Baltic Science Network

Connecting Through Science

International Mobility of Researchers in the Baltic Sea Region

Dr. Tom Schumacher

Interreg Baltic Sea Region

EU STRATEGY FOR THE BALTIC SEA REGION FLAGSHIP

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

Further details on the publication

Name of the project	Baltic Science Network
Affiliation of the project	Interreg Baltic Sea Region Programme funded project
Title of the publication	**International Mobility of Researchers in the Baltic Sea Region**
Affiliation to the Project Work Package	Work Package 4
Month & year of the publication	November 2016
Author of the publication	Dr. Tom Schumacher
Institutional affiliation of the author	Kiel University

Project in brief

Baltic Science Network (BSN) is the leading transnational forum for higher education, science and research cooperation in the Baltic Sea Region (BSR).

BSN is a policy network gathering relevant transnational, national and regional policy actors from the BSR countries. The Network serves as a springboard for targeted multilateral activities in the frame of research and innovation excellence, mobility of scientists and expanded participation. These joint activities are modelled with an overall aim to ensure that the BSR remains a hub of cutting-edge scientific solutions with the capacity to exploit the region´s full innovation and scientific potential. The activities are envisaged to serve as examples of best practice and as basis for the policy recommendations drafted by the Network.

The platform is tailored to provide advice on how to enhance a macro-regional dimension in higher education, science and research cooperation. Recommendations jointly formulated by the Network partners address the European, national and regional policy-making levels.

BSN is a flagship of the EU Strategy for the Baltic Sea Region under the Policy Area Education, Research and Employability, as well as one of two cornerstones of the Science, Research and Innovation Agenda of the Council of the Baltic Sea States.

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1. Introduction

Unlike many internationalization trends that have arisen in the era of globalization, researcher mobility is not a new phenomenon. Ever since the existence of science, mobility has been an integral part of the way of life of the academic community.[1] In recent decades, however, the intensity of both student and researcher mobility has strongly increased. Moreover, the way the issue is being discussed has changed. In the course of globalization the rationale behind researcher mobility has shifted from individual objectives such as personal self-fulfillment and career development to collective socio-economic needs. Thus, researcher mobility is today increasingly associated with topics such as economic competitiveness, dissemination of technical know-how, qualification of the labor force or the need to improve the international reputation of universities and other research institutions.[2]

As a consequence, mobility in academia has become an issue of public interest and political debates, guided by catchwords such as brain drain or brain gain and often associated with the general discourse on migration. A common understanding has spread that an increased and balanced international mobility of researchers is a desirable societal objective.[3]

The transfer of the issue to the sphere of public interest has raised the desire to support and guide researcher exchanges politically. Consequently, major efforts have been undertaken to gather data such as numbers and directions of mobile researchers and to provide political decision makers with a current background on the topic. Various studies have sought to shed light on the conditions associated with researcher mobility. Motives and incentives as well as obstacles have been analyzed and the impacts of mobility on individual career paths as well as on the development of research environments have been scrutinized.

There is, however, a major gap between the obvious need for comprehensive knowledge of all aspects of the topic 'international researcher mobility' on the one hand and the availability of exact figures on the other hand.[4] Clear limits are reached as soon as it comes to the provision of basic statistical information, such as numbers and mobility directions of incoming and outgoing researchers on a country per country basis.[5] Until today neither the EU, nor the OECD have managed to implement appropriate statistical standards among their member states in this context.

A major challenge for any kind of quantitative analysis of researcher mobility is related to the topics' very complex and difficult to grasp nature. There is even no commonly accepted definition of the

[1] http://www.gate-germany.de/fileadmin/dokumente/angebote/Expertenwissen/MIND/GATE-Schriftenreihe_12_MIND.pdf (p. 22)
[2] http://dea.nu/sites/dea.nu/files/litterature_review.pdf (p. 4)
[3] http://www.nifu.no/files/2013/10/Research-evaluation-final-3.pdf (p. 1)
[4] http://www.wissenschaftweltoffen.de/publikation/wiwe_2016_verlinkt.pdf (p. 3 and 94); http://ec.europa.eu/euraxess/pdf/research_policies/MORE_final_report_final_version.pdf (p. 130) http://www.tekes.fi/globalassets/julkaisut/fidipro_evaluation_5_2014.pdf (p. 11)
[5] In this respect, there is a sharp contrast between the availability of statistical data on student and researcher mobility, in so far as the former is relatively easy to obtain.

term ‘researcher’. In most cases, the term is used for academics, such as doctoral candidates, post-docs, research associates and professors, who work at universities, universities of applied sciences and at other public research institutions. Researchers in private companies are usually not considered in mobility studies. This is astonishing, since their share is quite important ranging from near 50% of the total number of researchers in the EU average to 80% in the USA.[6] Obviously, the reason is related to the fact that researchers in private companies are even more difficult to grasp than those working in the public sector and that they are not the prime target group for political regulation.

Apart from the term researcher, the exact meaning of mobility is also unclear. Generally, international (or geographic) mobility can be distinguished from inter-sector mobility, which implies moving between the academic and the private sector.[7] Mobility in a geographic sense has a spatial and a temporal dimension. Whereas the former is rather self-explanatory, the latter needs to be defined deliberately. Basically, analysts differentiate between temporary and permanent mobility. The former can be associated with the concept of brain circulation, the latter rather with brain gain and brain drain respectively.[8]

However, these are only rough categories. For analytical reasons, temporal mobility is usually divided into short term and long term research stays. But no internationally recognized standards exist as to which threshold value should be applied in order to differentiate between both categories.[9] Permanent mobility is not a clear case either. It often turns out that a researcher only after a few years decides to move back to his or her home country, a move that then would be categorized as return mobility. But even clear cases of permanent mobility are in fact often difficult to identify. In an attempt to grasp these cases, national statistical offices usually just record the number of employed researchers with another than the host country’s citizenship. It thus, however, remains open, whether the persons concerned had already been educated in the host country or whether they only moved there after having completed secondary education in their country of origin.

Such unsatisfactory conditions in terms of clear definitions and statistical standards are a characteristic feature for the Baltic Sea Region (BSR)[10] as well. The countries in the region differ considerably, regarding the type and extent of produced statistical data about researcher mobility. Finland, Estonia and Germany are the only countries that systematically record numbers of incoming and outgoing researchers by countries of origin and destination respectively. But even the corresponding figures from these three countries are based on different counting methods and are thus only to a limited extent directly comparable. With respect to the other countries in the region

[6] http://ec.europa.eu/euraxess/pdf/research_policies/MORE_final_report_final_version.pdf (p. 65)

[7] https://www.nordforsk.org/en/publications/publications_container/crossing-borders-obstacles-and-incentives-to-researcher-mobility (p. 72)

[8] https://publikationer.vr.se/produkt/forskningens-framtid-svenska-forskares-mobilitet/ (p. 8)

[9] In Finland short term mobility is defined by the duration between 5 days and 1 month. Other countries take 3 months or even 1 year as borderline for long term mobility. See https://ec.europa.eu/research/evaluations/pdf/archive/fp7-evidence-base/experts_analysis/a.%20inzelt_-_researchers'_mobility.pdf (p. 11)

[10] For the purpose of this study the Baltic Sea Region is defined as a group of Northern, Northeastern and Central European countries, comprising the five Nordic states (Denmark, Sweden, Norway, Iceland and Finland) plus Russia, Estonia, Latvia, Lithuania, Poland and Germany.

the conditions are even worse. Since sufficient published data concerning bilateral researcher exchanges from and to these countries are not available, other methods of analysis have to be applied in order to get an impression on the size and directions of mobility flows.

The overall purpose of this study is to increase the understanding of researcher mobility patterns within the BSR. The results may provide a basis for possible interventions by politicians and other decision makers in the scientific field. The central focus is on gaining a picture as complete as possible on concrete numbers and directions of researcher exchanges and on the identification and explanation of underlying trends.

In order to achieve these goals, the study will draw as much as possible on existing studies and data that are available from statistical offices and mobility funding agencies at the national and international levels. Although data gained in this way are not standardized and do not completely reflect actual movements of researchers they still, if analyzed carefully, will allow valuable insights into basic trends throughout the BSR. These trends will be identified from the perspective of individual countries and evaluated in the light of a possibly emerging integrated Baltic Sea Research Area.

The main part of this study (2.) consists of a synoptic overview over mobility flows in the BSR (2.1.) and individual analyses of patterns of researcher exchange on a country by country basis (2.2.). Chapter (2.1.) aims as far as possible at providing a synoptic overview over mobility flows throughout the whole BSR. The only career stage of researchers, at which data concerning international mobility exist almost completely for all BSR countries, is that of doctoral students. The corresponding figures are available from the OECD and the EU. They thus provide a unique opportunity to compare all bilateral mobility relations throughout the region on an equal footing and thus achieve a profound picture on overall region-wide trends. Similar, albeit with lower quantities and reflecting only one rather small segment of all ongoing researcher mobility, figures on researcher mobility in the context of the EU's Marie Curie actions are available for all BSR countries on a an equal footing. They thus form another basis for a synoptic analysis of the various mobility relations throughout the region.

In contrast, the country by country analysis (2.2.) focuses on the situation in all BSR countries individually. Due to the very large differences concerning national statistical practices, here the findings vary strongly from country to country in terms of scope and content. However, if evaluated jointly and in combination with the results from chapter 2.1., they contribute to the emergence of an overall impression of mobility patterns within the BSR. The final chapter (3.) summarizes the main findings and conclusions that could be obtained on this basis.

2. Empirical findings

2.1. Synoptic overview over mobility flows in the Baltic Sea Region

Before turning to the BSR countries individually, the following tables will provide an overview over numbers and trends of researcher mobility within the region as a whole. The first three tables deal with mobile doctoral students. They show the share (Table 1) respectively the number (Table 2) of foreign doctoral students in each of the BSR countries (plus in selected countries of comparison) differentiated by country of origin. Table 3 records the number of doctorates awarded to foreign students. The figures are based on data from the OECD and Eurostat. Since none of these organizations cover all BSR countries completely, an overall impression of mobility flows within the region can only be obtained approximately and by analyzing the three tables jointly.

Table 1: Mobile doctoral students (in percentage) in 2013

To / From	UK	DK	SE	NO	FI	EE	LV	PL
USA	6,5	3,4	1,9	2,4	1,2	1,8	0,7	1
Canada	2,2	0,9	0,6	0,3	1,1	0,9	3,4	0,3
UK		3	0,9	1	1,6	0,9	4,1	1,3
Belarus	0,1	0,1	0,4	0,4	0,1	0,5	4,1	7,6
Ukraine	0,2	0,4	1	1	0,8	0,9	3,4	27,6
Denmark	0,3		0,8	1,2	0,5	0,5	0,7	0,1
Sweden	0,5	6,5		2,5	3,6	2,3	1,4	1,3
Norway	0,3	3,6	0,7		0,8	0,5	2,7	0,3
Iceland	0,1	1,7	0,5	0,5	0,1	0,9	0	0
Finland	0,2	0,8	0,8	1,1		3,7	2	0,1
Russia	0,5	1,6	2,2	5	7	25,2	7,4	0,4
Estonia	0,1	0,1	0,3	0,1	3,4		4,1	0,3
Latvia	0,1	0,4	0,3	0,3	0,5	9,2		0,3
Lithuania	0,3	1,5	0,5	0,9	1,1	2,3	6,8	0,9
Poland	1,3	4	1,6	2,5	2,6	0,9	3,4	
Germany	5,2	10,8	7,6	8,8	4,6	4,1	6,1	2,2
BSR total	**8,9**	**31**	**15,3**	**22,9**	**24,2**	**49,6**	**34,6**	**5,9**

Source: www.stats.oecd.org
No data available for Lithuania, Iceland, Germany, Russia, Belarus, Ukraine and USA as host countries.

Significant:
Linguistic/cultural relationships
neighboring countries **Overall east-west mobility flow**

Table 2: Mobile doctoral students (in absolute numbers) in 2014

From \ To	UK	CH	AT	DK	SE	NO	IS*	FI	EE	LV	LT	PL	DE**
USA	2906	332	108	102	149	31	7	53	7	4	2	10	387
CN	5105	523	131	329	1024	150	3	404	6	2	0	17	3914
Europe	**15479**	**8950**	**4530**	**1783**	**2359**	**659**	**54**	**1562**	**158**	**116**	**66**	**456**	**8500**
UK		197	170	80	69	16	7	67	2	3	11	6	181
CH	342		85	22	28	14	1	17	1	1	0	2	208
AT	275	327		28	55	10	2	35	1	4	0	2	449
DK	139	26	5		53	28	2	16	1	1	2	3	41
SE	242	72	49	187		34	1	92	5	3	3	0	47
NO	130	18	12	101	53		0	23	1	4	2	0	20
IS	22	7	0	48	37	6		7	1	1	0	0	7
FI	113	36	21	22	52	16	0		7	4	0	2	38
EE	50	7	3	6	19	2	0	121		3	3	3	30
LV	49	12	3	16	27	3	1	13	25		3	4	42
LT	120	21	11	41	37	16	1	39	5	15		10	65
PL	549	221	148	120	104	44	6	86	2	4	1		624
DE	2356	3624	1980	323	517	119	10	176	8	13	6	18	
BSR total	**3770**	**4044**	**2232**	**864**	**899**	**268**	**21**	**573**	**55**	**48**	**20**	**40**	**914**

Source: Own representation based on data from Eurostat and DZHW *value for 2013 ** value for winter term 2014/15

Significant: Linguistic/cultural relationships; Overall east-west mobility flow; Neighboring countries; Overall south-north mobility flow

Table 3: Mobile doctoral students by awarded doctorates in 2014 (absolute numbers)

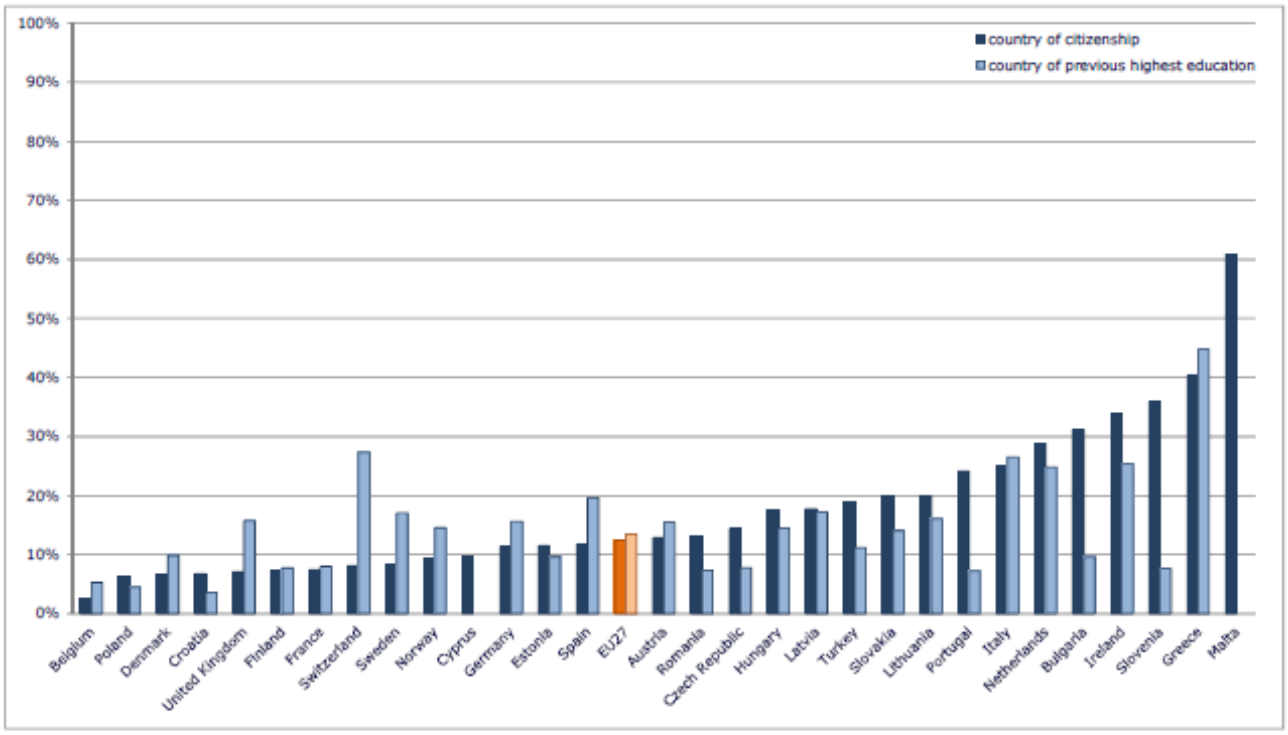
From \ To	UK	CH	DK	SE	NO	FI	EE	LV	DE
USA	793	49	17	14	9	10	0	0	24
UK		27	17	10	2	6	0	2	23
Switzerland	59		4	4	5	4	0	0	17
Belarus	7	1	0	1	1	0	0	0	12
Ukraine	19	16	5	13	2	4	0	0	29
China	1161	96	67	196	39	57	1	0	338
Denmark	27	3		3	7	2	0	0	3
Sweden	53	12	38		11	19	0	0	7
Norway	33	7	28	8		5	0	0	2
Iceland	11	2	9	7	2	1	0	0	1
Finland	26	9	7	9	8		1	0	6
Russia	56	46	11	30	10	29	2	1	54
Estonia	11	1	1	3	0	7		0	1
Latvia	7	3	0	2	1	2	2		2
Lithuania	16	2	13	5	1	7	0	0	4
Poland	160	37	38	22	12	16	0	0	52
Germany	606	675	96	88	45	21	0	1	
BSR total	**1006**	**797**	**241**	**177**	**97**	**109**	**5**	**1**	**132**

Source: www.stats.oecd.org
No data available for Lithuania, Iceland, Russia, Belarus, Ukraine, China, Poland and USA as host countries.

Significant: Linguistic/cultural relationships; Overall east-west mobility flow; Neighboring countries; Overall south-north mobility flow

Another way to shed light on the various levels of internationalization in the respective BSR countries is to compare the different intensities of PhD degree mobility. Figure 1 shows that there are major differences within the region as to the share of young researchers per country who decide to gain a doctoral degree in other than the country where they gained their previous degree (outgoing mobility). Within the BSR this is most often the case with doctoral students from Lithuania and Latvia. In contrast, Polish and Danish PhD students most often earn their doctorates in their respective home countries.

Figure 1: International PhD degree mobility per country of citizenship and previous highest education (departure)



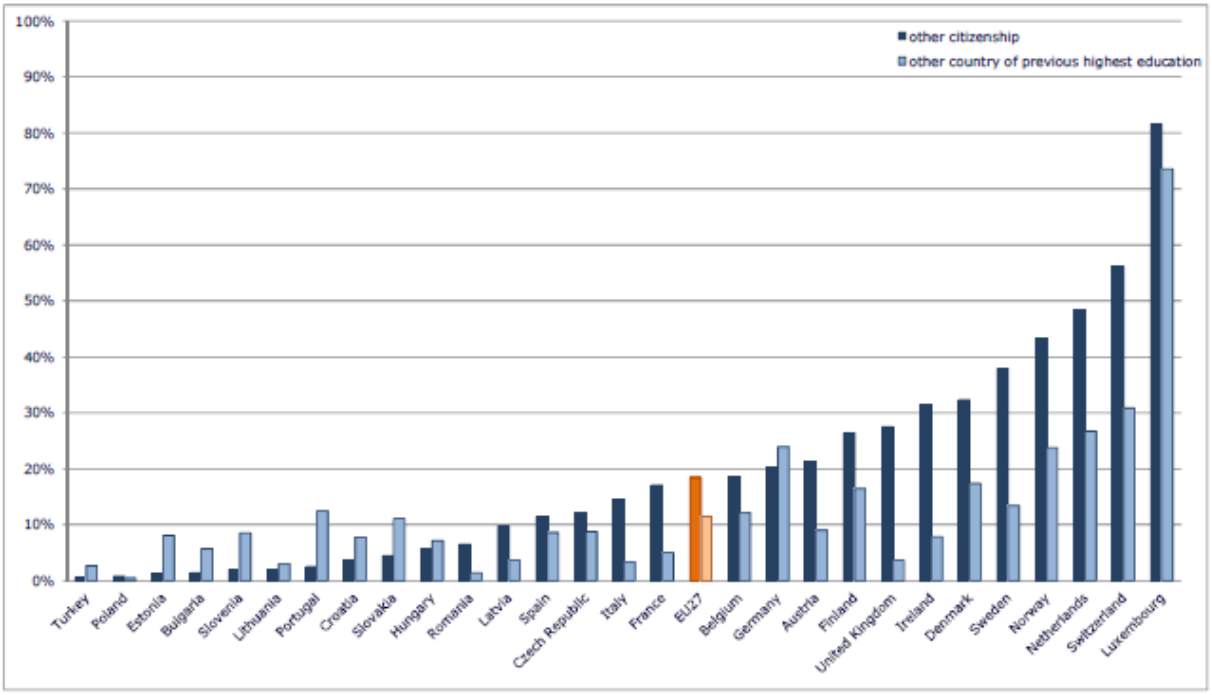
Source: MORE2 Higher Education Survey (2012)
Note:
- Share of PhD degree mobile researchers in current R1 (doctoral or equivalent) and R2 (post-doctoral or equivalent) career stages per country of PhD (n=3,892).
- With 'PhD degree mobility' defined as obtaining or having obtained a PhD in a country other than the one in which they obtained their previous degree.
- Countries with less than 30 observations are omitted: Iceland, Luxembourg and Macedonia (FYROM) for both and Cyprus and Malta also for country of highest previous education.

A rather different picture emerges when comparing the shares of foreign PhD students per country (incoming mobility). Figure 2 shows, that Norway, Denmark and Sweden occupy positions on top of the ranking and far above the EU average. In contrast, the share of foreign PhD students at universities in Poland, Estonia and Lithuania is the lowest within the region.

Again another impression on the degree of internationalization appears when comparing the share of those doctoral students per country, who are temporarily mobile during their PhD period (Figure 3). In this respect, especially Denmark is an interesting case. The country occupies the top position among the BSR countries and even comes second at the European level only after Italy. When

evaluating the three figures jointly the conclusion could be that Denmark obviously is a highly attractive place to gain a doctorate. Consequently, the number of incoming PhD students is highly above average, while Danes themselves prefer to stay in their home country when gaining a doctorate. Yet, they are strongly internationally oriented. They just do not intend to leave their country for good and thus are more prepared to gather international experience by means of temporary stays abroad.

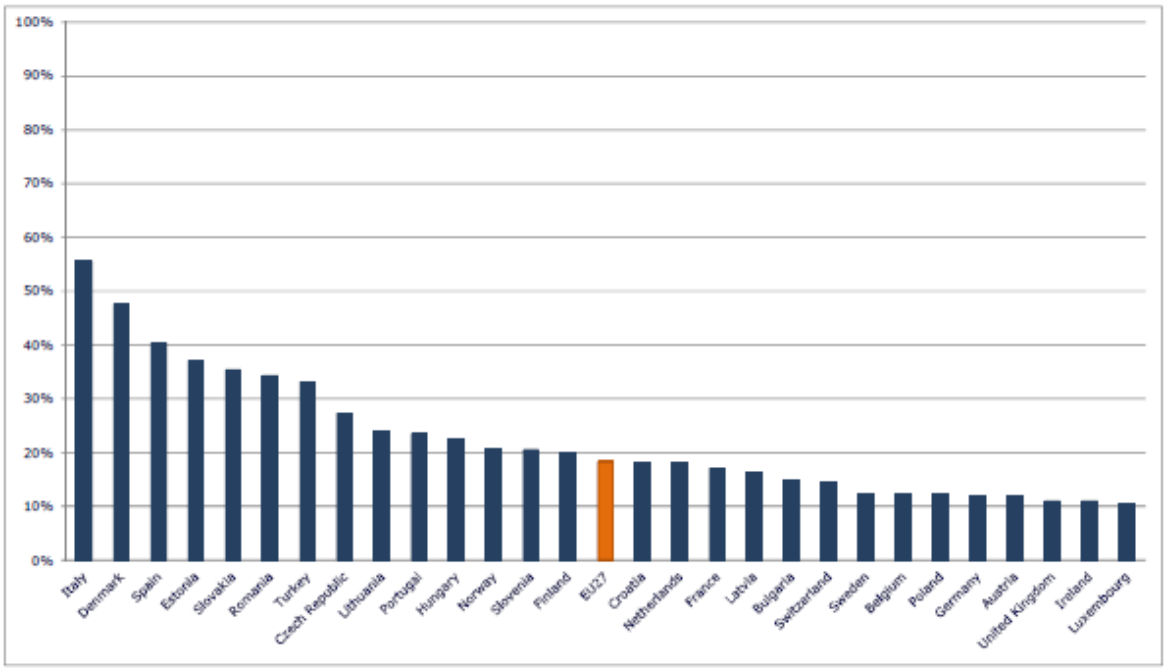
Figure 2: International PhD degree mobility per country of PhD (destination)



Source: MORE2 Higher Education Survey (2012)

Note:
- Share of PhD degree mobile researchers in current R1 (doctoral or equivalent) and R2 (post-doctoral or equivalent) career stages per country of PhD (n=3,892).
- With 'PhD degree mobility with respect to citizenship' defined as undertaking the PhD in a country other than that of citizenship
- And 'PhD degree mobility with respect to previous highest education' defined as having another country of PhD than the country of previous highest education
- Countries with less than 30 observations are omitted: Cyprus, Greece, Iceland, Macedonia (FYROM) and Malta.

Figure 3: International mobility for a limited period during PhD per country of PhD



Source: MORE2 Higher Education Survey (2012)

Note:
- Share of researchers >3 month mobile during PhD and in current R1 (doctoral or equivalent) and R2 (post-doctoral or equivalent) career stages per country of PhD. (n=3,892)
- With '>3 month mobility during PhD' defined as moving for 3 months or more to a country than the one in which they obtained or will obtain their PhD.
- Countries with less than 30 observations are omitted: Cyprus, Greece, Iceland, Macedonia (FYROM) and Malta.

The next table deals with mobility flows which take place within the context of the EU funded Marie Skłodowska-Curie actions. They comprise various schemes, which support mobility of researchers not only from Europe but also from other parts of the world. Generally, scientists at all career stages (pre- and post-doctoral as well as internationally renowned researchers) are eligible for funding.

Within the framework of Marie Curie actions financial support is given to measures such as the establishment of research networks, individual mobility fellowships in addition to research- and innovation staff exchanges. Moreover, co-funding of regional, national and international programs that finance mobility fellowships is provided.

For the purpose of this study, the comparison of researcher flows in the context of Marie Curie actions is of great value, since they provide the only framework for researcher mobility in which most of the countries in the BSR and beyond participate on an equal footing. Moreover, it is a great advantage that researchers at all career stages and from all scientific areas are recorded in the register. However, it is necessary to note that EU-supported researcher mobility represents only a small share of the total movements of scientists between the countries.

Table 4: Researcher Mobility supported by Marie Curie fellowships 2007-2014 (absolute numbers)

From \ To	UK	USA	DK	SE	NO	IS	FI	RU	EE	LV	LT	PL	DE	BY	UA
UK		255	25	65	10	7	-	156	-	-	-	6	120	26	67
USA	245		36	27	14	1	9	-	2	3	1	18	142	-	-
Denmark	32	45		11	3	13	1	7	-	-	-	-	20	-	-
Sweden	66	52	22		5	1	1	28	7	-	-	3	22	7	10
Norway	7	13	2	10		2	-	1	-	-	1	1	5	-	8
Iceland	4	2	5	3	-		-	14	-	-	-	-	7	-	-
Finland	37	19	6	9	-	-		39	8	-	-	-	24	2	11
Russia	273	-	18	34	8	14	52		8	21	17	62	190	2	-
Estonia	9	5	3	3	1	-	6	12		-	-	1	8	-	2
Latvia	4	-	1	4	-	-	1	19	1		-	-	7	11	18
Lithuania	17	14	1	3	-	-	2	15	1	-		4	10	1	33
Poland	225	86	11	25	7	14	7	90	-	-	-		120	23	115
Germany	540	255	85	70	23	7	18	102	13	1	-	18		10	42
Belarus	50	-	3	8	-	-	2	2	1	9	4	25	17		-
Ukraine	128	-	5	19	12	-	8	-	6	26	31	128	70	-	

Source: Own calculation, based on: www.ec.europa.eu/research/mariecurieactions/funded-projects/statistics/index_en.htm

Significant: Linguistic/cultural relationships | Overall east-west mobility flow | Neighboring countries | Overall south-north mobility flow

Four major trends can be identified when analyzing mobility flows of doctoral students and EU-supported researcher mobility within the BSR. First, an overall one-sided east-west mobility direction is prevailing. This becomes apparent when realizing the very high numbers of researchers that for instance move from Lithuania to Denmark, from Poland to Germany or from Russia to Finland. Those movements are not compensated by corresponding flows in the opposite direction. In fact, the trend is noticeable not only within the region but also beyond. There are extraordinarily high numbers of researcher, who move from all countries in the region to the UK and to the USA. But the region also gains from a net inflow of researchers in east-west-direction, coming from countries in its eastern neighborhood. There are thus high numbers of researchers moving from the Ukraine and Belarus to Poland, Lithuania, Latvia and Germany.

Second, the observed east-west trend is supplemented by an overall one-sided south-north mobility flow of researchers.[11] This trend becomes most striking when comparing numbers of researchers who move from Germany and Poland to Denmark, Sweden and Norway. In each bilateral relation the numbers are many times larger in south-north direction than in the opposite way. This trend is evident also in the one-sided south-north mobility flows from Lithuania to Latvia, from Latvia to Estonia and from Estonia to Finland.

Third, it is striking that linguistic as well as historical and cultural relations strongly influence the characteristics of international researcher mobility choices within the BSR[12]. They apparently explain the high numbers of Norwegian and Icelandic doctoral students at Danish universities as well as the high exchange rates of researchers between Finland and Estonia or Poland and Lithuania.

[11] http://ec.europa.eu/euraxess/pdf/research_policies/more2/Final%20report.pdf (p. 151)
[12] http://dx.doi.org/10.1787/5k43nxgs289w-en (p. 37)

Furthermore, linguistic ties strongly explain the extraordinarily high mobility rates with some countries outside the region, such as between Germany and Switzerland and Austria as well as between Poland and the Ukraine.

Fourth, closely related to the third trend, but not always identical with it, is the factor of geographic proximity. That is, countries tend to have especially high researcher exchange rates with their direct neighbors.[13] This applies all the more, if important universities and research institutions are located near to the border and are thus easy to access from the neighboring country.[14] For example, his is a characteristic feature of both the German-Swiss and the Danish-Swedish border regions.[15] Further examples in which geographic proximity rather than cultural ties explain high rates of bilateral researcher mobility are country pairs such as Finland and Russia or Lithuania and Latvia.

The trends presented in this chapter basically apply to both of the above analyzed frameworks of researcher mobility, namely doctoral students and Marie Curie actions. However, most of them appear more pronounced in the case of doctoral student mobility. The reason may be partly related to the fact that the latter usually concern younger people and lower budgets. Consequently, they are more likely to choose easily accessible countries with familiar languages and mentality when taking their first steps in international environments. In contrast, researchers at more advanced career levels would rather select the destination for a research stay depending on questions of professional suitability.

The last Table (5) of this chapter compares country-specific exchanges of teachers in higher education, which are supported by the Nordic Council of Ministers as part of the Nordplus program. It is thus another opportunity to analyze how characteristic patterns of mobility relations emerge between countries with similar starting conditions. The program aims at short term visits abroad, with a minimum duration of 8 teaching hours, and is eligible for teachers who are employed at higher education institutions in a Nordic or Baltic state. Thus major parts of the BSR are covered, with the exception of Germany, Poland and Russia.

[13] http://isites.harvard.edu/fs/docs/icb.topic1459278.files/2-28-14_STEPHAN-Paula_1_Foreign-Born-Scien-Mobility-16-Countries_Nature-Biotech_paper.pdf; https://publikationer.vr.se/produkt/forskningens-framtid-svenska-forskares-mobilitet/ (p. 11)

[14] http://www.wissenschaftweltoffen.de/publikation/wiwe_2016_verlinkt.pdf (p. 141)

[15] http://dx.doi.org/10.1787/5k43nxgs289w-en (p. 18)

Table 5: Teacher (higher education) mobility supported by Nordplus 2014/15 (in absolute numbers)

To / From	DK	SE	NO	IS	FO	GL	AX	FI	EE	LV	LT	Total from
DK		35	62	18	6	11	2	46	8	17	7	**212**
SE	23		32	8	3	-	3	36	8	8	6	**127**
NO	45	28		15	3	-	-	27	10	7	4	**139**
IS	8	19	15		5	1	-	9	3	10	-	**70**
FO	2	2	3	2		-	-	-	-	-	-	**9**
GL	2	2	-	-	-		-	-	-	-	-	**4**
AX	-	-	-	-	-	-		1	1	2	-	**4**
FI	26	58	45	12	1	-	6		30	10	10	**198**
EE	9	13	8	4	-	-	-	11		9	19	**73**
LV	6	7	13	-	-	-	1	20	7		17	**71**
LT	12	7	4	3	-	-	-	19	5	19		**69**
Total to	**133**	**171**	**182**	**62**	**18**	**12**	**12**	**169**	**72**	**82**	**63**	

Source: Nordplus higher education mobility statistics 2014/15

Compared to the previously discussed examples of researcher exchange, the distribution of mobility flows within the Nordplus program is relatively balanced. Most countries do not show major discrepancies regarding the number of incoming and outgoing grantees. The only country with a clear negative balance is Denmark. In contrast, Norway has the highest mobility surplus among the bigger Nordic nations, whereas the most positive results are achieved by the autonomous territories Faroe Islands, Greenland and Aaland Islands. A noticeable accumulation of mobility rates can be observed within both the western and the eastern parts of the BSR. Thus, the numbers of teacher exchanges within a group formed by the Baltic States plus Finland and a group formed by the Western Nordic countries respectively are slightly higher than the numbers of mobile teachers across these two groups.

2.2. Mobility patterns from the perspective of individual countries

2.2.1. Denmark

Danish researchers are more often short term mobile than most of their colleagues in all other European countries. Concerning short term mobility Danish PhD students are in second place (after Italy). Danish post doc researchers even occupy the first place. 55% of them have spent a temporary stay of more than three months abroad during the last 10 years. In contrast, only very few Danes

spend the whole period of their PhD studies abroad. This is obviously a consequence of the comparatively high salaries, which PhD students get in Denmark. [16]

The high degree of internationalization in the Danish academic community is also reflected by the high proportion of researchers in Denmark who hold a foreign citizenship. With a share of 31% Denmark ranked at the 5th place in Europe in 2012. However, this high degree of internationalization is more typical for the lower career levels of Danish researchers. It seems to be more difficult for foreigners to acquire more advanced positions within the Danish research environment. The table below shows that among newly employed researchers only 11% at professor but 21% at lecturer level "Adjunktniveau" had a position in a foreign country immediately before.

Table 6: Share of employees at professor-, lector- and adjunktlevel in 2011-2013, who had been employed in a foreign country immediately before, by subject area

	Professorniveau		Lektorniveau		Adjunktniveau		I alt	
	Antal	Pct.	Antal	Pct.	Antal	Pct.	Antal	Pct.
HUM	7	10 %	25	10 %	64	20 %	96	15 %
SAM	26	12 %	45	14 %	111	23 %	182	18 %
NAT	17	10 %	49	18 %	428	43 %	494	34 %
JORD	6	15 %	6	15 %	20	17 %	32	16 %
SUND	25	10 %	15	7 %	87	19 %	127	14 %
TEK	14	13 %	22	8 %	64	23 %	100	15 %
I alt	95	11 %	162	12 %	774	29 %	1.031	21 %

Kilde: Uddannelsesministeriet på basis af indberetninger fra universiteterne

Source: http://ufm.dk/forskning-og-innovation/statistik-og-analyser/forskere-ved-universiteterne/forskerrekrutteringen-pa-universiteterne-2011-2013-statistiknotat-2.pdf

In order to make Denmark more popular with foreign researchers, the country has introduced a special reduced tax rate of 25% for 60 months. Employees at research institutions, who had not been Danish tax residents in the previous 10 years, are eligible for this privileged rate.[17]

Outgoing mobility

Denmark does not produce any official statistics, which record outgoing and incoming researcher mobility by individual countries of origin and of destination respectively.[18] In order to still get an impression on which countries are the most frequent mobility partners of Denmark, various statistics that record certain parts of mobility separately have to be evaluated. As far as outgoing mobility is concerned, the tables above (2, 3, 4) as well as Figure 4 indicate, that the US and UK are by far the most frequent destination countries for Danish researchers. Within the BSR, the ranking is not as

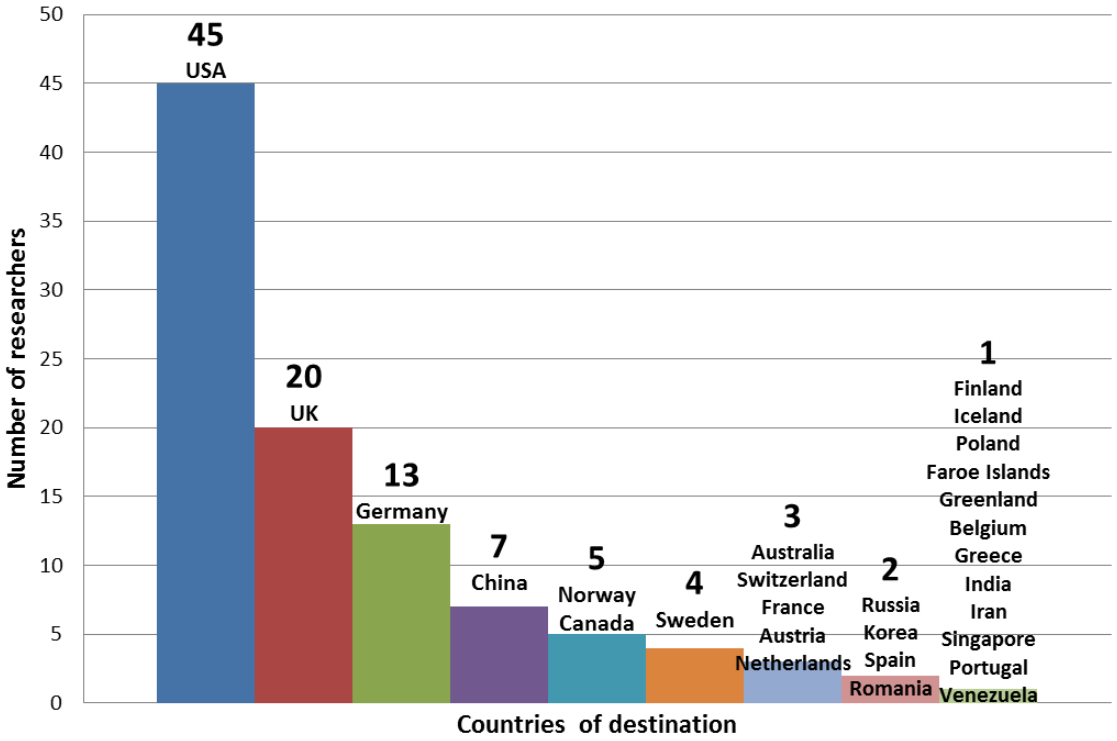
[16] http://ufm.dk/forskning-og-innovation/rad-og-udvalg/danmarks-forsknings-og-innovationspolitiske-rad/dfir-briefs/filer/dfirbrief_del2_endelig.pdf

[17] http://www.skm.dk/skattetal/statistik/generel-skattestatistik/bruttoskatteordningen-for-forskere-og-noeglemedarbejdere-fakta-og-statistik

[18] According to information from the National Statistics Office (Danmarks Statistik), the confederation of Danish universities (Universities Denmark) and the Danish Ministry of Higher Education and Science, September 2016

clear. Apparently, it has to be differentiated between doctoral students and more advanced researchers. Whereas the former most frequently chose Sweden, the latter more often go to Germany. However, the ranks behind Germany and Sweden are clearly occupied by the other Nordic countries, followed by Russia, Poland and the Baltic countries.

Figure 4: Temporary research stays of Danish postdoc researchers supported by the Danish Council for Independent Research in 2015

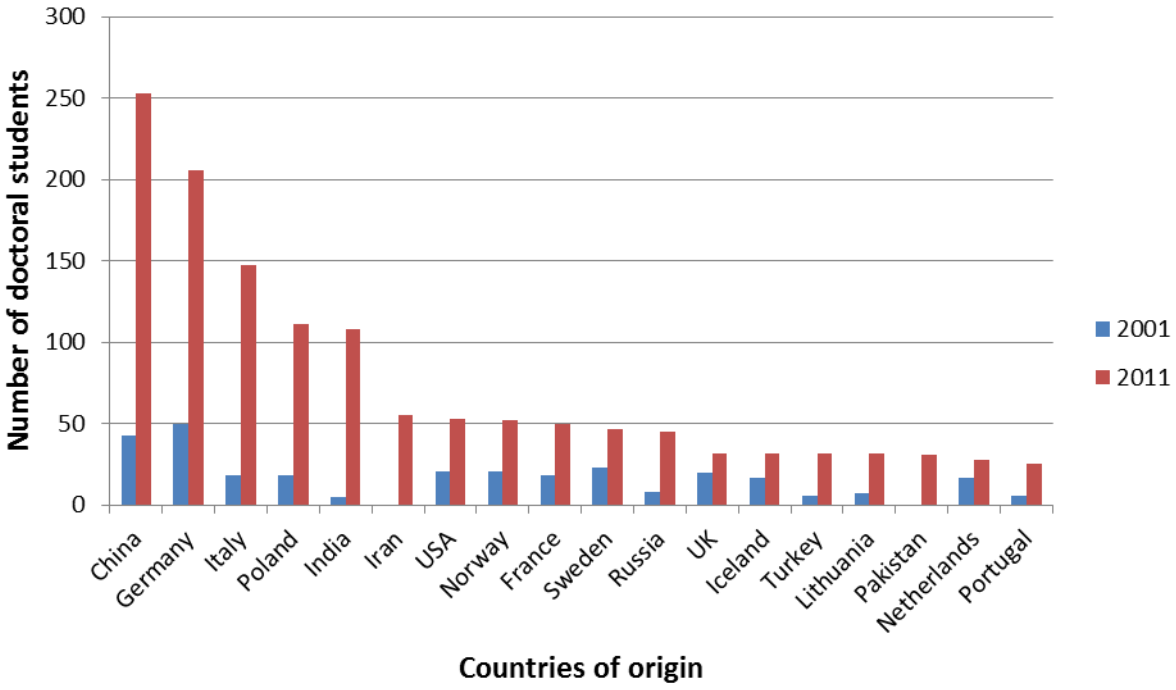


Source: http://ufm.dk/publikationer/2016/filer/dff_aarsrapport_2015_web.pdf

Incoming mobility

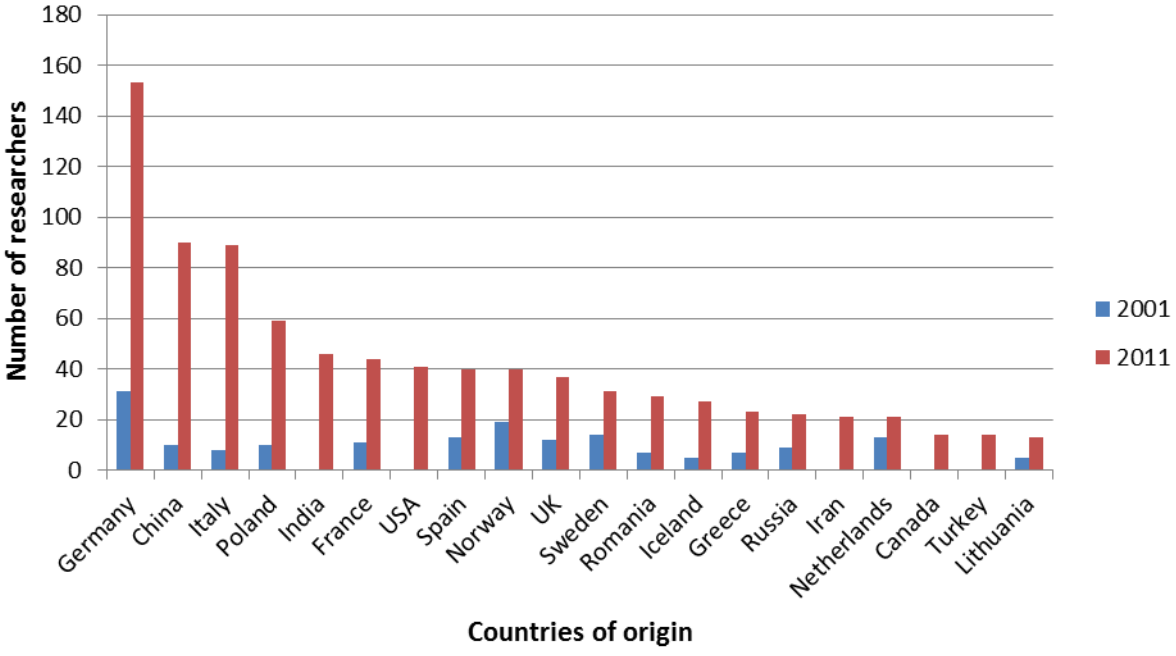
The number and the composition of incoming researchers to Denmark by country of origin have changed dramatically in recent years. The following two figures compare the most frequent countries of origin for doctoral students and young researchers coming to Denmark in the year 2001 versus 2011. The most striking observation is a trend towards more distant countries. Thus, China has taken over the number one position from Germany as the main country of origin for foreign doctoral students in Denmark. Moreover, Denmark's Nordic neighbors Norway and Sweden fell far behind in the ranking. The top places have instead been occupied by more exotic countries such as Italy, India and Iran. Among the BSR countries, next to Germany, Poland is the most important country of origin, ahead of Sweden, Norway and Russia. A special feature for Denmark is the high numbers of researchers coming from Iceland. They exceed by far the numbers of bigger countries within the region such as Finland, Lithuania, Latvia and Estonia. A plausible explanation may be seen in the close ties between the two countries in terms of language, culture and history.

Figure 5: Foreign doctoral students in Denmark by country of origin



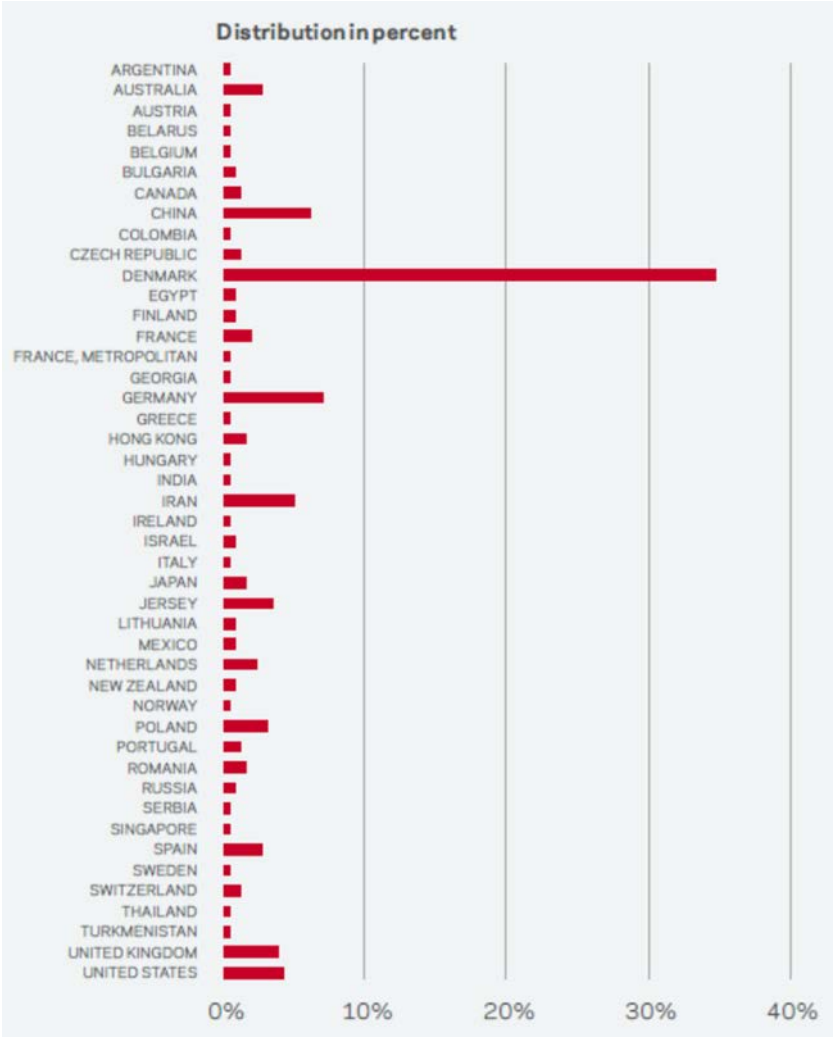
Source: Own presentation based on data from the Danish Ministry of Higher Education and Science

Figure 6: Incoming young researchers to Denmark by country of origin



Source: Own presentation based on data from the Danish Ministry of Higher Education and Science

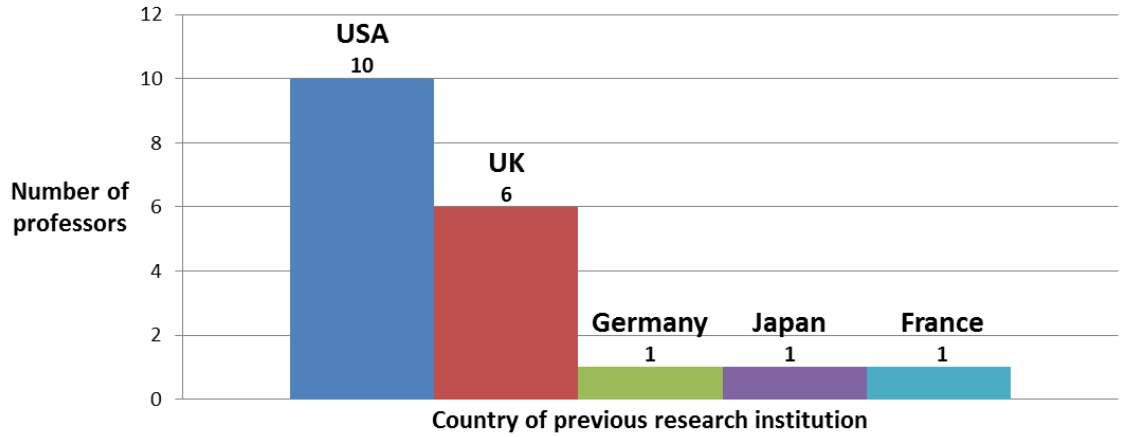
Figure 7: Post-docs at Danish Centers of Excellence (2007-2014) in percent by citizenship



Source: http://dg.dk/filer/Publikationer/The-Post-doc-Challenge.pdf

The final figure of this chapter shows incoming mobility supported by the Danish National Research Foundation as part of the Niels Bohr professorship program. It thus gives some impression on researcher mobility at a very advanced carrier level. Over a period of five years, Niels Bohr professors usually spend about six months a year in Danish research environments. About 25% of the researchers are of Danish origin. The program thus also has the side effect to serve as an incentive for outstanding Danish researchers to return to Denmark.

Figure 8: Incoming "Niels Bohr Professors", funded by the Danish National Research Foundation 2006-2016, by country of previous research institution



Source: http://dg.dk/en/other-funding-mechanisms/the-professorship-programs/

2.2.2. Sweden

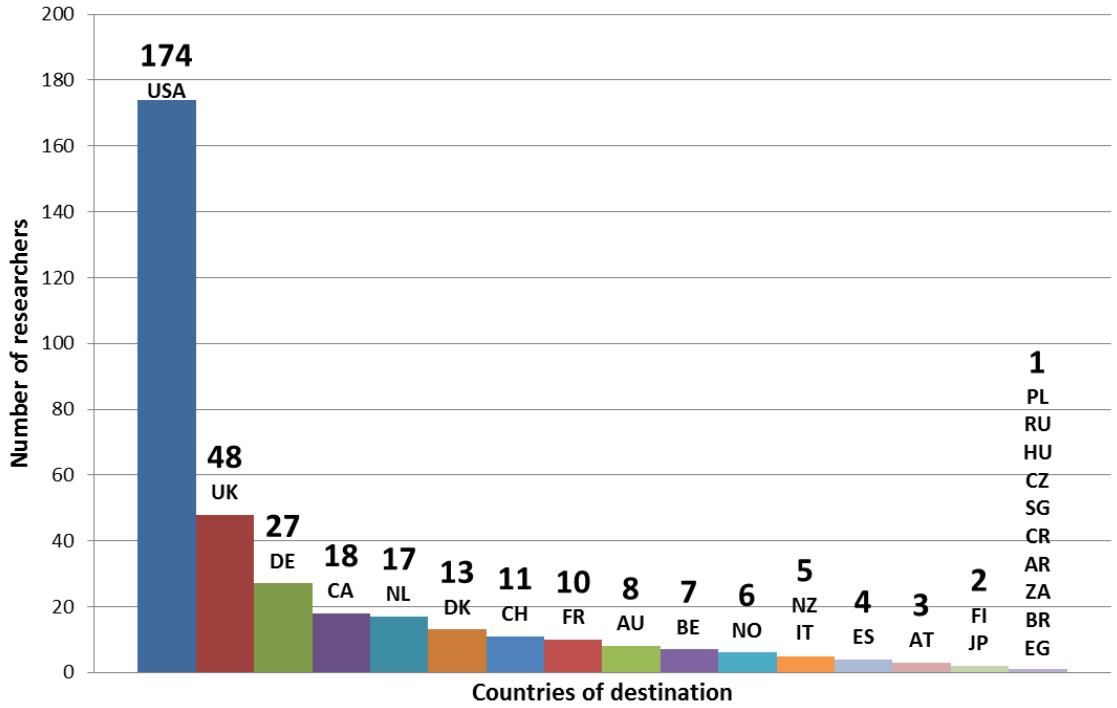
Similar to Denmark, the Swedish academic community is also characterized by a high degree of internationalization. In 2015 30% of all employees within the research and higher education sector had a foreign background. The largest groups hereof consisted of Germans (12%) and Russians (10%).[19] The share of foreign employees was highest in natural (42%) and technical sciences (35%) and lowest in social sciences (20%).[20] There is however a discrepancy regarding the involved career levels. Whereas the majority of lower academic positions in 2015 were occupied by staff with a foreign background, their share at higher career levels was only about 20%.[21]

Outgoing mobility

In Sweden no systematic statistic on outgoing and incoming researcher mobility is produced officially.[22] Trends have thus to be derived from data made available from existing mobility funding programs individually. In addition to the tables above (1-4) the following comparison of host countries for temporary research stays of Swedish post-doc researchers give an impression on which countries Swedish scientists chose most frequently for a research stay abroad. The funding period for each postdoc is 18-36 months of which at least two-thirds have to be spent abroad.

[19] https://publikationer.vr.se/produkt/forskningens-framtid-svenska-forskares-mobilitet/
[20] Årsrapport 2016 för universitet och högskolor
[21] http://www.scb.se/Statistik/UF/UF0202/2015A01S/UF0202_2015A01S_SM_UF23SM1601.pdf
[22] According to information from The Swedish Higher Education Authority and The Swedish Foundation for International Cooperation in Research and Higher Education (STINT), September 2016

Figure 9: Temporary research stays of Swedish postdoc researchers supported by the Swedish Research Council starting in the years 2012-2016



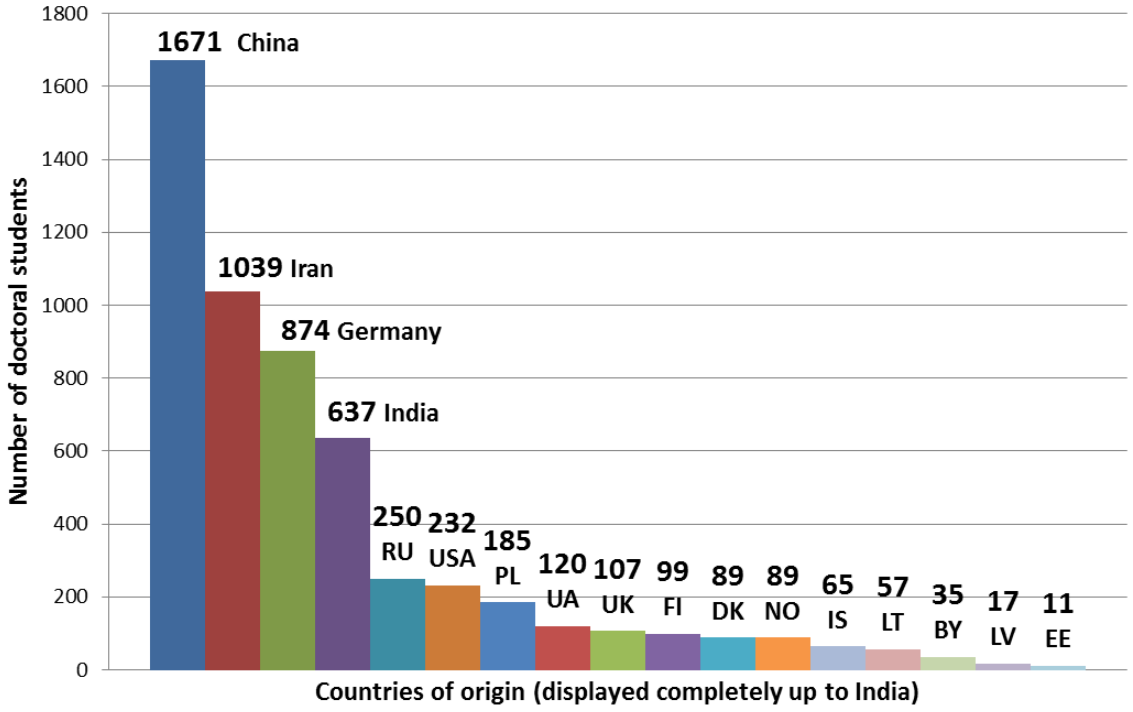
Source: www.vr.se/forskningsfinansiering/bidragsbeslut/internationellpostdok.4.41c4c50b1195b50750780002260.html

The outstanding importance of the USA as a country of destination for Swedish researchers is even more pronounced as in the case of Denmark. This becomes apparent when comparing the respective support programs for postdoc researchers. Whereas only 41% of the researchers, funded by the Danish Council of Independent research choose the USA for a research stay abroad, the percentage is 48% in the corresponding funding program of the Swedish Research Council and even 68% in another Swedish fellowship program for postdoc researchers, funded by the private Wenner-Gren Foundation (see below).

Within the BSR Germany and Denmark are the most frequently chosen countries of destination for Swedish researchers. There is, however, a difference regarding the career level. Whereas doctoral students more often go to Denmark, researchers at a more advanced stage of their career tend to choose Germany when going abroad. The importance of Denmark in comparison to other Nordic countries is apparently also enhanced by the proximity of large and renowned higher education institutions in the greater Copenhagen area that are easy to access from the southern parts of Sweden.

Incoming mobility

Figure 10: New foreign entrants to doctoral training programs at Swedish universities 2006-2015



Source: www.uka.se/download/18.6ae0944a15510e7b6ec22b/1465457174955/SM1601-universitet-och-hogskolor-doktorander-och-examina-pa-forskarniva-2015.pdf

The overall number of foreign entrants to doctoral training programs in Sweden has increased from 233 in 2006 and reached a peak in 2012 of 498. After that the numbers decreased slightly again to 400 in 2014. Within the represented period no major changes could be observed concerning the relation between numbers of doctoral students and the respective countries of origin. However, slightly increasing trends in numbers could be recorded in the case of new entrants from China, Ukraine, USA, UK and Germany. Numbers from the Nordic countries remained stable. In contrast, the number of doctoral students from Poland was slightly decreasing during the observed period. Among all students, who started a doctoral training in 2015, 38% were foreigners, who moved to Sweden less than 2 years before.[23] The share of foreigners, who gained their doctorate in that year, was 36%.[24]

In addition to publicly funded programs some major private institutions also support researcher mobility in Sweden. Two of the biggest are the Axel Wenner-Gren Foundation for International Exchange of Scientists and the Foundation Wenner-Grenska Samfundet. Incoming researchers are subsidized for a maximum period of two years via housing grants. They are offered apartments in the Wenner-Gren Center building in Stockholm. In 2015 researchers from 41 nations were awarded these grants. Sorted by number, the main countries of origin were Germany, China, Spain, Italy, Japan, India, France, USA, Great Britain, Australia, and Canada. The Wenner-Gren Foundation

[23] http://www.uka.se/statistik--uppfoljning/arsrapport-2016-for-universitet-och-hogskolor.html
[24] http://www.scb.se/Statistik/UF/UF0204/2015A01J/UF0204_2015A01J_SM_UF21SM1601.pdf

supports outgoing researcher mobility among others by postdoctoral fellowships. Here, 68% of the grantees chose the USA as destination country for a research stay abroad.[25]

When analyzing the mobility flows from and to Sweden within a BSR context it is striking that they are not always balanced. The strongest discrepancy can be observed in flows of doctoral students between Sweden and Germany /Poland which almost exclusively go in south-north direction. Thus 514 German and 107 Polish doctoral students went to Sweden in 2014 while in the opposite direction only 47 Swedish doctoral students came to Germany and none to Poland in the same year. In contrast, a more balanced relationship between these countries can be observed in the case of researcher exchange in the context of Marie Curie actions.

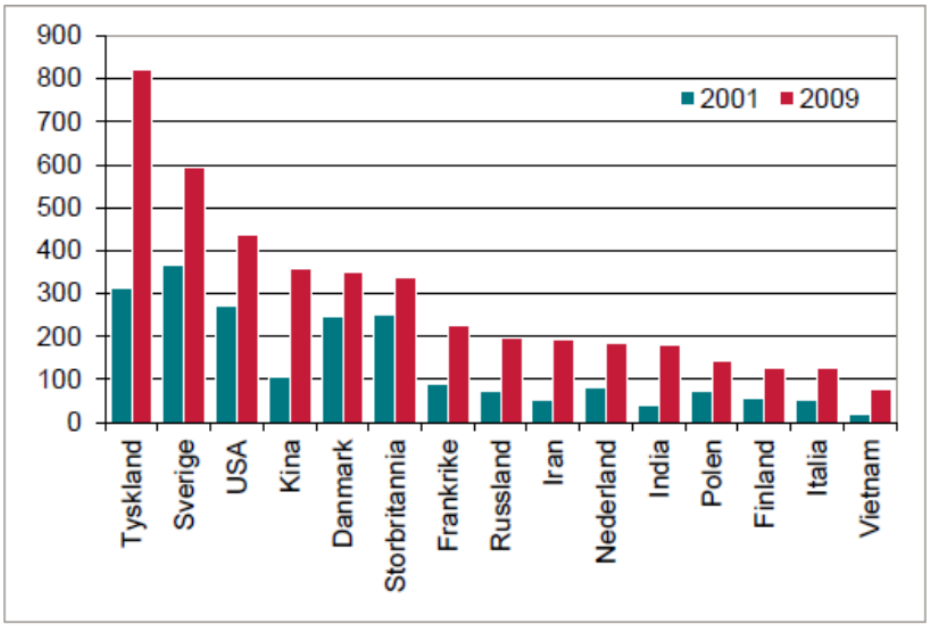
2.2.3. Norway

Among all countries analyzed in this study, the degree of internationalization of the academic community is highest in Norway. Moreover, together with Denmark, Norway is one of the few countries in the region with an overall positive researcher mobility balance. This internationalization process has intensified rapidly since the beginning of this century. The proportion of researchers with other than Norwegian citizenship in the country's higher education and public research sector increased drastically from 11% in 2001 to 20% in 2012.[26] Even more sharply was the increase of doctoral degrees awarded to researchers with a foreign citizenship from 24% in 2006 to 37% in 2015.[27]Norway, however, does not produce statistical information, which records outgoing researcher mobility flows by individual countries of destination. Numbers and comparisons of incoming mobility by countries of origin are only compiled on an irregular basis and at long intervals.[28]

As to the composition of incoming researchers there is a clear trend towards more distant countries. Until the turn of the millennium most foreign scientist came from the direct neighbor country Sweden. Then Germany took over the number one position. China, which used to be far behind in the ranking, replaced Denmark from the forth place in 2009. Also other geographically more distant countries like Russia, Iran, India and Vietnam advanced significantly in this ranking.

[25] http://www.swgc.org/annual-report.aspx
[26] https://www.regjeringen.no/no/tema/forskning/innsiktsartikler/forskningsbarometeret/id635788/ (p55)
[27] https://brage.bibsys.no/xmlui/bitstream/handle/11250/2409456/4/September2016_fra_doktorgradsregisteret.pdf
[28] According to information from NIFU (Nordisk institutt for studier av innovasjon, forskning og utdanning), October 2016. A new survey on immigrants to the Norwegian higher education and research environments is scheduled for 2017.

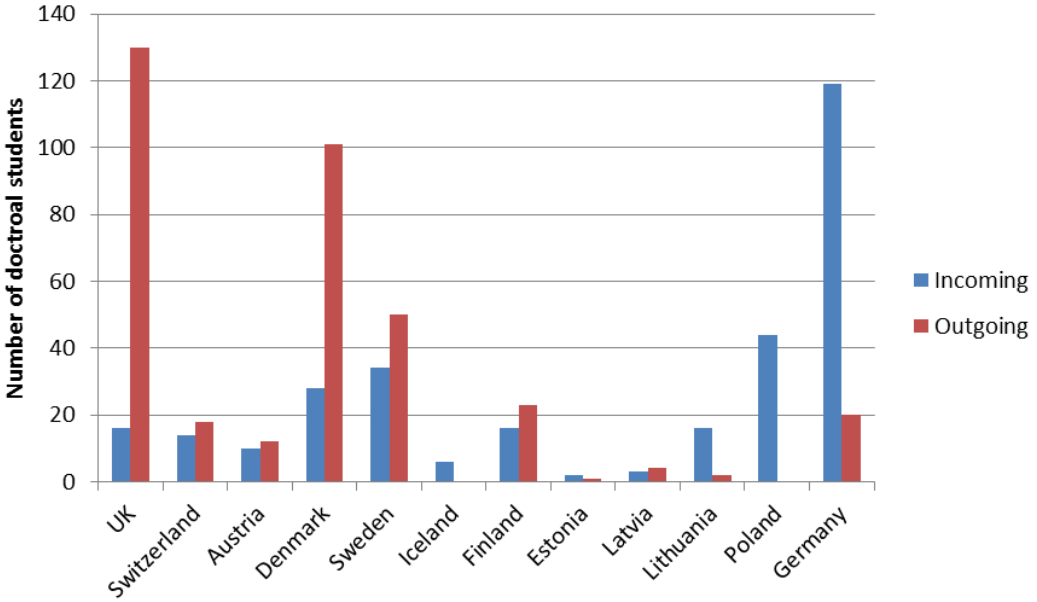
Figure 11: Numbers of incoming researchers to Norway by countries of origin



Source: NIFU/SSB

Current trends of researcher mobility from and to Norway can be derived from statistics, reflecting international flows of doctoral students. Researcher mobility on a more advanced career stage to a large extent takes place within the Marie Curie fellowship program (see Table 4). Both contexts have the advantage, that they enable a juxtaposition of in- and outgoing flows on the same basis. The overall finding for Norway is that there is a positive mobility balance with countries in the Eastern and Southern parts of the BSR (most striking Germany, Poland and Lithuania), whereas negative mobility balances prevail with countries in the Western and Northern parts of the region (most striking UK, Denmark and Sweden).

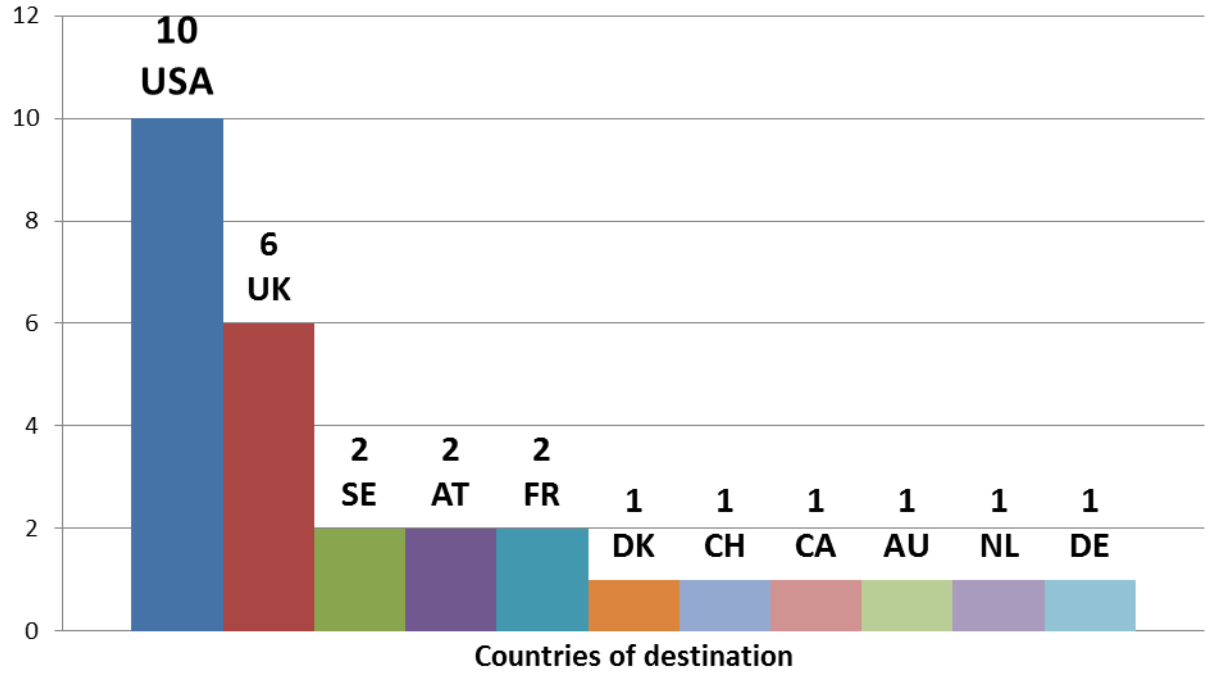
Figure 12: Mobility of doctoral students from/to Norway



Source: Own representation based on data from Eurostat and DZHW. The values for Iceland and Sweden (outgoing) are for 2013

In 2014 a new program for encouraging international mobility of young researchers has been started by The Research Council of Norway. Since then, two funding periods have been initiated. The fellowships support research projects of postdoc researchers for a period of three years, of which the two first have to be spent abroad. The following figure shows the distribution of destination countries, which the grantees of the first two rounds have chosen for their research-stays abroad. More than 50% will spend the time in either the USA or the UK.

Figure 13: Outgoing FRIPRO Postdoc fellows from Norway, total numbers for 2014-2015



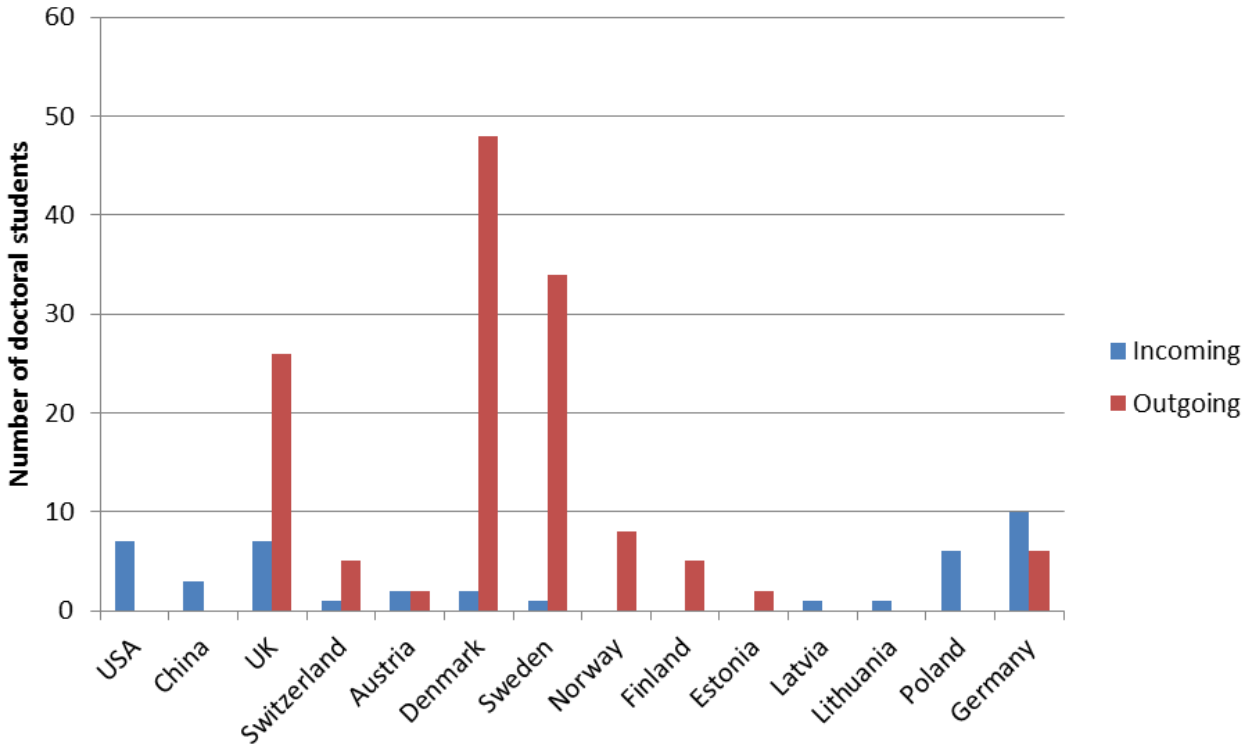
Source: own compilation on the basis of data from The Research Council of Norway

2.2.4. Iceland

Iceland does not produce official statistics on international researcher mobility, neither at national nor at university level.[29] Related information thus has to be compiled of data made available by international organizations such as the EU and the OECD. The following figure compares numbers of incoming and outgoing doctoral students between Iceland and the BSR as well as a few other countries. It reveals the extraordinary importance of Denmark and, at some distance behind, of Sweden and the UK as the main host countries for Icelandic PhD researchers. Germany is in a middle position and more close than any other BSR country to a balanced exchange relationship with Iceland. Mobility relations between Iceland and most of the BSR countries in the context of Marie Curie actions are generally more balanced (see Table 4).

[29] According to information from The Icelandic Centre for Research (rannis) and from the director of the University of Iceland's International Office, September 2016

Figure 14: Mobility of doctoral students from/to Iceland in 2013



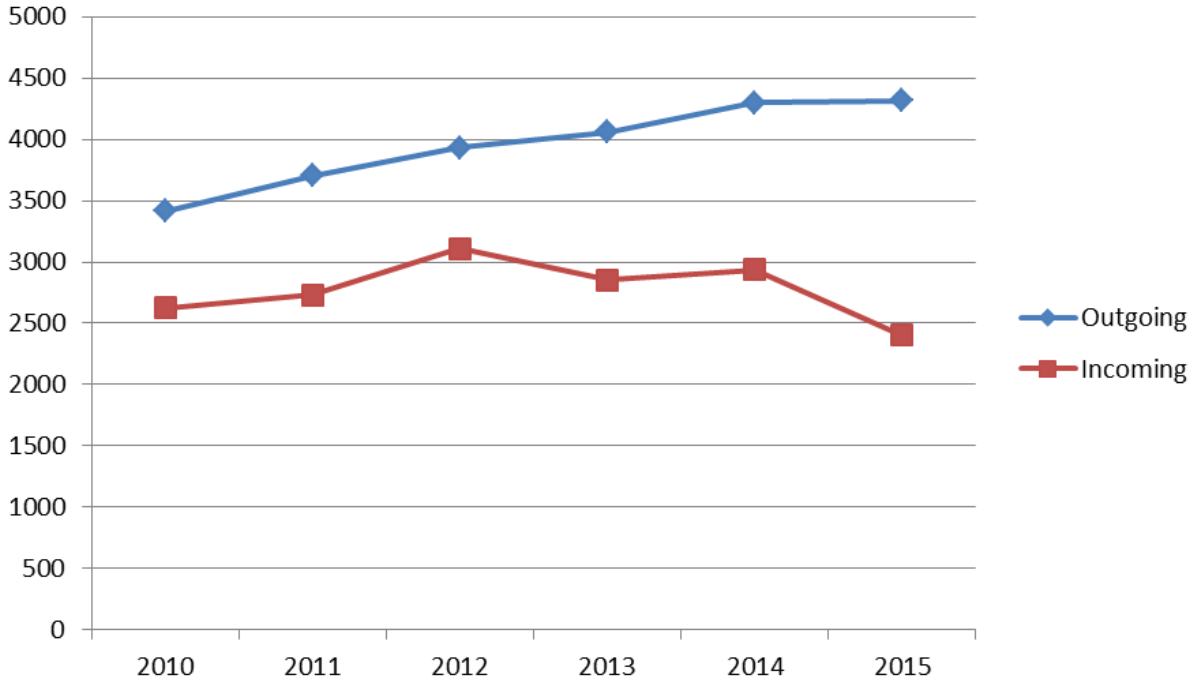
Source: Own representation based on data from Eurostat and DZHW. Figures on outgoing mobility to USA and China are not available.

2.2.5. Finland

The degree of internationalization of the Finnish academic community is lower than in its Nordic neighbor countries. This is illustrated by indicators such as lower percentages of foreign and non-EU doctoral candidates in Finland if compared to Norway, Denmark and Sweden.[30] With 4315 researchers, moving to or visiting a foreign country, outgoing mobility from Finland was in 2015 almost twice as high in numbers, than incoming mobility (2403). The gap between outgoing and incoming mobility has become wider during the last years.

[30] http://ec.europa.eu/euraxess/pdf/research_policies/more2/Final%20report.pdf

Figure 15: Finnish researcher mobility balance sheet 2010-2015

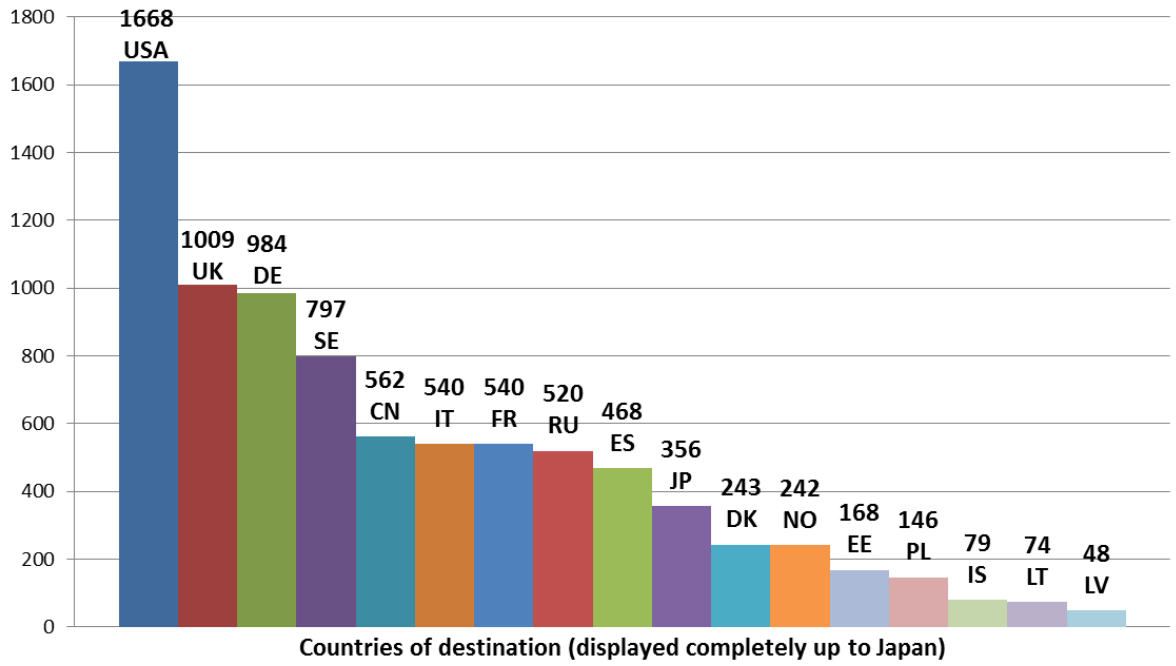


Source: Own compilation based on data from https://vipunen.fi/fi-fi/_layouts/15/xlviewer.aspx?id=/fi-fi/Raportit/Opetus-%20ja%20tutkimushenkil%C3%B6kunnan%20kv-liikkuvuus%20-%20kohdelaht%C3%B6maa.xlsb

For Finnish researchers the most frequented countries of destination were the USA (557), Germany (343) and the UK (342). In the opposite direction, most foreign researchers came to Finland from the USA (240), Russia (232) and the UK (200). [31]

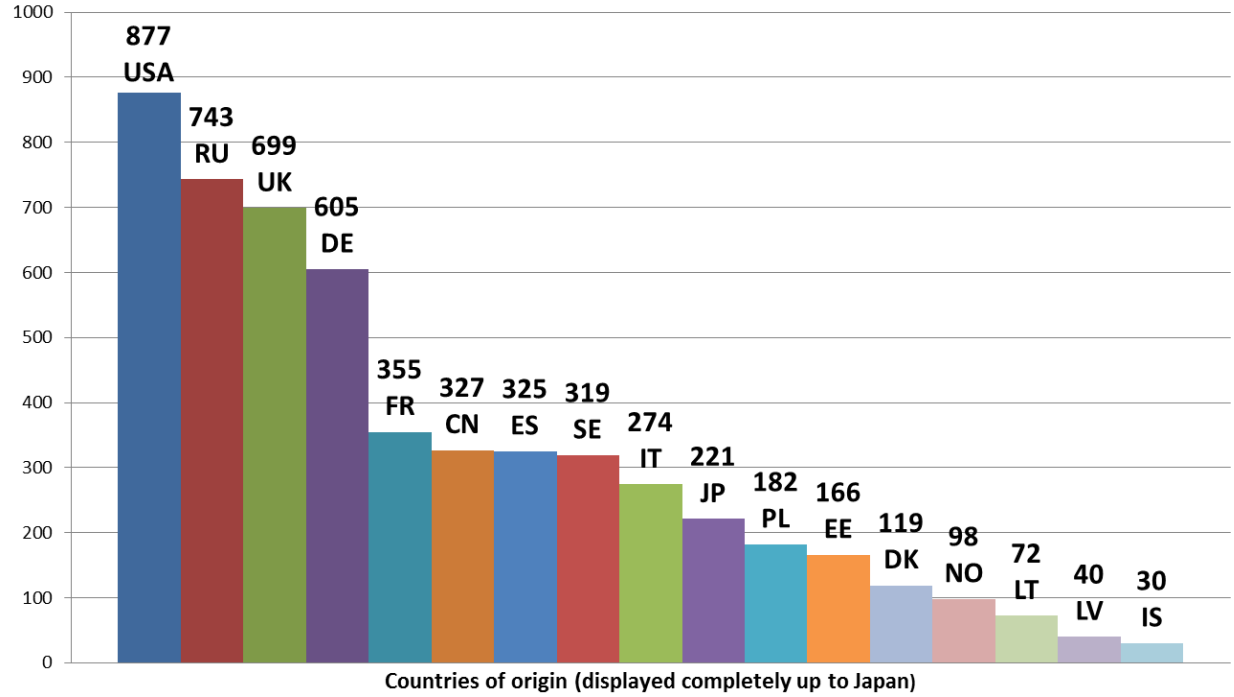
[31] https://vipunen.fi/fi-fi/_layouts/15/xlviewer.aspx?id=/fi-fi/Raportit/Opetus-%20ja%20tutkimushenkil%C3%B6kunnan%20kv-liikkuvuus%20-%20kohdelaht%C3%B6maa.xlsb

Figure 16: Number of outgoing researchers (more than 5 days) from Finland 2013-2015



Source: Own calculations based on data from https://vipunen.fi/fi-fi/_layouts/15/xlviewer.aspx?id=/fi-fi/Raportit/Opetus-%20ja%20tutkimushenkil%C3%B6kunnan%20kv-liikkuvuus%20-%20kohdelaht%C3%B6maa.xlsb

Figure 17: Number of incoming researchers (more than 5 days) to Finland 2013-2015

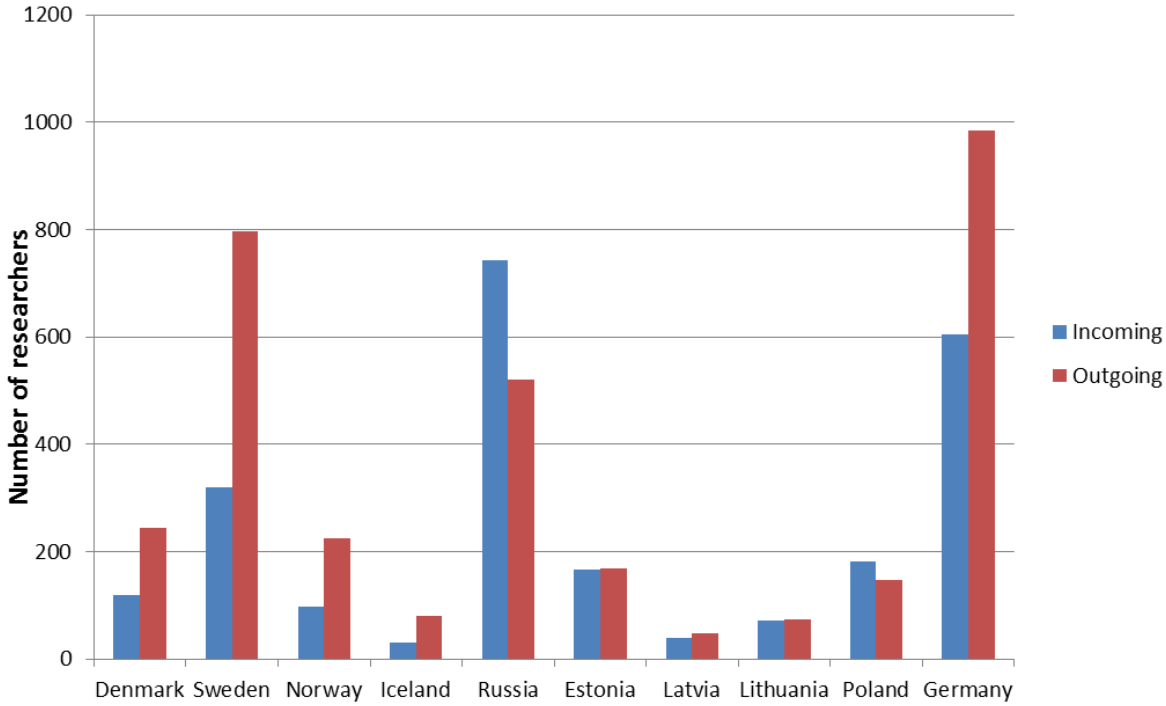


Source: Own calculations based on data from https://vipunen.fi/fi-fi/_layouts/15/xlviewer.aspx?id=/fi-fi/Raportit/Opetus-%20ja%20tutkimushenkil%C3%B6kunnan%20kv-liikkuvuus%20-%20kohdelaht%C3%B6maa.xlsb

Although the overall mobility balance for Finland is negative, there are huge differences in relation to individual countries (see Figure 18). The sharpest discrepancy can be seen in the cases of Sweden, Norway and Iceland. More than twice as many Finnish researchers had spent research stays in these Nordic neighbor countries than vice versa. On a global scale this negative value is only surpassed by Switzerland, which was a destination for 318 Finnish researchers during the observed period, whereas only 115 Swiss researchers moved in the opposite direction. Turning back to the BSR it is striking, that in contrast to negative mobility balances with the Nordic countries and Germany, mobility flows between Finland and all three Baltic countries are almost balanced. In contrast, Finland has positive mobility balances with Poland and Russia.

Mobility directions between Finland and foreign countries are influenced by research policies and support programs funded by institutions such as the Academy of Finland. The exchange of scientists with Russia strongly benefits from that kind of measures, which also include a cooperation agreement with the Russian Academy of Science concerning the support of mobility between both countries.[32] Another measure is the FIRST Program. It promotes partnerships between higher education institutions in Finland and in Northwest Russia, including joint intensive courses and student and teacher exchange.[33] The university consortium CBU, which brings together two Finnish and five Russian highly recognized universities, also promotes student and teacher mobility by offering joint Master`s Degree Programs in various fields of study.[34]

Figure 18: Mobility balances between Finland and BSR countries 2013-2015



Source: Own calculations based on data from https://vipunen.fi/fi-fi/_layouts/15/xlviewer.aspx?id=/fi-fi/Raportit/Opetus-%20ja%20tutkimushenkil%C3%B6kunnan%20kv-liikkuvuus%20-%20kohdelaht%C3%B6maa.xlsb

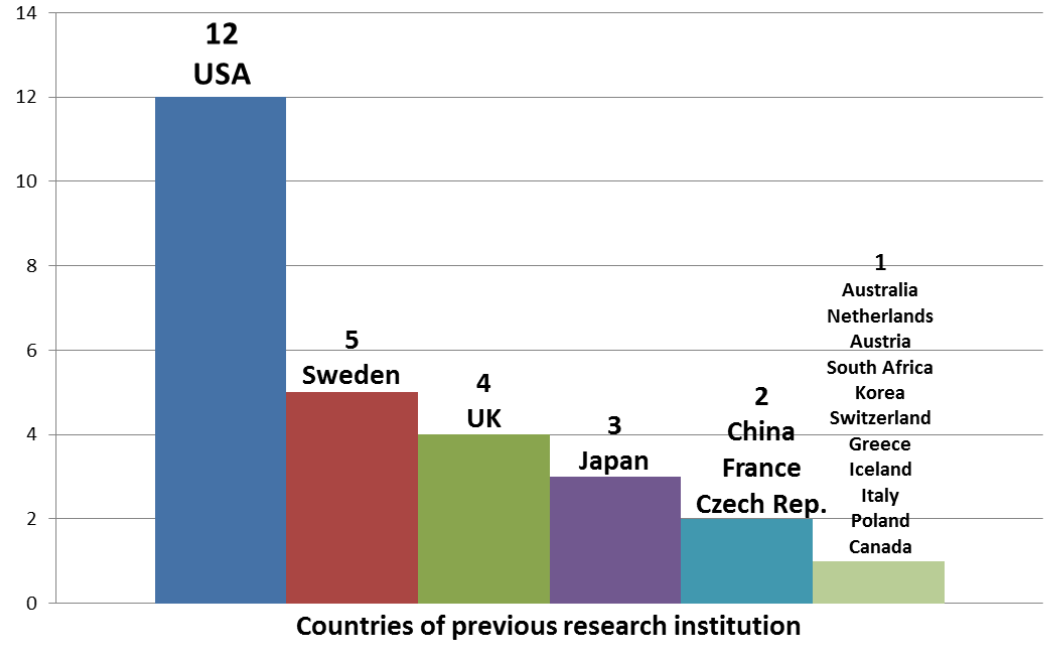
[32] http://www2.aka.fi/Tiedostot/Tiedostot/Julkaisut/tiedeyhteisty%C3%B6%20Ven%C3%A4j%C3%A4_sivuttain.pdf

[33] http://www.cimo.fi/programmes/first

[34] http://www.cbu.fi/en/web/cbu/about

In the case of Finland it also becomes evident, that mobile researchers at higher career levels tend to choose more distant countries for a research stay abroad, than their colleagues at earlier career stages. This is reflected in the following figure, which displays the FiDiPro professors' countries of origin in the years 2012-2015. The FiDiPro program enables Finnish universities and research institutions to invite internationally highly respected scientists to work in joint research projects in Finland. Most of them came from the US.

Figure 19: Number of incoming professors to Finland supported by the FiDiPro program 2012-2015

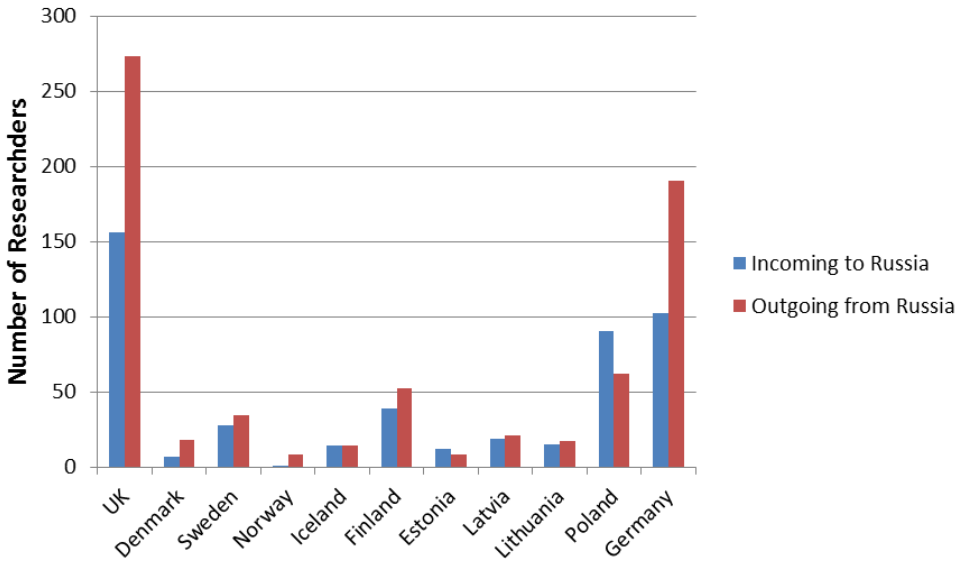


Source: http://www.tekes.fi/en/whats-going-on/news-from-tekes/tekes-funds-eight-new-fidipro-professors-or-fellows/

2.2.6. Russia

Within the scope of this study it was not possible to acquire comprehensive data on researcher mobility from and to Russia. Some conclusions on the different intensities of bilateral cooperation between Russia and EU countries can be drawn from the distribution of researcher exchange flows supported by the EU`s Marie Curie fellowship program. The following figure clearly reveals the major importance of Germany and Poland as the main BSR partner countries for researcher exchange with Russia.

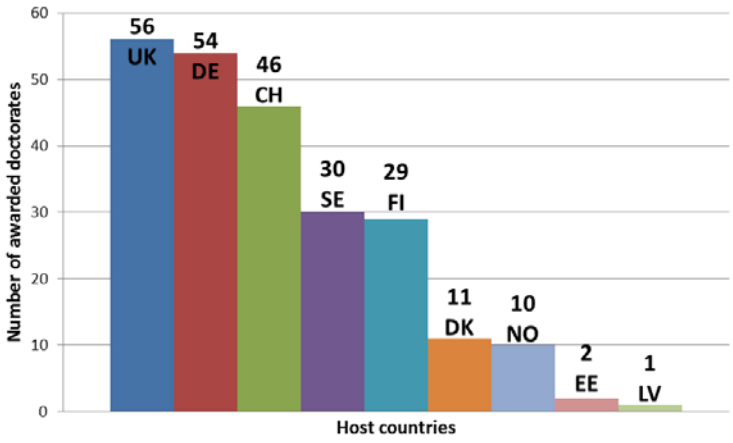
Figure 20: Mobility balances between Russia and BSR countries within the context of Marie Curie actions 2007-2014



Source: Own calculation, based on: www.ec.europa.eu/research/mariecurieactions/funded-projects/statistics/index_en.htm

The figure below shows a comparison of selected European host countries for Russian doctoral students. It reveals the high importance of Germany, Sweden and Finland as destinations for mobile Russian researchers. The high number of doctorates gained by Russians in Switzerland is outstanding. It is more than four times higher than the respective numbers in Denmark and Norway.

Figure 21: Doctorates awarded to Russian researchers abroad in 2014



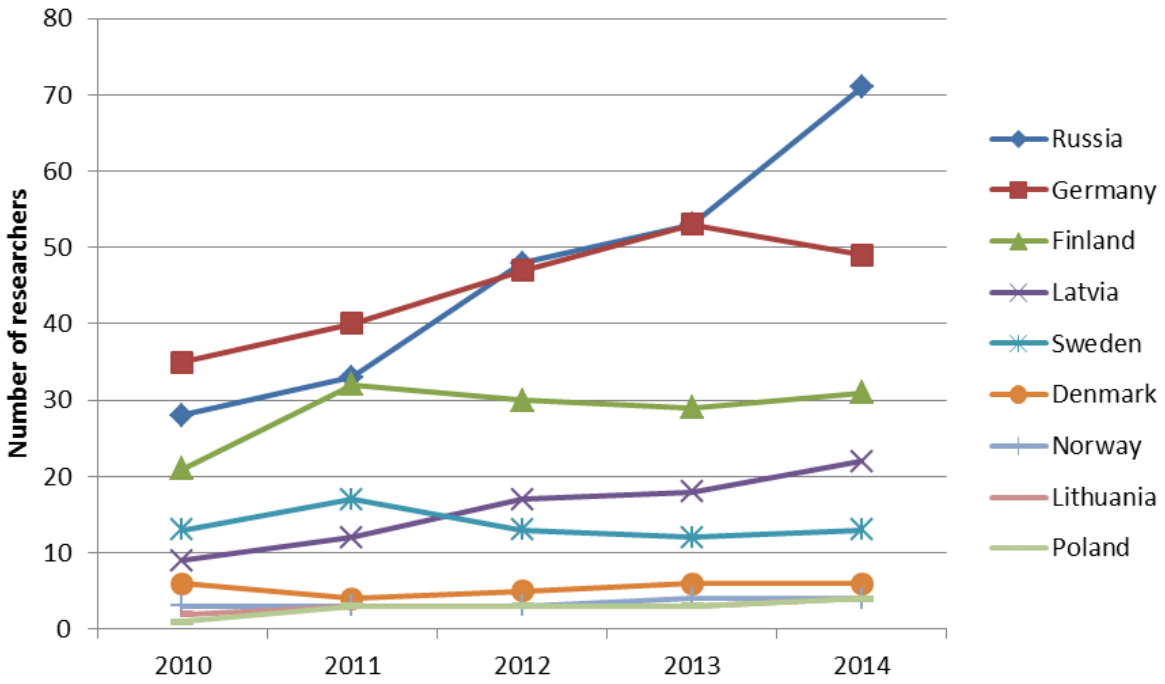
Source: Own compilation based on data from www.stats.oecd.org

2.2.7. Estonia

Generally, the share of foreign scientists living and working in Estonia has increased strongly during the last decade. Whereas in 2006 the number (101) was still very low it increased more than four times to 426 in 2014. That year, the main countries of origin were Russia (16,7%), Germany (11,5%), Finland (7,3%), Italy (6,8%), the UK (4,5%) and India (3,8%). Since 2010, the number of researchers coming from Russia has increased more sharply than from any other country in the Baltic Sea Region.

Consequently, Russia took over the position of being the most frequent country of origin of foreign researchers in Estonia from Germany in 2013 (see Figure 22). Moreover, the number of Latvian researchers has constantly increased since 2010, albeit at a lower level. In contrast, incoming flows from the Nordic countries as well as from Lithuania and Poland have remained rather stable.

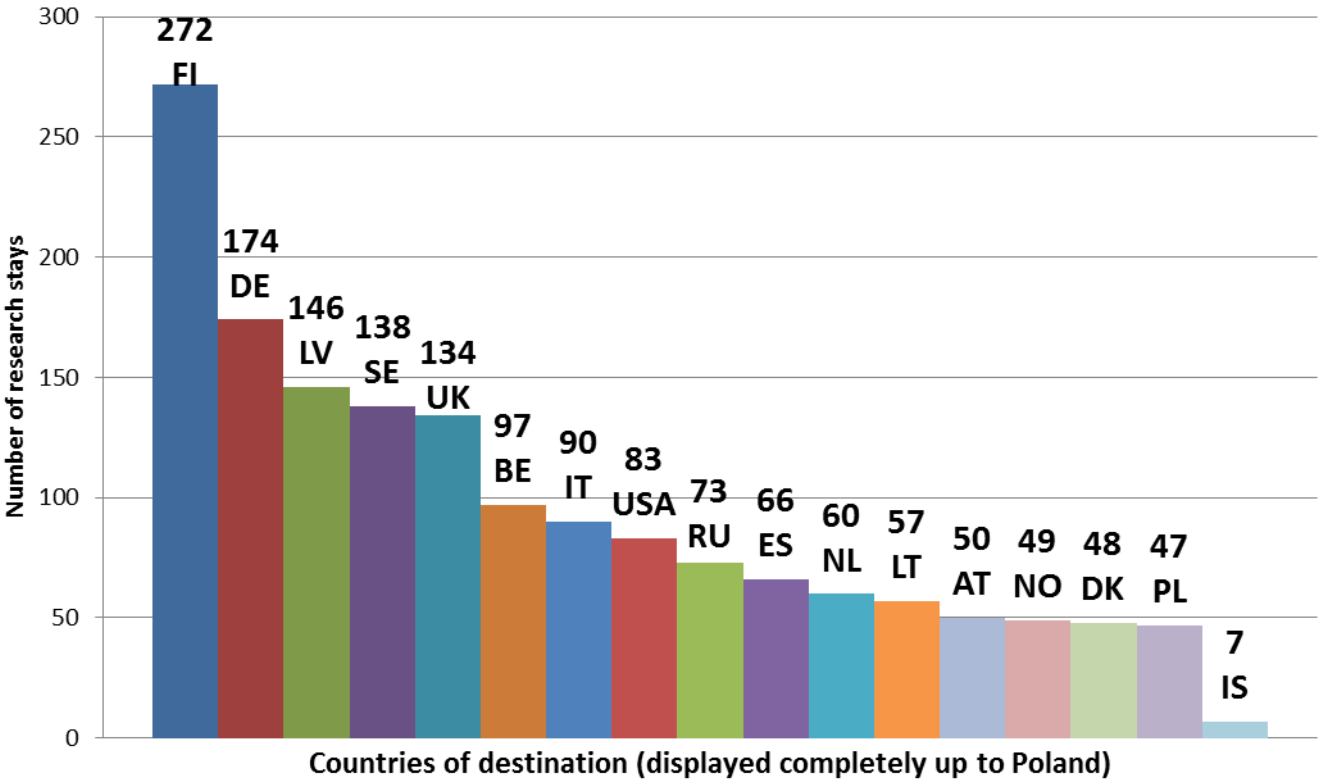
Figure 22: Incoming researchers from BSR countries to Estonia 2010-2014



Source: www.stat.ee/en

As to the favored countries of destination, exact numbers are hardly available. However, the tables above (1-4) indicate that most Estonian scientists chose Finland, the UK, Russia, Latvia or Germany when deciding to spend a medium-to-long term research stay abroad. In case of shorter research visits (between a couple of days and one month) Finland is also by far the most frequent country of destination, followed by Germany, Latvia and Sweden. In contrast, all other Baltic Sea countries range far behind these destinations and even behind Belgium and Italy (see Figure 23 below).

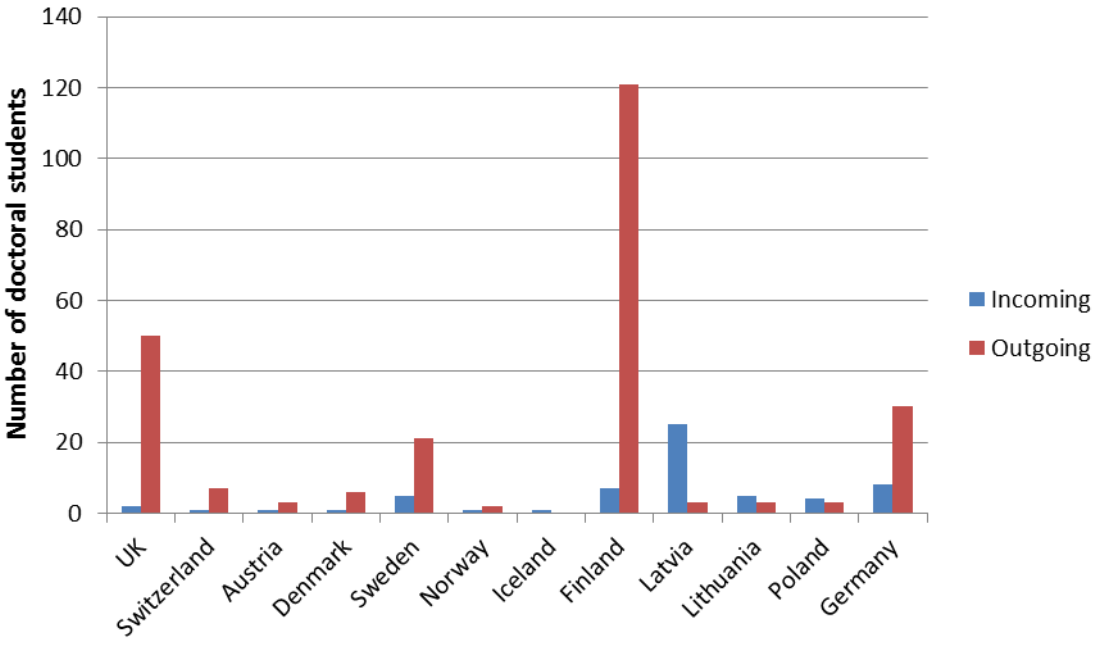
Figure 23: Outgoing short term (< 1 month) mobility from Estonia in 2015



Source: Own representation based on data from the Estonian Education Information System (EHIS)

With regard to doctoral students the case of Estonia confirms the general observation, according to which researchers, when going abroad in this very first stage of their academic career rather choose nearby countries, that are easily accessible and do not differ too much from their home countries in terms of culture and mentality.

Figure 24: Mobility of doctoral students from/to Estonia in 2014

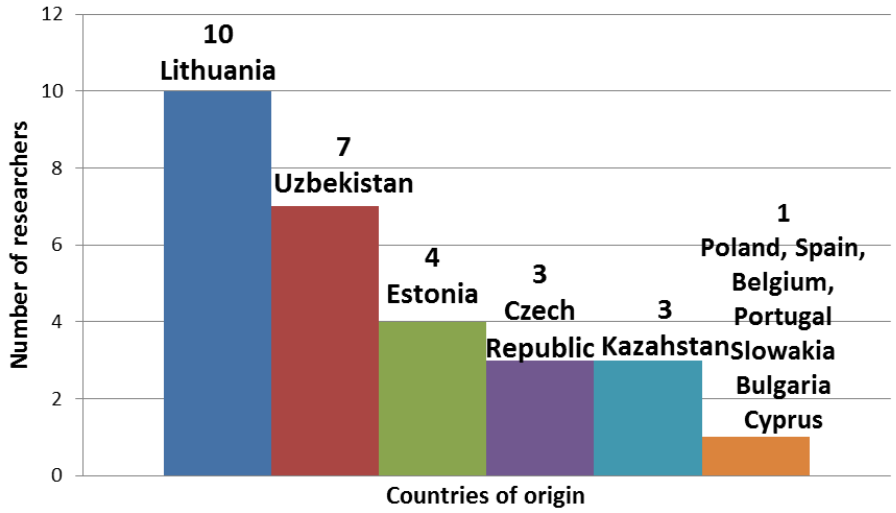


Source: Own representation based on data from Eurostat and DZHW. The values for Iceland and Sweden (outgoing) are for 2013

2.2.8. Latvia

For Latvia, Russia, Germany, the UK and its Baltic neighbors Lithuania and Estonia, are the most frequent partner countries for researcher mobility. This conclusion can be drawn from tables 1-4. The strong position, which Lithuania holds in this respect, also becomes apparent, when studying the list of grantees who were awarded the Latvian government fellowship for research during the last three years. Lithuania, Uzbekistan and Estonia are the top countries of origin for researchers coming to Latvia under this support program.

Figure 25: Number of incoming researchers supported by Latvian government fellowships 2014-2017

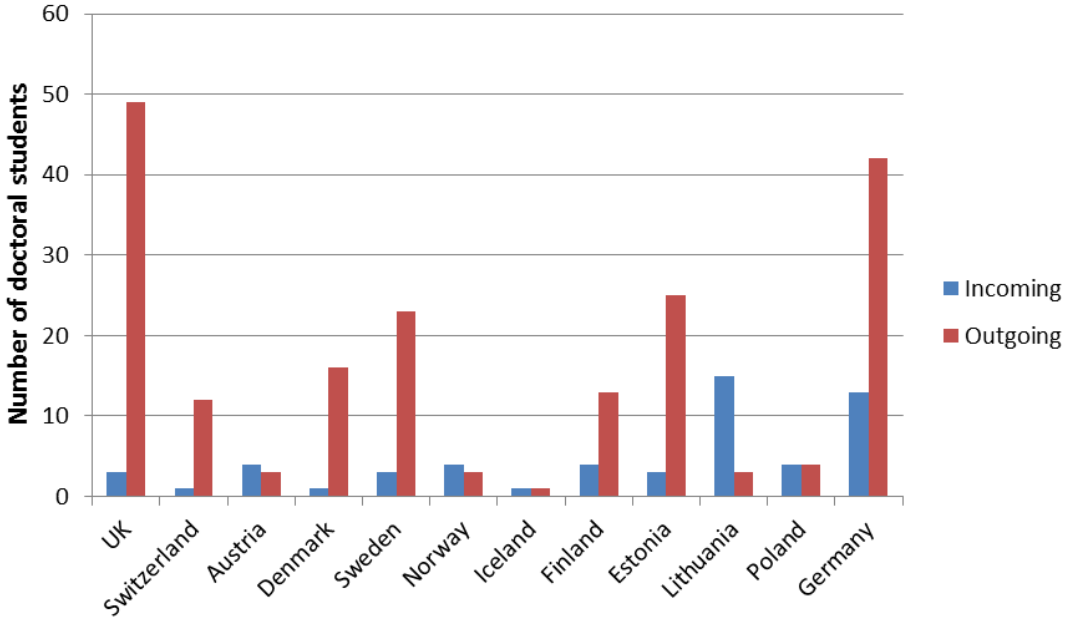


Source: Own compilation based on http://viaa.gov.lv/library/files/original/Results_2016_2017_scholarships_29_07.pdf

However, it has to be taken into consideration that only researchers from countries, which have signed an agreement on co-operation in education and science, are eligible to apply for a Latvian government fellowship for research. Apart from Finland neither the Nordic countries nor Russia and Germany are among these countries.

With regard to in- and outgoing doctoral students, a relatively broad distribution of mobility flows throughout the BSR appears, if compared with other countries in the region. An interesting feature is, however, the central position of Latvia as a part of a Baltic south-north mobility flow. It follows from the fact, that the mobility balance with Lithuania is positive, while it is negative with Estonia and Finland.

Figure 26: Mobility of doctoral students from/to Latvia in 2014

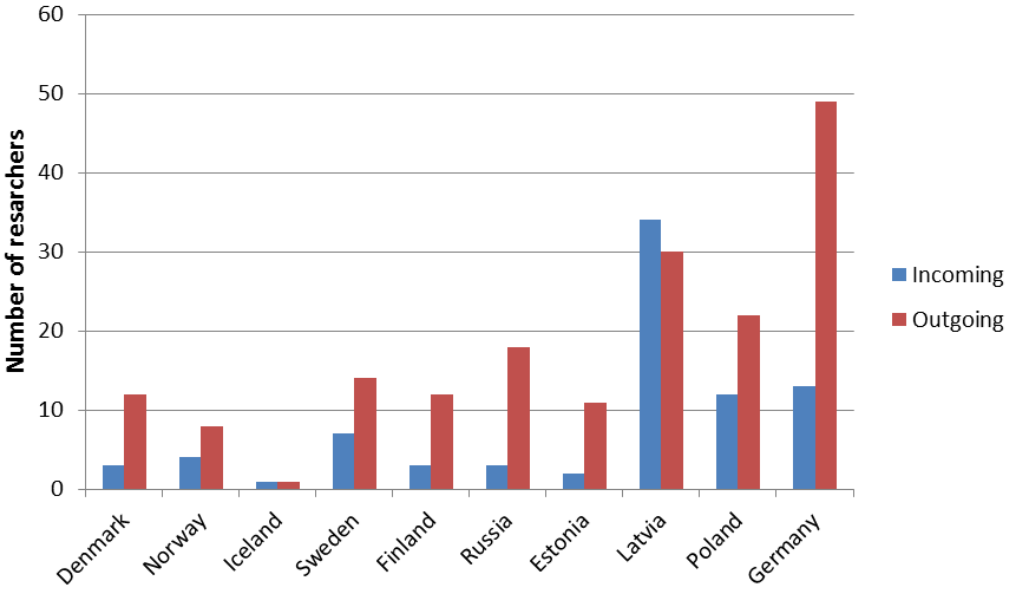


Source: Own representation based on data from Eurostat and DZHW. The values for Iceland and Sweden (outgoing) are for 2013

2.2.9. Lithuania

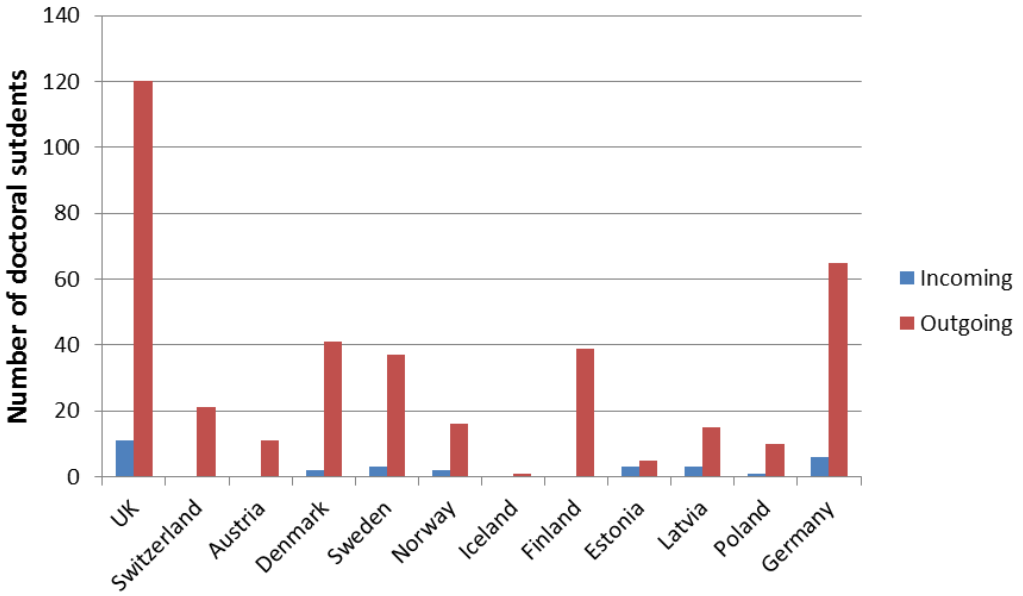
For Lithuania, exact numbers of incoming and outgoing researchers are hardly available, except those regarding doctoral students. The tables above (1-4) indicate, that Lithuania`s mobility relations with countries in the western part of the Baltic Sea Region (Denmark, Sweden, Norway) are not balanced but can rather be characterized as one-way streets. In contrast, mobility flows with the direct neighbors (Latvia and Poland) are quite extensive and more balanced. Among all BSR countries Latvia is the only one with a positive balance regarding researcher mobility funded by the Research Council of Lithuania.

Figure 27: Researcher mobility funded by the Research Council of Lithuania 2014-2016



Source: Own compilation based on data from the Research Council of Lithuania

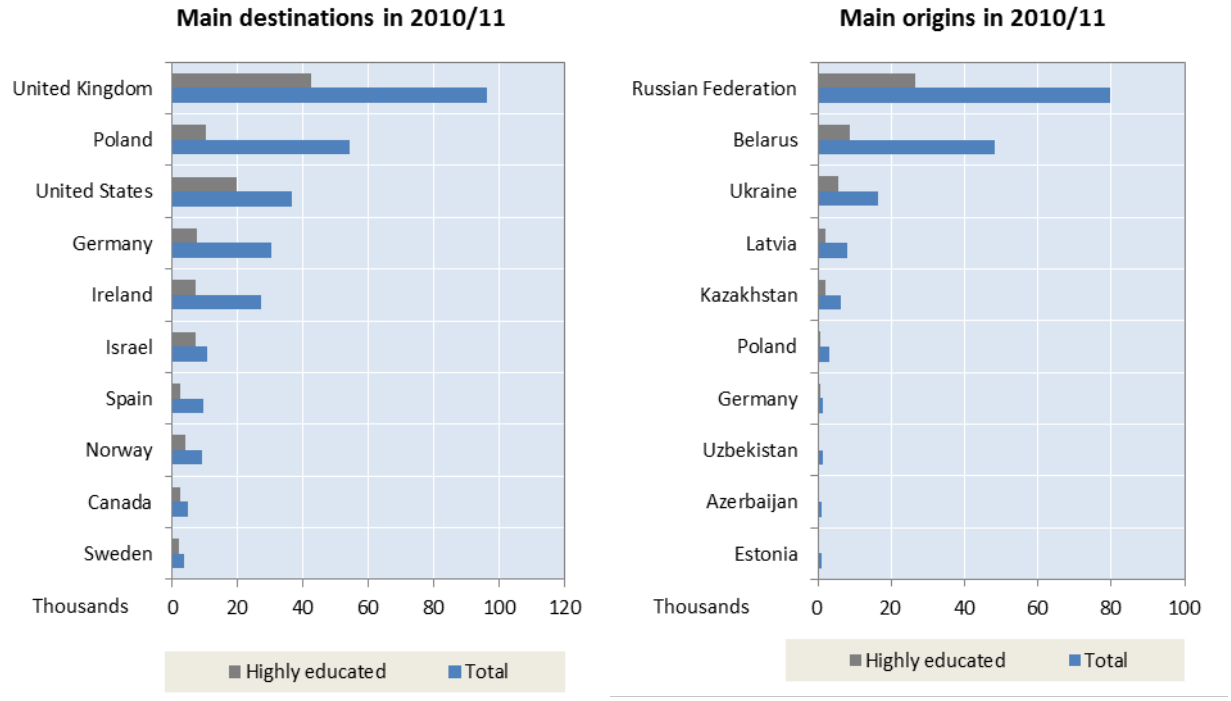
Figure 28: Mobility of doctoral students from/to Lithuania in 2014



Source: Own representation based on data from Eurostat and DZHW. The values for Iceland and Sweden (outgoing) are for 2013

Beyond the BSR, Lithuania has also particular intense researcher exchanges with the Ukraine and Belarus. The country is a good example for the prevailing east-west mobility flow, which is typical for the whole region. This impression is additionally underlined when comparing the total numbers of migrants to and from Lithuania. The OECD statistic (see below) shows that almost all people, who intend to leave Lithuania for good, turn to countries in the west, whereas almost no migration takes place in the reverse direction.

Figure 29: Total emigrant/immigrant populations (15+) of Lithuania

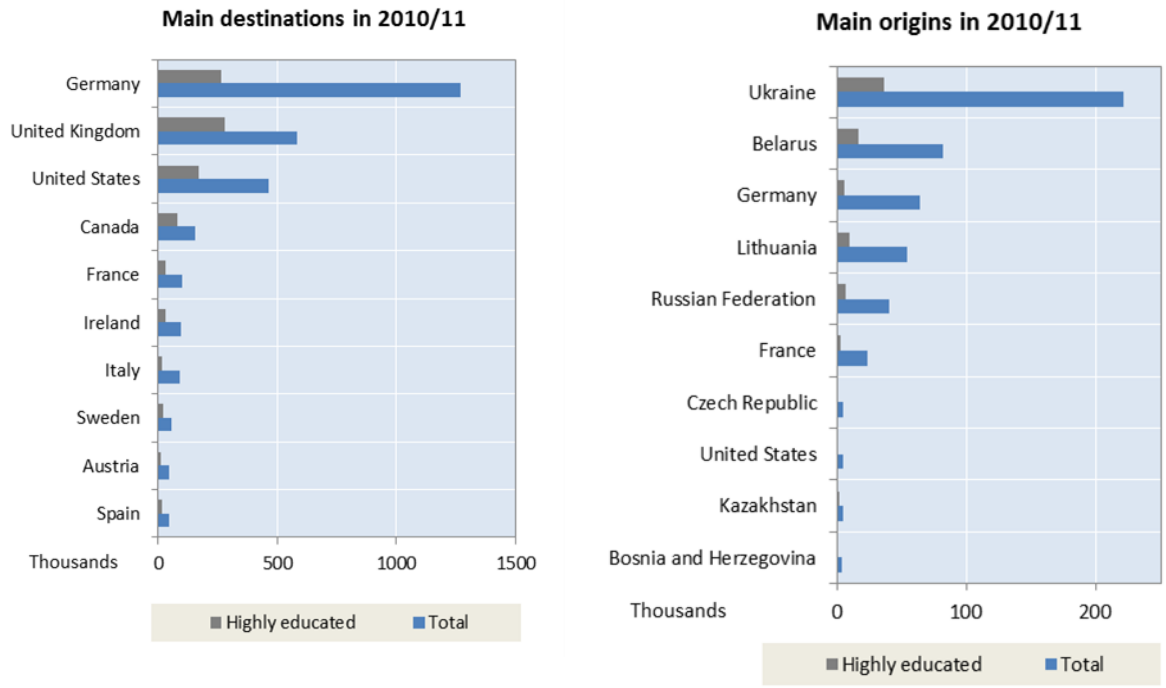


Source: http://www.keepeek.com/Digital-Asset-Management/oecd/social-issues-migration-health/connecting-with-emigrants_9789264239845-en#page291

2.2.10. Poland

Various indications suggest that the degree of internationalization of the Polish academic community is rather low if compared to all other BSR countries. For instance, in 2011, Poland had the smallest share of foreign-born doctorate holders (5%). In Norway, which held the top position in this ranking, the share was 32%.[35] Moreover and very similar to Lithuania, Poland is a typical example for the prevailing east-west mobility flow of migrants within the region. However, it must be noted that the numbers of emigrants leaving the country are significantly higher than the numbers of immigrants.

Figure 30: Total emigrant/immigrant populations (15+) of Poland

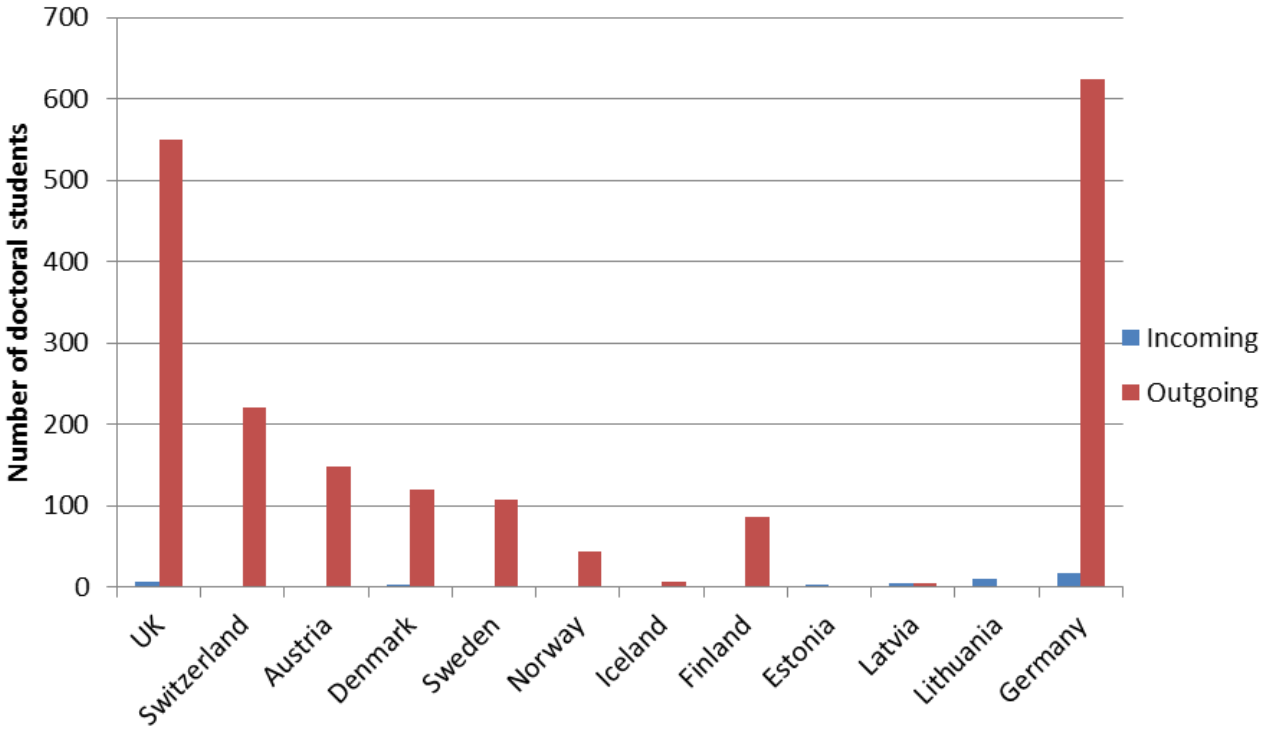


Source: http://www.keepeek.com/Digital-Asset-Management/oecd/social-issues-migration-health/connecting-with-emigrants_9789264239845-en#page240

When identifying the main mobility partners, the high numbers of migrants and in particular academics, who move from the Ukraine and Belarus to Poland, are striking. Both countries, that directly border Poland to the east, are also among the few, with which Poland has positive migration balances. In contrast, Polish researchers, who decide to spend a stay abroad or even to move permanently to a foreign country, most frequently chose Germany, the UK and the US as countries of destination. Although no complete statistics on researcher mobility from and to Poland exist, this conclusion can be drawn from the analysis of various surveys, each reflecting a certain segment of mobility (see tables 1-4). The following figures illustrate mobility of doctoral students from and to Poland as well as movements of researchers supported by the EU's Marie Curie fellowship program.

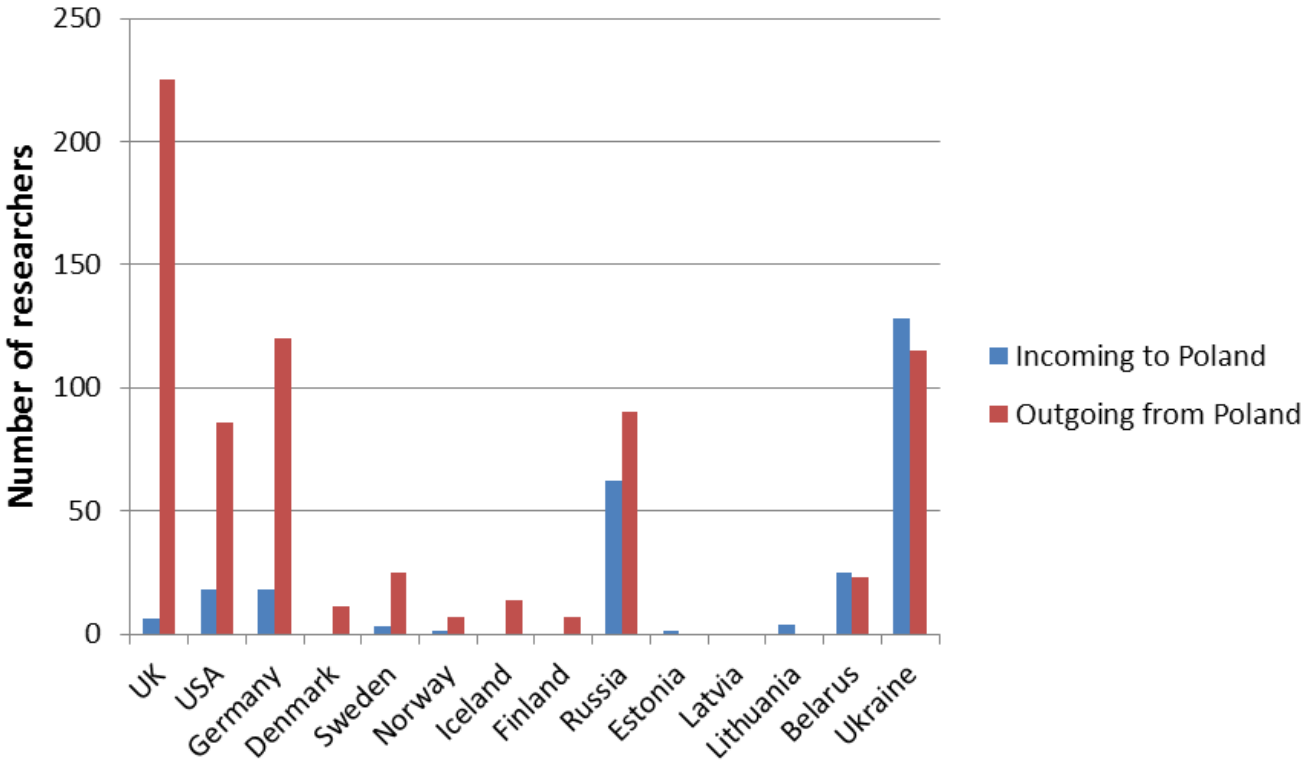
[35] OECD (2013), OECD Science, Technology and Industry Scoreboard 2013, OECD Publishing. http://dx.doi.org/10.1787/sti_scoreboard-2013-en

Figure 31: Mobility of doctoral students from/to Poland in 2014



Source: Own representation based on data from Eurostat and DZHW. The values for Iceland and Sweden (outgoing) are for 2013

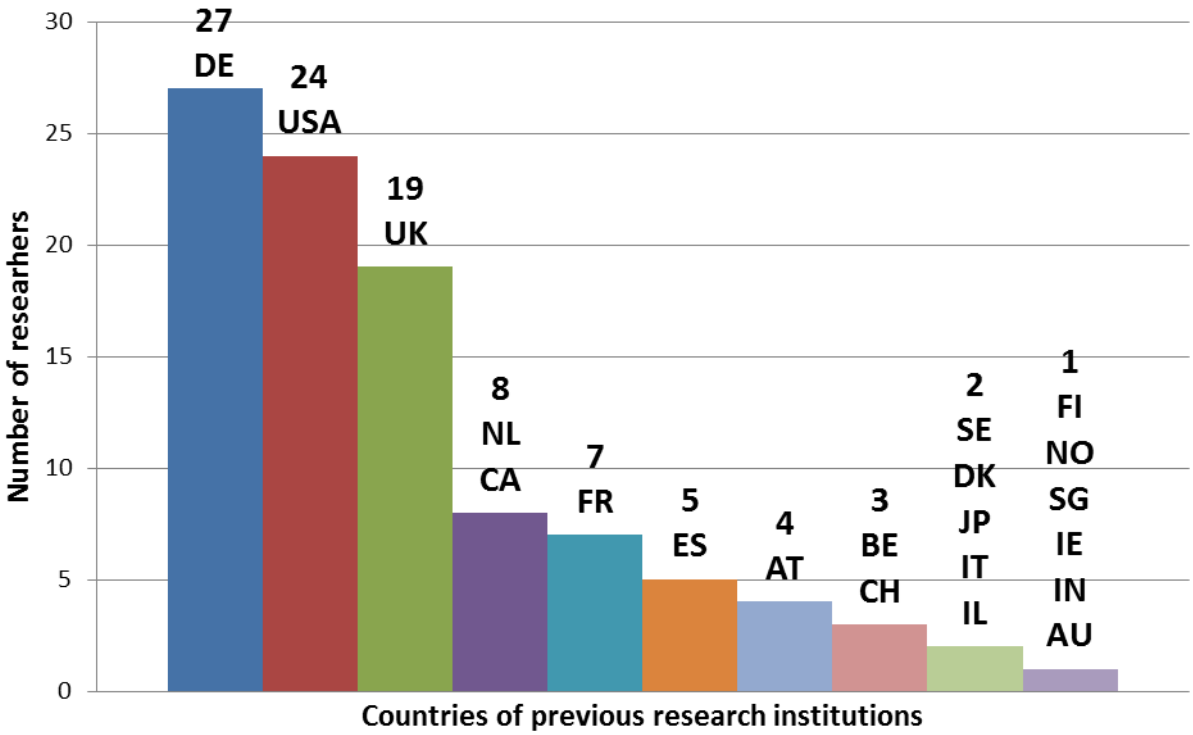
Figure 32: Polish mobility balances within the context of Marie Curie actions 2007-2014



Source: Own calculation, based on: www.ec.europa.eu/research/mariecurieactions/funded-projects/statistics/index_en.htm

Poland has initiated several support programs, which are intended to give incentives to outstanding scientists of Polish descent living in foreign countries to return to Poland.[36] One of them is the HOMING program, funded by the Foundation of Polish Science. Basically, it is eligible to researchers of any nationality, who have gained a doctoral degree not longer than 9 years ago and who have stayed outside Poland uninterruptedly for at least 9 months. In fact, however, judging from the names of the grantees within the years since 2010, near all of them are of Polish origin. Thus, a juxtaposition of the grantees' previous countries of residence, before coming, respectively returning to Poland clearly reveals the attractiveness of certain countries of destination for ambitious Polish researchers at an advanced stage of their career.

Figure 33: Incoming researchers to Poland supported by the HOMING programs 2010-2016



Source: Own calculations on the basis of http://www.fnp.org.pl/en/oferta/homing-plus-2/

The outstanding importance of Germany and the USA as mobility partner countries for Poland is even enhanced by bilateral support programs for researcher exchange such as the Alexander von Humboldt Polish Honorary Research Scholarships[37], the Nicolaus Copernicus Polish-German Research Award or the New York based, private Kosciuszko Foundation.[38]

If seen from a Baltic Sea regional perspective it is striking, that apart from Germany and Russia, all other countries of the region are mobility partners of only minor importance for Polish researchers.

[36] http://ec.europa.eu/euraxess/pdf/research_policies/Researchers%20Report_2014_GOOD%20PRACTICES_FINAL.pdf, p. 38

[37] It awards scholarships for research stays in Poland to about 4-5 internationally renowned German scientists from different disciplines per year. For a list of laureates see http://www.fnp.org.pl/en/laureaci-polskiego-homorwego-stypendium-im-a-von-humboldta/

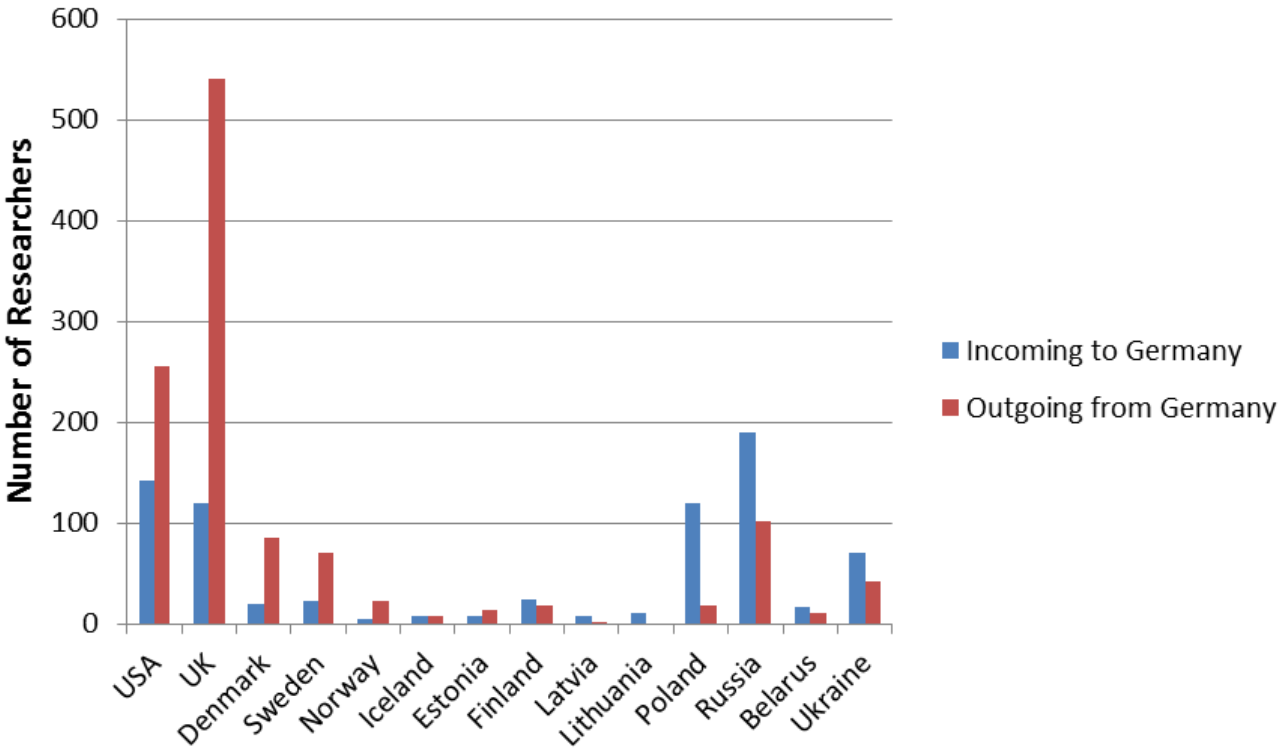
[38] http://www.thekf.org/kf/

Lithuania is the only Baltic Sea country showing a positive researcher mobility balance with Poland. In contrast, the relation to the Nordic countries can rather be characterized as a south-north one-way street. This becomes particularly clear when realizing, that mobility from Poland to Iceland, Denmark, Norway and Finland, supported by the EU's Marie Curie actions, had exclusively been oriented in a south-north direction from 2007-2014 (see Table 4).

2.2.11. Germany

Germany is, similar to Poland and Lithuania, a country which stands for the prevailing east-west and south-north migration flows of researchers within the Baltic Sea Region. However, in contrast to Poland, a characteristic feature for Germany is that the origin of incoming researchers is much more diversified. No country of origin of incoming researchers has a share of more than 10%.[39] In contrast, the origin of incoming researchers in Poland is highly concentrated on the Ukraine (about 25%).
The prevailing east-west and south-north directions become apparent, when analyzing mobility balances between Germany and the other BSR countries. The two figures below show mobility balances of researchers (supported by the EU's Marie Curie actions) and of doctoral students. Both of them clearly reflect these flow directions.

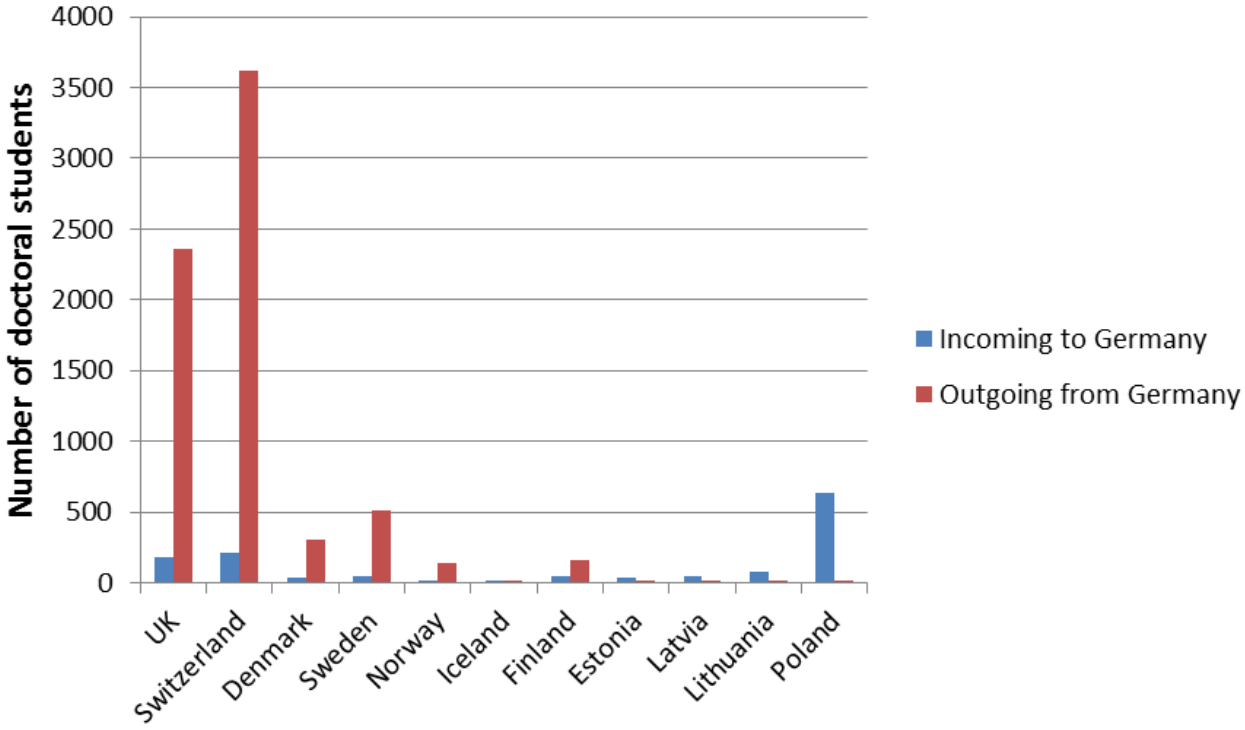
Figure 34: German mobility balances within the context of Marie Curie actions 2007-2014



Source: Own calculation, based on: www.ec.europa.eu/research/mariecurieactions/funded-projects/statistics/index_en.htm

[39] http://www.wissenschaftweltoffen.de/publikation/wiwe_2016_verlinkt.pdf (p. 22)

Figure 35: Mobility of doctoral students from/to Germany 2013/14

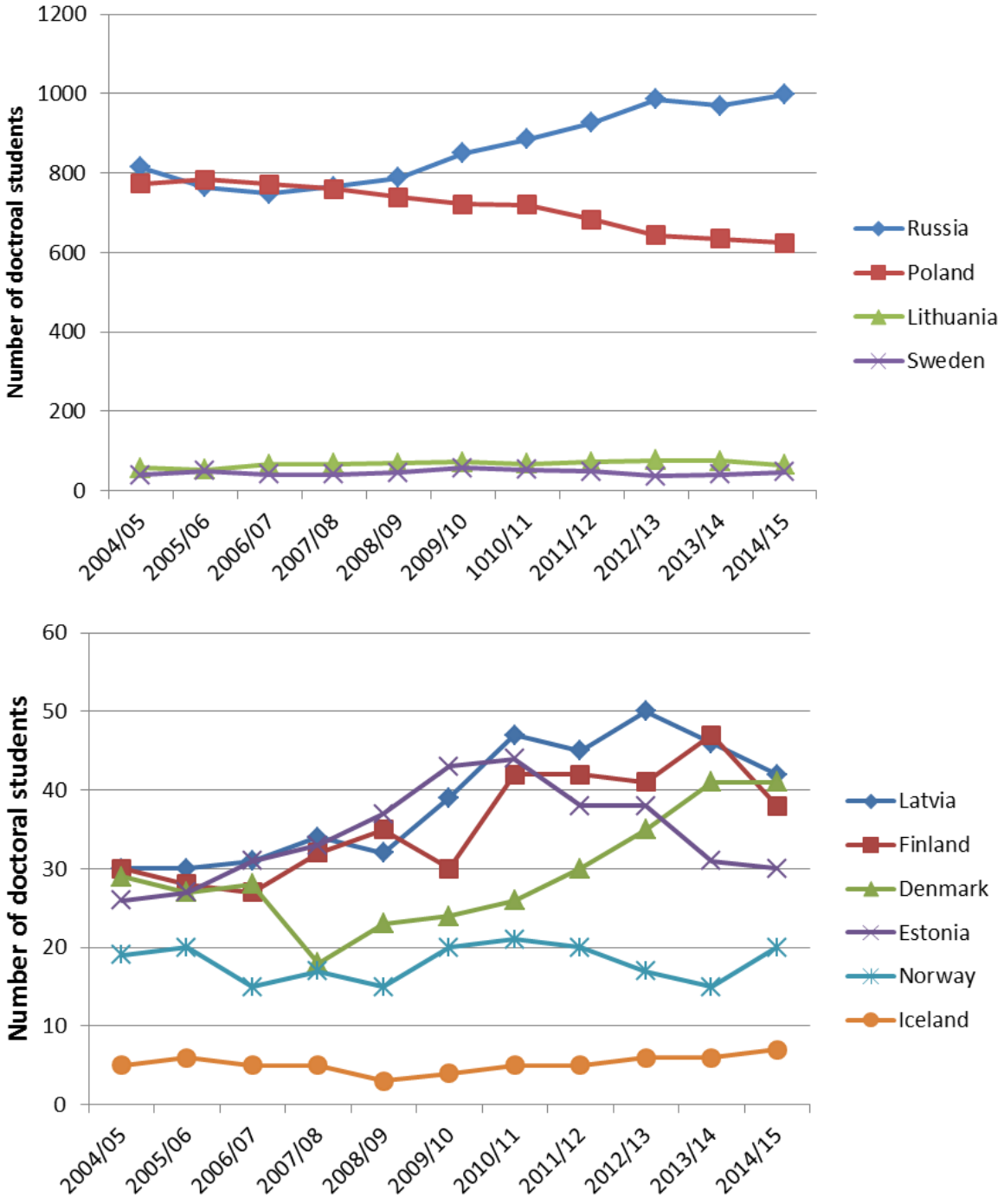


Source: Own compilation based on data from Eurostat/DZHW.
* No data available for outgoing doctoral students from Germany to Russia

Accordingly, Germany has negative mobility balances with countries in the northern and western parts of the BSR (Denmark, Sweden and Norway), while mobility balances with countries in the eastern parts (Poland, Lithuania, Latvia and Russia) are positive. This constellation is even more pronounced and more extensive in the case of doctoral student exchange than in the case of researcher mobility supported by Marie Curie actions.

The next two figures show longer-term trends regarding incoming doctoral students from the BSR to Germany. During the last decade, their total quantity has remained rather stable. The numbers were 1825 in 2004 and 1871 in 2014. However, the composition of countries of origin has changed. Most striking is the strong increase of Russian doctoral students from 815 in 2004 to 998 in 2014 and the corresponding decline of doctoral students from Poland from 773 to 624. In contrast, the shares of all other BSR countries have remained more or less stable at relatively low levels ranging from Lithuania (65 doctoral students), Sweden (47), Estonia (30) to Iceland (7) by 2014.

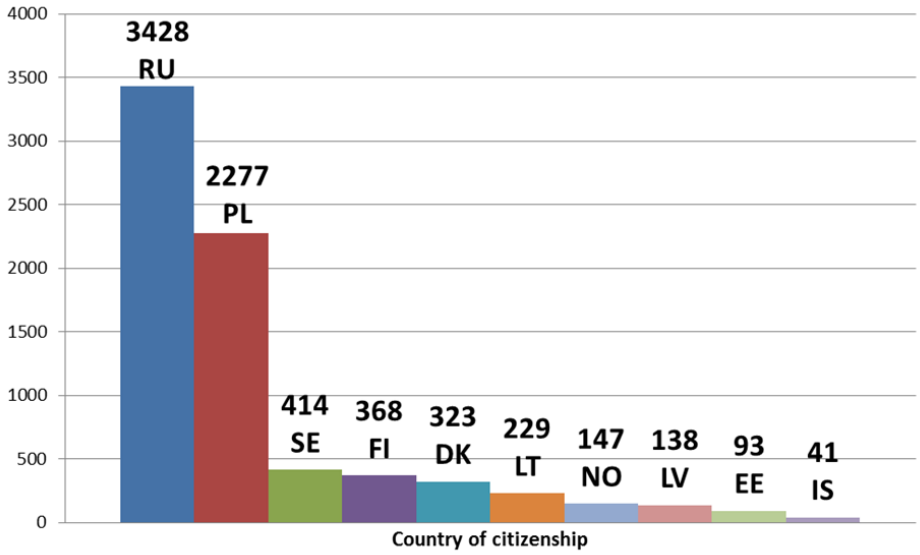
Figure 36: Incoming doctoral students from BSR countries to Germany 2004-2014



Source: Own presentation based on data from DZHW

The figures above already suggest that Russia and Poland can be classified as Germany´s most frequent partner countries for incoming mobility in the BSR. With a large gap they are followed by Sweden, Denmark, Finland and Lithuania. A similar pattern appears, when the BSR countries are ranked by citizenships for academic staff at German higher education institutions (see Figure 37). Please mind, however, that this calculation also includes non-mobile researchers with German citizenship, who were born and/or grew up in Germany (so-called “Bildungsinländer”).

Figure 37: Academic and artistic staff holding a BSR citizenship at higher education institutions in Germany in total numbers for the years 2013-2014



Source: Own compilation on the basis of data from Statistisches Bundesamt. The figures presented do not include research assistants and student tutors

As far as outgoing mobility from Germany to the BSR countries is concerned it is more difficult to achieve a clear result as to which countries are most frequently chosen by German scientists for a research stay. The two figures below may contribute to clarify the picture. They show outgoing and incoming temporary researcher mobility supported by German funding agencies and non-university research institutes. Thus they do not comprise all mobility, since neither permanent moves to another country nor mobility supported by non-German funding organizations are recorded.

Figure 38: Number of outgoing researchers from Germany 2013-2014

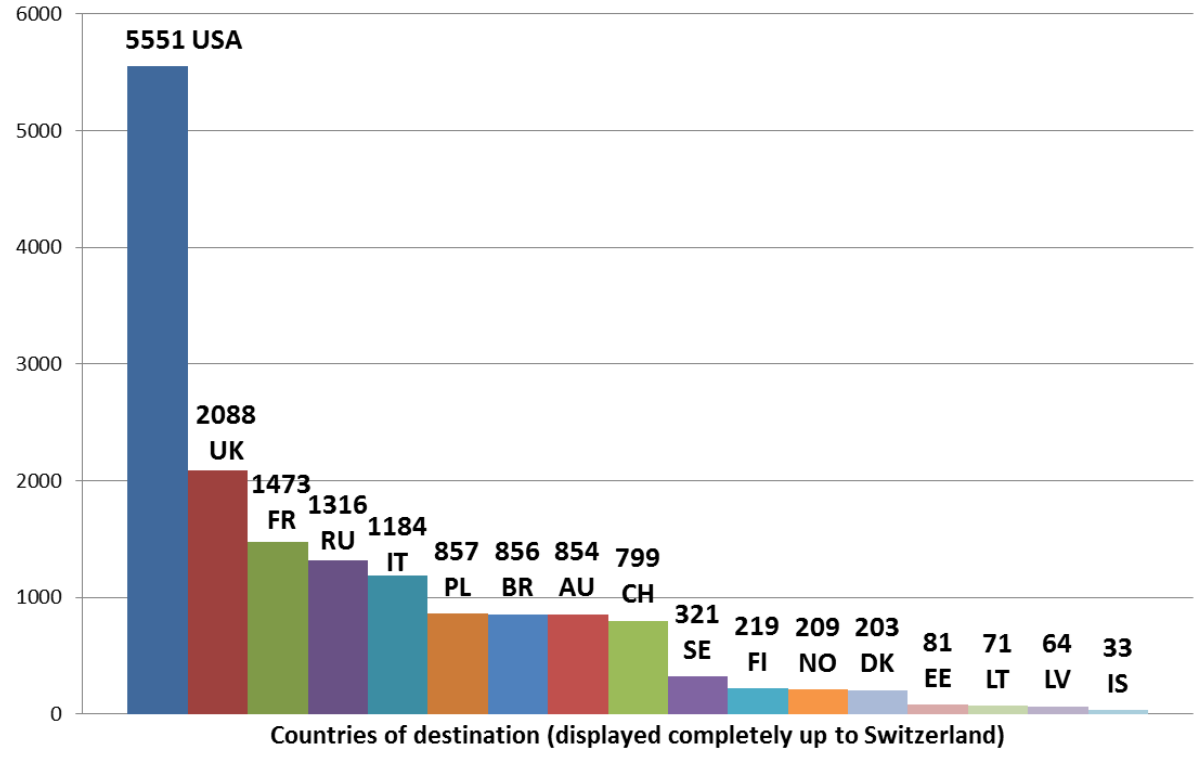
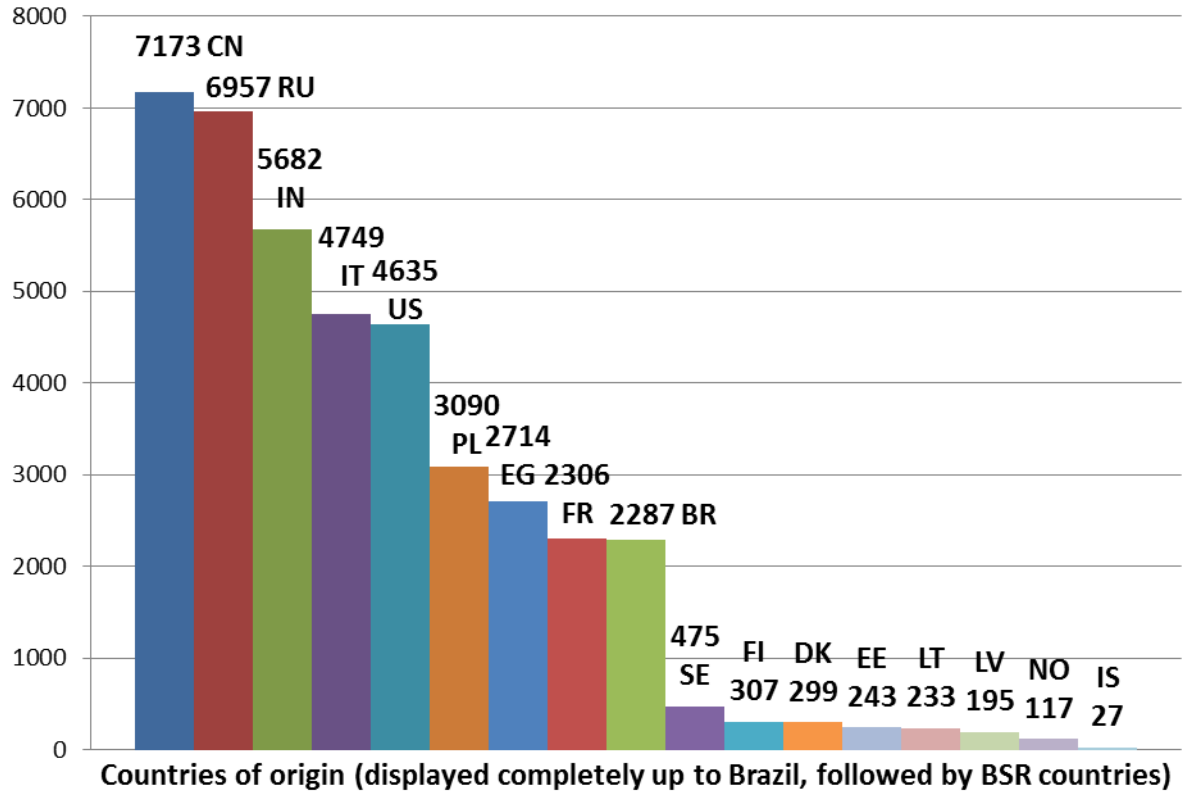


Figure 39: Number of incoming researchers to Germany 2013-2014



Source: Own compilations on the basis of data from DAAD/DZHW. The numbers reflect incoming and outgoing researcher mobility supported by German funding agencies and non-university research institutes

The two figures reflect similar trends as described above. Russia and Poland are quantitatively by far the most important mobility partners for Germany among the BSR countries. This observation is yet more pronounced in the case of incoming mobility. Here, even in a global scale, Russia ranks by far among the most important countries of origin for incoming researchers to Germany, second only to China. But even when regarding outgoing mobility, it is striking that scientists from Germany much more frequently spend research stays in Russia and Poland, than in any other of the BSR countries.

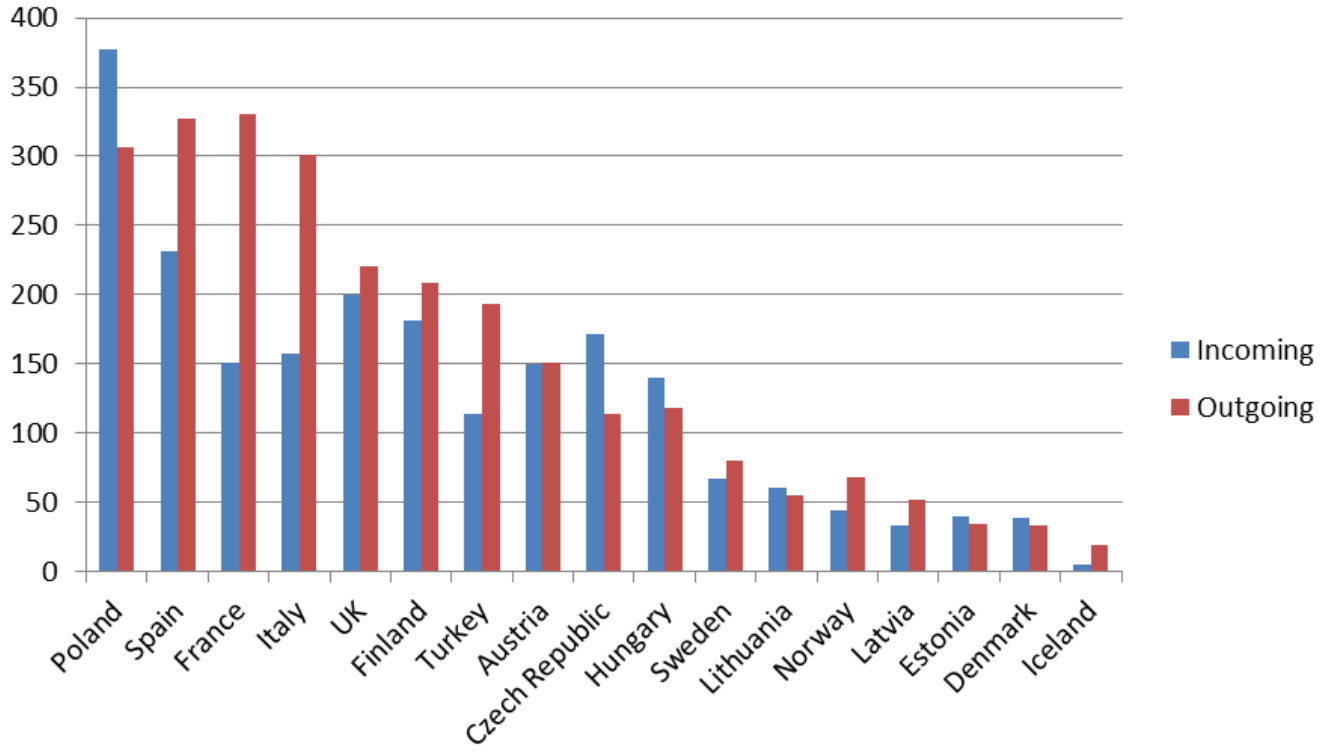
Another perspective on German researcher mobility relations with foreign countries appears from a comparison of partners within the EU's Erasmus+ guest lecturers exchange program. Research associates, assistant lecturers and professors at higher education institutions as well as corporate staff are eligible for this funding scheme. A major difference to the previously analyzed types of mobility is that the Erasmus program only supports short term mobility which lasts between 2 days and 2 months. The average stay of a foreign guest lecturer in Germany is 5.5 days, while an Erasmus guest lecturer from Germany spends abroad 5.3 days on average.[40] Switzerland and Russia, two of the otherwise most important partner countries for Germany in terms of researcher mobility, do not take part in the Erasmus+ program.

Generally, it is striking, that mobility balances between Germany and most of the Erasmus partner countries are quite well balanced with France and Italy as the only major exceptions. Both countries are twice as often visited by German lecturers than vice versa. Poland is by far the most important country of origin for Erasmus lecturers coming to Germany. But also in the opposite direction the

[40] http://www.wissenschaftweltoffen.de/publikation/wiwe_2016_verlinkt.pdf (p. 135,151)

country is among the most frequently chosen destinations for German lecturers ranking third, only behind France and Spain. The top position of Finland next to the UK and ahead of Turkey and Austria is also remarkable. In contrast, Sweden, Norway and Denmark rank relatively low. Generally, it can be concluded, that the earlier stated east-west and north-south flows are not as pronounced in the context of Erasmus guest lecturer mobility as in the other, previously analyzed cases of researcher mobility.

Figure 40: Number of Erasmus guest lecturers from/to Germany in 2014/15



Source: Own presentation based on data from DZHW. Countries displayed completely up to Hungary.

As already mentioned, the figures above do not reflect researcher mobility flows completely. When calculating all types of mobility (temporary short and long term, permanent stays) and all funding sources together, it turns out that the USA, followed by Switzerland and Austria are the most important German partners for outgoing mobility.[41] Apart from excellent research environments, this clearly reveals the importance of close cultural and linguistic ties as well as of the attractiveness of directly bordering countries for scientists aiming for a research stay abroad.[42]

The high intensity of researcher exchanges between Germany and its southern neighbors has no counterpart in the north. Mobility rates with Denmark and Sweden are far below those with Switzerland and Austria. This may partly explain the fact, that among the federal states of Germany, those bordering the Baltic Sea had the lowest shares of foreign academic staff employed at higher

[41] It is currently not possible to compile a complete ranking of German mobility partners, since many countries do not record incoming researchers by country of origin.

[42] http://www.wissenschaftweltoffen.de/publikation/wiwe_2016_verlinkt.pdf (p. 141)
https://www.erziehungswissenschaften.hu-berlin.de/de/mobilitaet/projektergebnisse/abschlussbericht-1/abschlussbericht-internationale-mobilitaet-und-professur.pdf (p. 34)

education institutions in 2014 with a share of only 8,8% in Hamburg, 8,1% in Schleswig-Holstein and 7,1% in Mecklenburg-Vorpommern. The German average was 10,6% with Saarland (16,5%), Berlin (12,5%) and Bavaria (12,1%) on top of the ranking.[43]

[43] http://www.wissenschaftweltoffen.de/publikation/wiwe_2016_verlinkt.pdf

3. Main findings of the study

Although various sets of data exist, that describe certain segments of researcher mobility in the BSR, the study has shown that there are major gaps regarding the availability of truly comparable figures. The only framework for researcher exchanges, in which all BSR states participate on an equal footing and were mobility rates are recorded centrally, exists in the form of the EU's Marie Curie actions. In order to gain a complete and representative picture of mobility flows it would be necessary to implement the same standards for statistical recording in all countries of the region.
Notwithstanding these limitations, this study has provided an approximate impression of BSR mobility patterns by compiling all relevant and available data and by evaluating existing studies on the issue. In this way, some characteristic trends concerning researcher mobility could be identified and placed in a wider context. The main findings can be summarized as follows:

- The overall frequency of international researcher mobility in the BSR is high. However, for many BSR countries the **main mobility partners** are located **outside the region** (USA, UK, Switzerland and the Ukraine). The **most important mobility partner** for many BSR states within the region is **Germany** (Denmark, Sweden, Norway, Finland, Russia and Poland).

- In many BSR countries **flows of researcher mobility are not balanced**, at least not at the level of individual mobility partners. For most countries the overall mobility balance is negative, i.e. the number of outgoing researchers exceeds the number of incoming researchers. Only Denmark and Norway have positive mobility balances.

- For many countries the main mobility partners for outgoing and incoming researcher mobility are not identical. Instead, throughout the BSR an **overall east-west mobility** flow is clearly evident. A good example is Poland, where the majority of incoming researchers originate from the Ukraine and Belarus, whereas the main host countries for Polish researchers are the United Kingdom and Germany. Finland is also a good example for the prevailing east-west mobility flows, since it attracts a huge number of researchers from Russia, whereas Finnish researchers mainly turn to countries in the west, mostly to the US, the UK, Germany and Sweden (in that order).

- In **some countries** (Norway, Estonia, Latvia) **mobility patterns are more balanced**. In- and outgoing researcher mobility flows from and to these countries are distributed rather broadly throughout the BSR and to countries beyond the region in both eastern and western direction.

- The **degree to which the BSR countries take part in regional researcher mobility flows varies strongly**. Denmark, Sweden, Finland, Estonia and Latvia can be classified as the core countries of an emerging BSR research area, since they have developed a high intensity of

researcher exchanges within the region. In contrast, for other countries such as Poland, Russia and Germany exchanges with partners in the BSR have a rather marginal importance when compared to other European regions.

- The observed east-west trend is supplemented by an **overall one-sided south-north mobility flow** of researchers. This trend is most striking when looking at numbers of researchers who move from Germany and Poland to Denmark, Sweden and Norway. In each bilateral relation they are many times larger in the south-north than in the opposite direction. Moreover, this trend is evident also in one-sided south-north mobility flows going from Lithuania to Latvia, from Latvia to Estonia and from Estonia to Finland.

- As far as patterns of researcher mobility are concerned, there are clear **differences between** mobility taking place at **lower** (PhD students, Postdocs) **versus higher career levels** (senior researchers). The more advanced the researchers' career stage is, the more likely it is he or she chooses more distant countries when becoming internationally mobile.

- Over the last years there has been **a general change towards more distant destinations** when researchers choose a country for a research stay abroad. This trend is most striking in the Nordic countries. Two decades ago the first choice when going abroad often was another Nordic country. Today, countries beyond the Nordic region and even Europe are much more frequently envisaged by researchers from the Nordic countries.

- Countries with **close linguistic and cultural ties** tend to have **frequent mutual researcher exchanges**. Typical examples from the BSR are the country pairs Norway/Denmark, Iceland/Denmark, Finland/Estonia, Ukraine/Poland and Germany/Switzerland.

- **Language** can be a **decisive obstacle to incoming researcher mobility** if a) the host country´s language is rather exotic or usually not taught in other countries (Finland, Poland), b) if there is a lack of English-language programs at universities, c) if application for funding schemes have to be applied for in the host country´s language (Lithuania) and/or d) if there are strict legal language requirements for foreign applicants to researcher/teaching positions (Latvia).

- **Countries which border each other** tend to have **extraordinarily high mutual exchange rates**. Typical examples from the BSR are the country pairs Germany/Denmark, Finland/Russia, Finland/Estonia, Estonia/Latvia, Latvia/Lithuania, Poland/Ukraine and Poland/Belarus. This applies even more so **if important universities and research institutions are located near to the border** and are thus easy to access from the neighboring country. This is for instance a characteristic feature of both the German-Swiss and the Danish-Swedish border regions.

- **Being internationally mobile** is not an aim in itself and **not equally important for researchers from all countries**. Generally, researchers living and working in small states can benefit more from being internationally mobile than their colleagues in big states. This is due to the more limited numbers of research institutions, inspiring research environments, resources and career opportunities that small states can offer to ambitious scientists. In contrast, researchers in states (such as the USA and Great Britain), that offer attractive working conditions, host world-leading research institutions and recruit the most talented scientists from all parts of the world, are less likely to feel a need for moving abroad.[44]

- **Brain drain/brain gain is not just a question of quantities**, i.e. the sheer amount of mobile researchers but also of qualities. Consequently, when developing mobility support schemes, there is a trend to focus more on questions such as: Do successful or non-successful researchers leave/move to a country? How does mobility contribute to the emergence of a competitive regional research profile?[45] By aiming at raising quantities, existing funding instruments often have not sufficiently taken the added value of researcher mobility into account.[46] Thus, **consequences in terms of quality developments should be taken into consideration when developing mobility funding programs in the BSR**. This applies not only to the individual researcher´s level but also to regional research environments and to the macroregional research profile. [47]

- **Bureaucracy and administrative burdens can be an obstacle to researcher mobility**. High frequencies of researcher exchanges among the Nordic states are also a consequence of favorable framework conditions in terms of low administrative and bureaucratic barriers. For instance, in contrast to regulations within the EU, a citizen of a Nordic country who intends to move to another Nordic country is not required to apply for a residence permit in the envisaged country. Furthermore, the compatibility of the Nordic countries' social security systems may function as an incentive for researchers, especially when they have children, to stay within the Nordic region rather than going to more distant countries.

- Researcher **mobility among the Nordic states is enhanced by special Nordic research programs** (NordForsk), of which the Nordic Centre of Excellence (NCoE) is the most important funding instrument to increase and facilitate cooperation between excellent researchers, researcher groups or institutions in the Nordic countries. An NCoE is usually built on cooperation between at least three countries within one topic or field.

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[44] http://www.oecd-ilibrary.org/docserver/download/5k43nxgs289w.pdf?expires=1471256953&id=id&accname=guest&checksum=357BCB4C41F320A858694D88BF3D7922 (p. 37); http://cs.ioc.ee/excs/policy/teadlasmobiilsus-en.pdf (p. 49); http://www.wissenschaftweltoffen.de/publikation/wiwe_2016_verlinkt.pdf (p. 158)

[45] http://dea.nu/sites/dea.nu/files/mobility_and_networks_web.pdf (p. 5)

[46] https://ec.europa.eu/research/evaluaktions/pdf/archive/fp7-evidence-base/experts_analysis/a.%20inzelt_-_researchers'_mobility.pdf (p. 30)

[47] http://www.nifu.no/news/riksbankens-jubileumsfond-tenker-videre/ (p. 198)

- The **Swedish Visby Program** is the only national program which is **directly targeted to enhance research cooperation and mobility within the BSR** and to implement the EU Strategy for the Baltic Sea Region. It is open to citizens from Belarus, Estonia, Georgia, Latvia, Lithuania, Moldova, Poland, Russia and Ukraine.

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