative of the population of PhD holders in Belgium. The mobility in our sample is much more likely to be geared towards North America:

⁵ We define Europe as the EU 27 + Norway, Switzerland and Turkey. Although our definition of Europe extends somewhat beyond the borders of the actual European Union, we will use the terms 'EU' and 'Europe' interchangeably throughout the paper.

58% of the mobile researchers go toward the US in our sample, versus 12% in the CDH sample. However, the CDH sample is not completely unbiased either: it is based on all Belgian PhD holders currently working in Belgium, and thus does not account for researchers who move abroad permanently, be it within Europe or to North America. We therefore do not use these data to correct for our sample bias, as it would probably introduce another sample bias in the opposite direction. It is thus important to keep in mind that our sample is not representative of mobility flows within the whole population of European-born researchers. However, as discussed above, our primary goal is to compare the determinants of mobility between EU-mobile and NA-mobile researchers. Specifically, we want to address the following two research questions:

1. How do intra-EU mobile researchers differ from researchers mobile to North America in their personal characteristics, motivations and external influencing factors for mobility? Do particular characteristics or motivations increase the likelihood of choosing North America as a destination over another European country?
2. Does previous degree-mobility experience within the EU affect the likelihood of remaining mobile within the EU compared to becoming mobile to North America? Are the effects of motivations and influencing factors different for researchers with degree mobility experience?

These two research questions are addressed in the next section.

4 Results

4.1 Mobility statistics

We begin this analysis by presenting some descriptive statistics on the mobility patterns in the sample. In line with our data description above, we define four groups: researchers who obtain their PhD degree in their birth country and become intra-EU mobile (EU0-EU2) or mobile to North America (EU0-NA) and researchers who obtain their PhD degree in another European country and become mobile within Europe (EU1-EU2) or to North America (EU1-NA). Table I divides the 998 researchers in our mobile sample over these four groups.

Table I: Composition of sample in mobility groups

	degree in ...		
	EU 0 (birth country)	EU 1 (other EU)	Total
Intra-EU mobility	342	74	416
%	<i>39.81</i>	<i>53.2</i>	<i>41.7</i>
Mobility to North America	517	65	582
%	<i>60.19</i>	<i>46.8</i>	<i>58.3</i>
Total	859	139	998
%	<i>100</i>	<i>100</i>	<i>100</i>

The majority of our sample, 582 researchers, are mobile to North America. Researchers with a degree from another EU country are less likely to be mobile to North America (46.8% of 139 researchers) compared to their peers with a degree from their birth country (60.19% of 859 researchers).

Table II contains the different regions in Europe where the respondents in our sample obtained their PhD, as well as the major degree countries. Western Europe and the Mediterranean are the largest source regions, representing 34% of the sample each. Anglo-Saxon Europe (the UK and Ireland) is the third largest degree region, despite being the smallest in terms of population. Scandinavia and Central and Eastern Europe represent 10% and 9% of the sample, respectively. Of the major individual degree countries, Italy is the largest source country of mobile researchers with 190 individuals in the sample. Germany and Spain make up the top 3 with 136 and 127 researchers.

Table II: Degree regions and major countries

Degree region	frequency	percent
Western Europe	341	0.34
Central and Eastern Europe	91	0.09
Mediterranean	340	0.34
Scandinavia	102	0.10
Anglo-Saxon Europe	124	0.12

Major degree country	frequency	percent
Italy	190	0.19
Germany	136	0.14
Spain	127	0.13
United Kingdom	119	0.12
France	65	0.07
Netherlands	48	0.05
Austria	33	0.03
Sweden	31	0.03
Belgium	30	0.03

Table III shows the different destination regions in North America and in Europe, as well as the major destination countries. North America is the most popular destination region, with all 58% of all mobile researchers going to the United States. The second major destination region is Western Europe which receives 21% of the sample. Anglo-Saxon Europe, though the smallest region in our sample, comes in third with 9%. This is explained by the particular attraction of the United Kingdom: after the United States, it is the most popular destination country, receiving 89 researchers from our sample. Germany, France and the Netherlands complete the top 5 of the most frequent destination countries.

Table III: Destination regions and major countries

<u>Destination region</u>	<u>frequency</u>	<u>percent</u>
North America	582	0.58
Western Europe	208	0.21
Anglo-Saxon Europe	94	0.09
Mediterranean	63	0.06
Scandinavia	42	0.04
Central and Eastern Europe	9	0.01

<u>Major destination country</u>	<u>frequency</u>	<u>percent</u>
United States of America	582	0.58
United Kingdom	89	0.09
Germany	60	0.06
France	58	0.06
Netherlands	32	0.03
Spain	32	0.03
Switzerland	25	0.03
Italy	22	0.02

The source and destination countries reveal interesting information about mobility patterns, but say little about particular links between specific countries. Are researchers from, say, Italy more likely to be mobile to particular countries in Europe? Or are researchers from the UK more likely to be mobile to the US, perhaps because of the language link? Table IV presents the major degree country – destination country dyads, and includes the relative share of the degree country in a destination country’s inflow of researchers. For example, the UK may attract 10% of all researchers in the sample, but 20% of all Italians – this means that the relative share of Italians in the UK’s inflow is twice as high as expected, and suggests that Italians have a specific preference for the UK (or the UK has a preference for incoming Italian researchers). A relative share above 1 indicates that the inflow from a particular country is larger than expected given the average inflow into the destination country. The relative share is only calculated for mobility flows of at least 10 individuals, because smaller flows tend to cause strong variation in this measure.

The flow of Italians to Spain is 2.3 larger than expected given Spain’s average attractiveness. This special link may be due to similarities in language and culture. Certain degree countries also have relatively larger flows to the United States, such as Austria, Belgium and the United Kingdom. Other countries send relatively fewer researchers to the United States, among which Italy, Poland and Finland. For Italy, this is partly explained by a disproportionate preference for mobility within Europe, in particular to the UK, Germany, France and Spain, as already mentioned.

Table IV: Major degree country – destination country dyads

degree country	destination country	Freq.	Percent	relative share
Italy	United States of America	96	9.62	0.87
Germany	United States of America	84	8.42	1.06
United Kingdom	United States of America	83	8.32	1.20
Spain	United States of America	83	8.32	1.12
France	United States of America	38	3.81	1.00
Netherlands	United States of America	29	2.91	1.04
Austria	United States of America	24	2.4	1.25
Belgium	United States of America	21	2.1	1.20
Italy	United Kingdom	20	2.0	1.18
Sweden	United States of America	19	1.9	1.05
Denmark	United States of America	18	1.8	1.06
Switzerland	United States of America	17	1.7	1.01
Italy	Spain	14	1.4	2.30
Italy	Germany	14	1.4	1.23
Finland	United States of America	14	1.4	0.86
Italy	France	13	1.3	1.18
Spain	United Kingdom	12	1.2	1.06
Germany	United Kingdom	12	1.2	0.99
Poland	United States of America	11	1.1	0.86

4.2 Descriptive statistics

Where the previous section characterized the mobility flows in our sample, this section gives descriptive statistics on the explanatory variables for mobility. The explanatory variables of interest can be divided into three groups. The first are personal characteristics of researchers: gender, age, marital status, children and type of employer (academic versus industry). The second are researchers' motivations for mobility. The survey asked researchers to score 7 motivations on a scale from 1 to 5, ranging from not important at all to extremely important. These motivations are

1. personal education and/or research agenda (i.e. the content and direction of the respondent's research)
2. career progression goals (the possibility for the respondent's career as a researcher to evolve further)
3. getting access to the facilities or equipment necessary for the respondent's research
4. the prospect to work with leading experts ('star scientists') in the respondent's field of research at (or close to) the respondent's new employer
5. personal/family factors
6. personal interest in the culture of the country
7. salary and other financial incentives

A principal component analysis was done to check whether these motivations could be regrouped into a smaller number of factors. The individual motivations are grouped into 3 composite motivations: career motivations, comprised of the first four motivations, personal motivations, of the next two, and financial motivations.

The third group of explanatory variables are external influencing factors in the decision to become mobile. Again, the survey asked respondents to score 8 external influencing factors on a scale from 1 to 5. These external influencing factors are:

1. immigration regulations (e.g. immigration law, labor permission law, law of residence permission)
2. pension and social care provisions in the destination country
3. obtaining funding for own research
4. potential loss of contacts with the respondent's professional network at the location where he or she previously worked
5. work permission for partner (and other family members)
6. availability of adequate schools for children
7. quality and cost of accommodation
8. language

The external influencing factors were also regrouped into a few composite factors: regulatory factors, which include factors 1 and 2, and personal factors, including factors 5, 6 and 7. The remaining influencing factors are included individually.

Tables V, VI and VII compare the personal characteristics, motivations and external influencing factors of researchers from the four mobility groups: researchers with a degree from their birth country who move within Europe (EU0-EU2) and who move to North America (EU0-NA), and researchers with a degree from another European country who move within Europe (EU1-EU2) and to North America (EU1-NA). T-tests are done comparing the degree mobility groups (EU0 versus EU1) and comparing intra-EU mobility to NA-mobility within degree mobility groups.

In the total sample, 73% of respondents are male, 80% are married and 64% have children, and the average respondent is a little over 44 years old. Researchers with a EU-degree are significantly younger and less likely to currently be working for an academic employer. This indicates that intra-EU degree mobility is a recent phenomenon, and perhaps that non-academic employers are especially interested in PhD holders with intra-EU mobility experience. Compared to researchers with a birth country degree who are intra-EU mobile, researchers who are mobile to North America are significantly older as well as more likely to be working for an academic employer. This may indicate that it is more difficult to move to North America outside the academic sector than it is to move within the EU.

Comparing the motivations between EU- and North America-mobile groups reveals that researchers mobile to North America have significantly higher career motivations, regardless of where they obtained their PhD. Researchers with an EU-PhD, however, are more likely to be motivated by financial reasons, regardless of their destination. The other motivations are not significantly different across groups.

For the external influencing factors, researchers who have been mobile for their degree attach a little more importance to regulatory factors, but somewhat less importance to language, indicating that intra-EU degree mobility lowers the perceived language barriers within Europe somewhat. Researchers mobile from their birth country to North America attach more importance to personal factors and language (although neither of the factors is deemed to be important, as all scores remain below 3). We find the same language difference for researchers mobile from another EU country to North America – which suggests that the fact that English is the native language makes language less of a barrier for moving to North America compared to moving within Europe. Finally, researchers who obtained their PhD in another EU country and move to North America are more likely to attach importance to obtaining funding for their own research compared to their peers who remain mobile within the EU. This could either suggest that funding is more abundant and/or more accessible in North America, or that students who obtain their PhD in another EU country build up specific knowledge of the funding system in that country or at the European level, and do not wish to renege on that expertise.

Table V: Personal characteristics by mobility groups

broad mobility categories	Mean	Mean	Mean	Mean	Mean
	male	age	married/cohabiting	children	academic employer
EU0	0.74	44.93	0.81	0.64	0.76
EU0-EU2	0.75	43.75	0.8	0.65	0.73
EU0-NA	0.73	45.72***	0.82	0.64	0.79**
EU1	0.68	41.71 ^{ooo}	0.75 ^o	0.64	0.68 ^{oo}
EU1-EU2	0.68	42.37	0.78	0.68	0.64
EU1-NA	0.66	40.97	0.72	0.60	0.74
Total	0.73	44.48	0.80	0.64	0.75

Note:* t-tests done comparing intra-EU and NA mobility within degree mobility groups; ^o t-tests done comparing EU0 degree to EU1 degree

Table VI: Motivations by mobility groups

broad mobility categories	Mean	Mean	Mean
	career motivations	personal motivations	financial motivations
EU0	3.87	2.48	2.63
EU0-EU2	3.71	2.43	2.65
EU0-NA	3.97**	2.52	2.62
EU1	3.81	2.47	3.02 ^{ooo}
EU1-EU2	3.55	2.48	2.89
EU1-NA	4.12**	2.51	3.2
Total	3.86	2.49	2.69

Note:* t-tests done comparing intra-EU and NA mobility within degree mobility groups; ^o t-tests done comparing EU0 degree to EU1 degree

Table VII: External influencing factors by mobility groups

broad mobility categories	Mean	Mean	Mean	Mean	Mean
	regulatory factors	funding	loss of contacts	personal factors	language
EU0	1.75	2.82	2.08	2.1	2.76
EU0-EU2	1.75	2.85	2.06	2	2.5
EU0-NA	1.75	2.8	2.1	2.16**	2.93***
EU1	1.91 ^o	2.97	2.18	2.13	2.57 ^o
EU1-EU2	1.92	2.72	2.22	2.05	2.28
EU1-NA	1.91	3.29**	2.12	2.26	2.91***
Total	1.77	2.84	2.1	2.1	2.73

Note: * t-tests done comparing intra-EU and NA mobility within degree mobility groups; ^o t-tests done comparing EU0 degree to EU1 degree

4.3 Regression analysis

To see which descriptive differences hold up while all factors are controlled for simultaneously, we run three logit regressions for the probability of being mobile to North America instead of within the EU. In the first model, we include the personal characteristics, motivations and external influencing factors. In the second model, we add a number of interaction terms with and EU-degree dummy and the motivations and influencing factors. Finally, in the third model, we add a number of interaction terms between the researchers birth region dummies and the EU-degree dummy, to check whether degree mobility alters later mobility decisions in a different way depending on the researcher's nationality⁶. All regressions also control for researchers' field, cohort and birth region. Table VIII presents the results.

Career motivations are significantly higher among researchers who are mobile to North America. This could imply that the most motivated researchers are more likely to move to North America, which would be bad news for Europe. Further research into why intra-EU mobile researchers are less career motivated and what the implications are for the impacts of this mobility is needed to address this issue further.

As observed in the descriptive statistics, researchers who obtained their degree elsewhere in the EU are more likely to remain mobile within the EU (column 1). For EU policymakers, this suggests that one way to stimulate intra-EU researcher mobility is through stimulating PhD student mobility. However, the effect of the degree mobility dummy disappears as soon as interactions with motivations and external influencing factors are introduced (columns 2 & 3), which means that the differences in mobility choices can be explain by differences in degree-mobile researchers' motivations and perception of external influencing factors.

⁶ A Chow test to check whether the coefficients are jointly significantly different for degree-mobile and non-degree-mobile researchers was not significant, however. This indicates that the coefficients of all the explanatory variables are not jointly significantly different for degree mobile and non-degree mobile researchers.

Researchers who indicate concern with research funding are less likely to go to North America, which could imply that researchers become embedded in national or European funding systems early in their careers and are hesitant about their ability to successfully obtain funding in North America. However, researchers with a EU degree who are concerned with research funding are more likely to move to North America, as indicated by the interaction effect in the second model (column 2). This could indicate that researchers who are mobile as students have a more flexible perception of funding systems and are less likely to perceive funding as an inhibiting factor for mobility. By contrast, researchers with an EU degree who are concerned with the potential loss of contacts after moving are less likely to move to North America. Arguably these researchers put more effort into building a network within Europe as mobile students, and are more reluctant to lose these contacts if they move outside of Europe.

Researchers who attach more importance to personal influencing factors (which includes factors such as the ability to obtain a work visa for a spouse, availability of good schools for children, quality and cost of accommodation, etc.) and to language are more likely to be mobile to North America. This suggests that it is easier for a researcher to move a family to North America than within Europe, which is something EU policy makers could, and should, address.

Finally, researchers from Mediterranean countries and from Central and Eastern Europe are less likely to move to North America compared to Europeans from Western Europe. This may be attributable to larger cultural differences between these countries and North America. A similar argument could be made to explain why researchers from the Anglo-Saxon countries (the U.K. and Ireland) are more likely to be mobile to North America. For researchers from Central and Eastern Europe, however, cultural differences are only part of the story: researchers who are born in this region but obtain their PhD elsewhere in Europe are more likely to be mobile to North America. This indicates that in some cases, intra-EU degree mobility is used as a 'stepping stone' for follow-up mobility to North America. Arguably the quality differences for researchers who obtain their PhD in this region are too large to make mobility to North America feasible.

5 Conclusion

Using a sample of 998 European-born researchers who obtained their PhD in Europe, we study the differences in personal characteristics, motivations and perceived external influencing factors between researchers who are internationally mobile within Europe or internationally mobile to North America. We find that career motivations are more strongly related to mobility to North America, which suggests that Europe is indeed losing its most motivated (and best?) researchers to the United States. However, researchers with previous mobility experience as students within Europe are more likely to remain internationally mobile within Europe, due to their different perception of external influencing factors. Personal influencing factors, which includes things like obtaining a work permission for a spouse, availability of adequate schools for children and the quality and cost of accommodation, are linked to mobility to North America, suggesting that it is easier for researchers to move a family to North America than within Europe .

Table VIII: Logit models for the probability of being mobile to North America (compared to intra-EU mobility)

VARIABLES	(1) Mobility to NA	(2) Mobility to NA	(3) Mobility to NA
1 if male	-0.212 (0.165)	-0.224 (0.167)	-0.223 (0.168)
Age in years	0.00257 (0.0155)	0.00187 (0.0156)	0.00241 (0.0157)
cohort 10-19	-0.0631 (0.214)	-0.0556 (0.217)	-0.0678 (0.217)
cohort 20-29	-0.0464 (0.354)	-0.0467 (0.358)	-0.0472 (0.360)
cohort 30-49	0.727 (0.489)	0.700 (0.495)	0.675 (0.497)
industry	0.0851 (0.399)	0.0833 (0.401)	0.106 (0.403)
degree in other EU country	-0.387* (0.225)	-0.695 (1.196)	-0.966 (1.214)
career motivations	0.582*** (0.0999)	0.570*** (0.109)	0.566*** (0.110)
personal motivations	-0.0178 (0.0849)	0.0117 (0.0924)	0.0154 (0.0927)
money motivations	-0.0100 (0.0648)	-0.0285 (0.0710)	-0.0190 (0.0714)
EU1 * career motivations		0.0323 (0.290)	-0.00934 (0.291)
EU1 * personal motivations		-0.176 (0.249)	-0.121 (0.251)
EU1 * financial motivations		0.127 (0.181)	0.119 (0.189)
regulatory influencing factors	-0.169* (0.0995)	-0.163 (0.109)	-0.160 (0.109)
research funding	-0.120** (0.0594)	-0.176*** (0.0640)	-0.181*** (0.0643)
loss of contacts	-0.0883 (0.0725)	-0.0370 (0.0784)	-0.0379 (0.0786)
personal influencing factors	0.193** (0.0898)	0.192* (0.0984)	0.184* (0.0986)
language	0.358*** (0.0652)	0.362*** (0.0708)	0.368*** (0.0712)
EU degree * regulatory influencing factors		-0.135 (0.277)	-0.144 (0.279)
EU degree * funding		0.407** (0.180)	0.489*** (0.189)
EU degree * loss of contacts		-0.405* (0.223)	-0.404* (0.225)
EU degree * personal factors		0.0752 (0.249)	0.00754 (0.252)
EU degree * language		0.00908 (0.191)	0.0290 (0.198)

Exact Sciences	0.122 (0.268)	0.0919 (0.273)	0.0960 (0.274)
Life Sciences	0.387 (0.336)	0.385 (0.340)	0.389 (0.341)
Social Sciences	-0.176 (0.284)	-0.226 (0.288)	-0.230 (0.290)
Mediterranean	-0.428** (0.195)	-0.464** (0.198)	-0.590*** (0.225)
Anglosaxon Europe	0.725** (0.321)	0.803** (0.326)	0.757** (0.339)
Scandinavia	-0.290 (0.253)	-0.288 (0.255)	-0.293 (0.266)
Central and Eastern Europe	-0.655* (0.348)	-0.702* (0.361)	-1.203*** (0.460)
EU1 * Mediterranean			0.146 (0.522)
EU1 * Scandinavia			-0.172 (0.982)
EU1 * Central and Eastern Europe			1.209* (0.707)
EU1 * Anglosaxon Europe			0.631 (1.174)
relative impact per degree country publication	0.430 (0.580)	0.311 (0.600)	-0.290 (0.687)
Constant	-2.575** (1.007)	-2.328** (1.061)	-1.703 (1.118)
Observations	998	998	998

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

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