



Intra-EU mobility of researchers

Main Findings

Doctoral candidates in the EU

In the EU, intra-EU mobility accounts for 5.5% of doctoral candidates (EU citizens who work in a Member State of which they do not hold the nationality).

Intra-EU inflows range from less than 1% in Czech Republic, Slovakia, Estonia and Italy, to 12% in Austria and the United Kingdom, in percentage of the total number of doctoral candidates in each country.

In absolute numbers, the UK, France and Spain rank top on the list of receiving countries of foreign doctoral candidates of EU origin, with respectively 11,000, 5,100 and 2,600 individuals.

In the UK, doctoral candidates come from all over the EU but the nationalities that rank first are Greek, German, Italian, French, Irish and Spanish. In France, the Italians, the Greeks and the Germans are the most numerous among doctoral candidates EU citizens. In Spain, intra-EU inflows from Portugal and Italy are the highest.

As far as intra-EU outflows are concerned, Germany, Greece and Italy rank first, each of them sending some 3,700 doctoral candidates in the other EU countries. In relative terms however, Malta, Cyprus, Greece, Portugal, Estonia and Belgium are the countries which send the highest share of their nationals' doctoral candidates in other EU countries.

Junior researchers in life sciences in the EU

The following results are based on a survey of young researchers in life sciences in Europe.

The number of doctoral candidates in the EU25 is estimated to be around 37,000, in 2003. 28,000 (75%) of them are not internationally mobile, 3,500 (9%) are from another EU country and 6,000 (16%) are from third countries.

The number of postdoctorates in life sciences in the EU25 is about 19,000. 11,000 (57%) of them are not mobile, 3,600 (19%) are from another EU country and 4,800 (24%) are from third countries.

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Contact details:

Philippe Mogu rou, Maria Paola di Pietrogiacomo
IPTS – Institute for Prospective Technological Studies
European Commission, Joint Research Centre
Edificio EXPO, Calle Inca Garcilaso s/n
E-41092 Sevilla
Spain

Web: <http://www.jrc.es/>

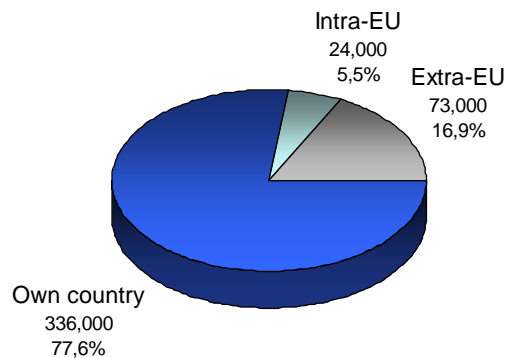
Doctoral candidates in the EU

Origin of doctoral candidates in the EU: a global picture

In the EU¹, in 2004, 77.6% of doctoral candidates work in a country of which they are citizens (“own country”), 5.5% are EU nationals who work in another EU country (“intra-EU”) and 16.9% come from third countries (“extra-EU”) (cf. Figure 1).²

The distribution for each of the 16 EU countries is given in relative terms (in percentage) in Figure 2 and in absolute numbers in Figure 3.

Figure 1. Percentage of doctoral candidates in the EU according to their country of citizenship (2004)

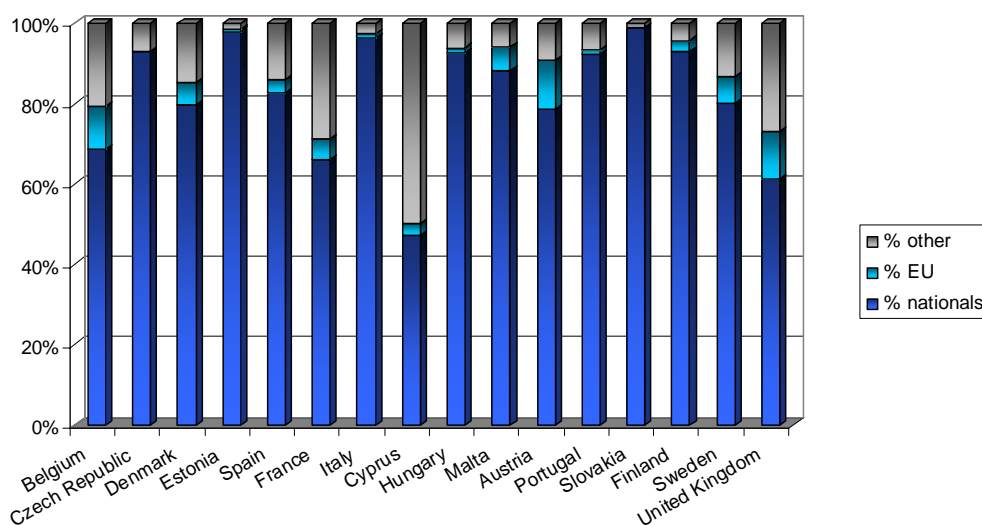


Source: IPTS with Eurostat data. The category “unknown” has not been taken into account.

¹ Based on Eurostat data for 16 EU countries.

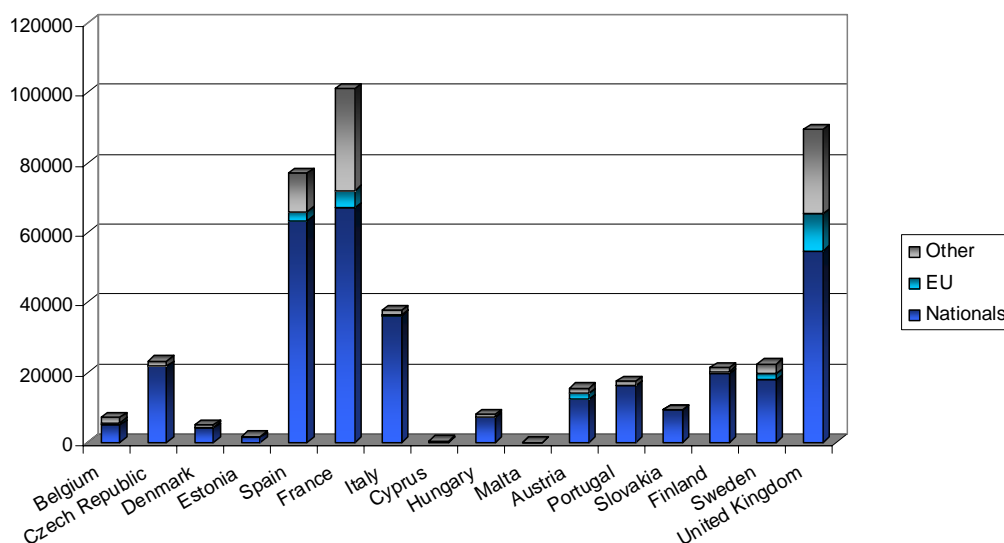
² These calculations are done for the total number of doctoral candidates with known nationalities, i.e. 0.8% of individuals are excluded as they have unknown nationalities.

Figure 2. Percentage of doctoral candidates in 16 EU countries according to their country of citizenship (nationals, EU, non-EU) (2004)



Source: IPTS with Eurostat data. Calculations based on 16 countries.

Figure 3. Number of doctoral candidates in 16 EU countries according to their country of citizenship (nationals, EU, non-EU) (2004)



Source: IPTS. Calculations based on 16 countries for which Eurostat provides data on foreign students in tertiary education by country of citizenship.

Intra-EU inflows

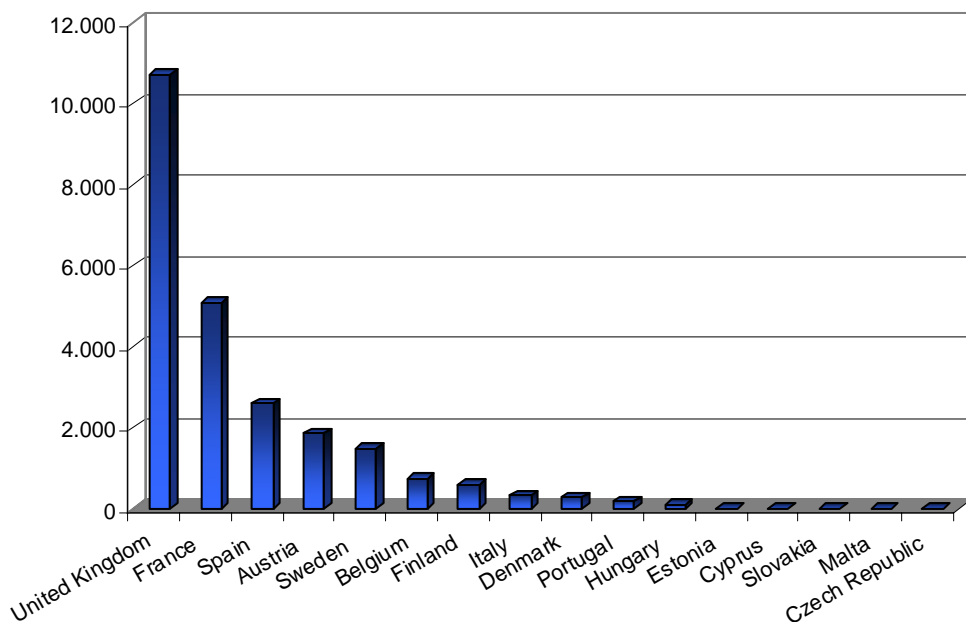
Receiving countries

The percentages of doctoral candidates who are of EU origin³ are the highest in the UK (12%), Austria (12%) and Belgium (11%). They are the lowest (less than 1%) in Czech Republic, Slovakia, Estonia and Italy.

³ except from the country which is considered.

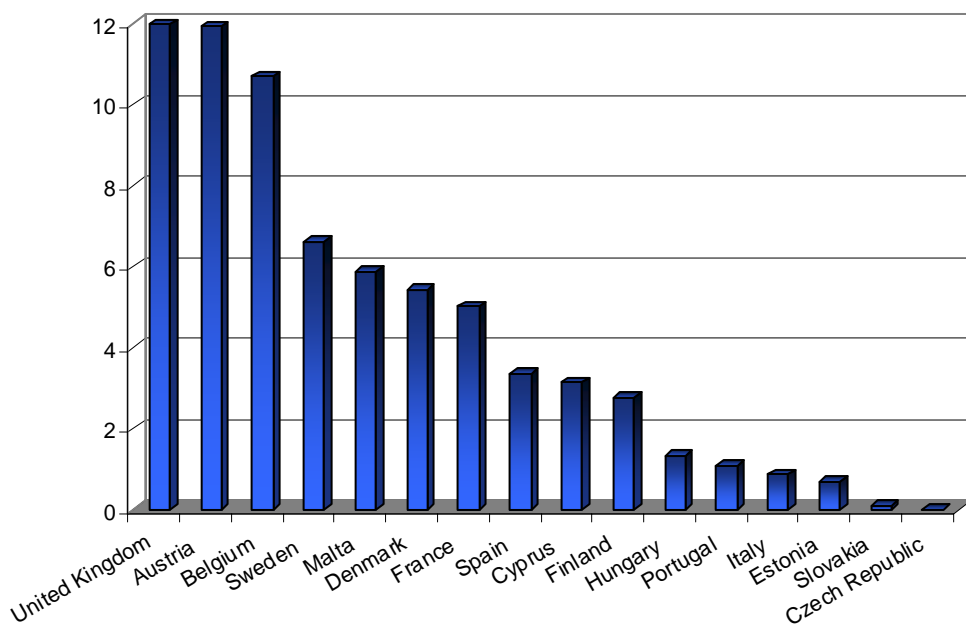
Considering the absolute number of doctoral candidates, the highest numbers of doctoral candidates of EU origin are found in the UK (10,700). France (5,100), Spain (2,600), Austria (1,900) and Sweden (1,500) are the top countries following on the list.

Figure 4. Inflows of doctoral candidates of EU origin: numbers per country



Source: IPTS with Eurostat data.

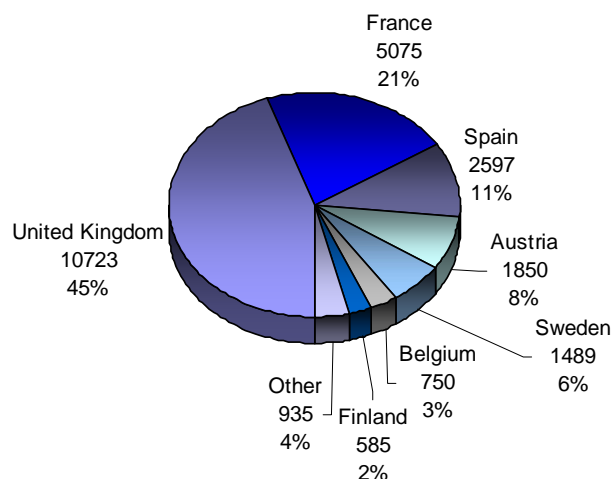
Figure 5. Inflows of doctoral candidates of EU origin, as percentage of the total number of doctoral candidates per country



Source: IPTS with Eurostat data.

UK, France and Spain account for 77% of the EU total number of doctoral candidates of EU origin studying outside their country of origin (45% for the UK alone).

Figure 6. Number of doctoral candidates of EU origin studying outside their country of origin, by receiving country



Source: IPTS. Eurostat data.

Detailed results by receiving countries and nationalities

The following table shows the number of doctoral candidates EU citizens in the 16 EU countries where data are available, presenting for each of them the six nationalities that rank first.

In Belgium, doctoral candidates of French origin account for more than one third of doctoral candidates of EU origin expatriated in this country, followed by the Italians (18%).

In Denmark, 53 Germans are doctoral candidates (one fifth of the total number of doctoral candidates citizens of the other EU Member States in this country).

In Spain, Portuguese doctoral candidates are the most numerous (1,270) and account for nearly half of intra-EU inflows. They are followed by the Italians (500) which represents about 20% of EU doctoral candidates expatriated in this country.

In France, Italians, Greeks and Germans are the most highly represented among doctoral candidates EU citizens, with respectively 1,100, 900 and 600 individuals, accounting in total for 52% of intra-EU inflows in France.

In Italy, a great diversity of nationalities is observed but in total there are only 329 EU citizens' doctoral candidates in this country.

In Austria, there are 746 doctoral candidates from Germany, 40% of the EU total number of doctoral candidates EU expatriates in this country.

In Finland, the first three EU citizenships are Estonian, German and Swedish, whereas in Sweden, the three first are German, Finnish and French.

In the UK, doctoral candidates come from all over the EU. The first six countries or origin of doctoral candidates rank like the following: Greece (2,400), Germany (1,700), Italy (1,300), France (1,000), Ireland (1,000) and Spain (700).

In Czech Republic, Estonia, Cyprus, Hungary, Malta and Slovakia, there are zero or only a few doctoral candidates from the other EU Member States.

Table 1. Origin of doctoral candidates EU citizens, according to receiving countries and citizenships (top six citizenships)

| Country | Number | % | Country | Number | % | Country | Number | % | Country | Number | % |
|----------------|------------|------|---------------|-------------|------|-----------------|-------------|-------|-----------------|--------------|------|
| Belgium | | | Spain | | | Hungary | | | Slovakia | | |
| France | 265 | 35,3 | Portugal | 1270 | 48,9 | Slovakia | 67 | 63,8 | CZ | 6 | 54,5 |
| Italy | 135 | 18,0 | Italy | 538 | 20,7 | Germany | 6 | 5,7 | Greece | 2 | 18,2 |
| Spain | 54 | 7,2 | France | 243 | 9,4 | France | 5 | 4,8 | Germany | 1 | 9,1 |
| Greece | 51 | 6,8 | Germany | 181 | 7,0 | Poland | 5 | 4,8 | Hungary | 1 | 9,1 |
| Netherlands | 42 | 5,6 | UK | 84 | 3,2 | Austria | 4 | 3,8 | Poland | 1 | 9,1 |
| Luxembourg | 41 | 5,5 | Greece | 75 | 2,9 | UK | 4 | 3,8 | Belgium | 0 | 0,0 |
| TOTAL | 750 | | TOTAL | 2597 | | TOTAL | 105 | | TOTAL | 11 | |
| CZ | | | France | | | Malta | | | Finland | | |
| Belgium | 0 | | Italy | 1126 | 22,2 | Germany | 1 | 100,0 | Estonia | 92 | 15,7 |
| Denmark | 0 | | Greece | 918 | 18,1 | Belgium | 0 | 0,0 | Germany | 74 | 12,6 |
| Germany | 0 | | Germany | 607 | 12,0 | CZ | 0 | 0,0 | Sweden | 62 | 10,6 |
| Estonia | 0 | | Spain | 452 | 8,9 | Denmark | 0 | 0,0 | France | 43 | 7,4 |
| Greece | 0 | | Poland | 433 | 8,5 | Estonia | 0 | 0,0 | Hungary | 40 | 6,8 |
| Spain | 0 | | Belgium | 294 | 5,8 | Greece | 0 | 0,0 | Spain | 39 | 6,7 |
| TOTAL | 0 | | TOTAL | 5075 | | TOTAL | 1 | | TOTAL | 585 | |
| Denmark | | | Italy | | | Austria | | | Sweden | | |
| Germany | 53 | 19,1 | France | 50 | 15,2 | Germany | 746 | 40,3 | Germany | 278 | 18,7 |
| Italy | 33 | 11,9 | Germany | 49 | 14,9 | Italy | 364 | 19,7 | Finland | 208 | 14,0 |
| Spain | 30 | 10,8 | Spain | 48 | 14,6 | Poland | 161 | 8,7 | France | 113 | 7,6 |
| Sweden | 24 | 8,7 | Greece | 33 | 10,0 | Slovakia | 126 | 6,8 | Italy | 107 | 7,2 |
| Poland | 23 | 8,3 | Poland | 26 | 7,9 | Hungary | 102 | 5,5 | Poland | 102 | 6,9 |
| UK | 21 | 7,6 | UK | 19 | 5,8 | Slovenia | 86 | 4,6 | Denmark | 93 | 6,2 |
| TOTAL | 277 | | TOTAL | 329 | | TOTAL | 1850 | | TOTAL | 1489 | |
| Estonia | | | Cyprus | | | Portugal | | | UK | | |
| Italy | 3 | 25,0 | Greece | 11 | 91,7 | France | 46 | 24,5 | Greece | 2439 | 22,7 |
| France | 2 | 16,7 | Germany | 1 | 8,3 | Spain | 42 | 22,3 | Germany | 1651 | 15,4 |
| Latvia | 2 | 16,7 | Belgium | 0 | 0,0 | Italy | 34 | 18,1 | Italy | 1275 | 11,9 |
| Hungary | 2 | 16,7 | CZ | 0 | 0,0 | Germany | 26 | 13,8 | France | 1039 | 9,7 |
| Finland | 2 | 16,7 | Denmark | 0 | 0,0 | UK | 13 | 6,9 | Ireland | 1036 | 9,7 |
| Germany | 1 | 8,3 | Estonia | 0 | 0,0 | Belgium | 7 | 3,7 | Spain | 722 | 6,7 |
| TOTAL | 12 | | TOTAL | 12 | | TOTAL | 188 | | TOTAL | 10723 | |

Source: IPTS with Eurostat data. TOTAL: total number of EU citizens' doctoral candidates in the considered country. %: percentage among this total. How to read: in Belgium, 265 doctoral candidates are French citizens. They account for 35.3% of the total number of doctoral candidates of EU origin non-Belgian citizens.

To have a better apprehension of the origin of doctoral candidates in each country, it is possible to control for the size of the doctoral population of each country in the EU. To do so, we will calculate the relative risk.

1. For each country, we calculate the distribution of doctoral candidates from EU countries, according to citizenship.
2. At the EU level, we calculate the distribution of doctoral candidates, according to citizenship.
3. We calculate the risk ratios of the two previous percentages.
4. For each country, we rank the nationalities.

It has only been possible to do this for 13 EU countries as for some of them no sufficient information was available.

For example, for Belgium:

1. There are 265 doctoral candidates of French origin. This represents 50.3% of the doctoral candidates of EU origin in EU countries (12 EU countries).
2. On average, in the EU13, France accounts for 21% of doctoral candidates.
3. Therefore, for Belgium, the risk ratio is $.503/.21 = 2.39$. It can be interpreted like the following: the percentage of French in Belgium is 2.39 times the percentage of French in the EU13. French doctoral candidates are 2.39 times more represented in Belgium than they are on average in the EU13.
4. We do this for all countries and for all nationalities.

This indicator measures the relative importance of the different countries as source of doctoral candidates for each of the 13 EU countries. It measures the relative links or the relative attractiveness. Some notable changes have to

be noted compared to the previous table (some citizenships of small countries rank now first, notably Belgians, in a few countries).

In Denmark, Sweden is now the citizenship the most highly represented in relative terms, and not German anymore.

In France, Belgians and Italians are the two first citizenships, as well as in Portugal.

In Sweden, the three first origin countries in relative terms are Estonia, Denmark and Finland.

In the UK, Belgian, Danish and Portuguese rank first.

Table 2. Risk ratios of doctoral candidates according to citizenships, by country

| Belgium | Spain | Hungary | Slovakia | UK |
|----------------|---------------|-----------------|-----------------|---------------|
| France | 2,39 Portugal | 10,03 | Slovakia 26,64 | Hungary 42,69 |
| Italy | 2,10 Italy | 1,95 | Estonia 4,07 | Belgium 0,00 |
| Portugal | 1,19 Belgium | 1,67 | Austria 1,22 | Denmark 0,00 |
| Hungary | 0,65 France | 0,51 | Belgium 0,70 | Estonia 0,00 |
| Slovakia | 0,58 Austria | 0,27 | France 0,28 | Spain 0,00 |
| Spain | 0,52 Denmark | 0,26 | UK 0,28 | France 0,00 |
| Denmark | France | Austria | Finland | |
| Sweden | 2,76 Belgium | 6,61 | Hungary 6,08 | Estonia 41,56 |
| Estonia | 2,26 Italy | 3,45 | Slovakia 6,02 | Hungary 4,41 |
| Italy | 1,75 Hungary | 1,98 | Italy 4,17 | Sweden 2,86 |
| Hungary | 1,65 Portugal | 1,82 | Denmark 1,04 | Denmark 1,93 |
| Austria | 1,35 Estonia | 1,50 | Estonia 0,49 | Belgium 1,09 |
| Portugal | 1,15 Denmark | 0,89 | Belgium 0,34 | Slovakia 1,06 |
| Estonia | Italy | Portugal | Sweden | |
| Hungary | 9,49 Denmark | 3,65 | Belgium 2,84 | Estonia 13,23 |
| Finland | 3,62 Belgium | 3,27 | Italy 1,88 | Denmark 7,95 |
| Italy | 2,73 Hungary | 3,25 | France 1,48 | Finland 3,88 |
| France | 1,06 Portugal | 1,55 | Spain 1,43 | Hungary 1,52 |
| Belgium | 0,00 Spain | 1,31 | Hungary 0,58 | Italy 1,01 |
| Denmark | 0,00 France | 1,29 | Austria 0,53 | Belgium 0,96 |

Source: IPTS with Eurostat data.

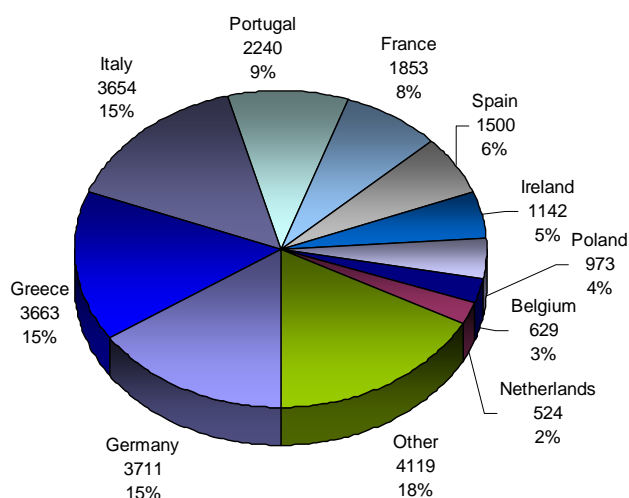
Intra-EU outflows

Sending countries

About 3,700 Germans, Greeks and Italians (each) are pursuing doctoral studies in the EU-16 outside their country of origin. These three first citizenships account for 46% of all the EU citizens who pursue doctoral studies outside their countries of origin in the EU-16.

They are followed by Portugal (2,200), France (1,900), Spain (1,500) and Ireland (1,100), the citizens of all the other EU countries being less than 1,000 each.

Figure 7. Number of citizens of a particular country pursuing doctoral studies in the EU-16



Source: IPTS. Eurostat data.

A relative measure

To take into account the size of the doctoral population at home, we have created an indicator that is the ratio of the number of expatriates' doctoral candidates of a specific country in the EU-16 to the number of nationals who pursue doctoral studies in their country of citizenship.⁴

With this indicator, Malta and Cyprus are the countries that rank first. This ratio is very high for these two countries, respectively 7.7 and 1.8, given the limited number of doctoral candidates they have at home.⁵

Greece, Portugal, Estonia, Belgium and Italy are the countries that follow on the list, with ratios ranging between 0.1 and 0.2.⁶

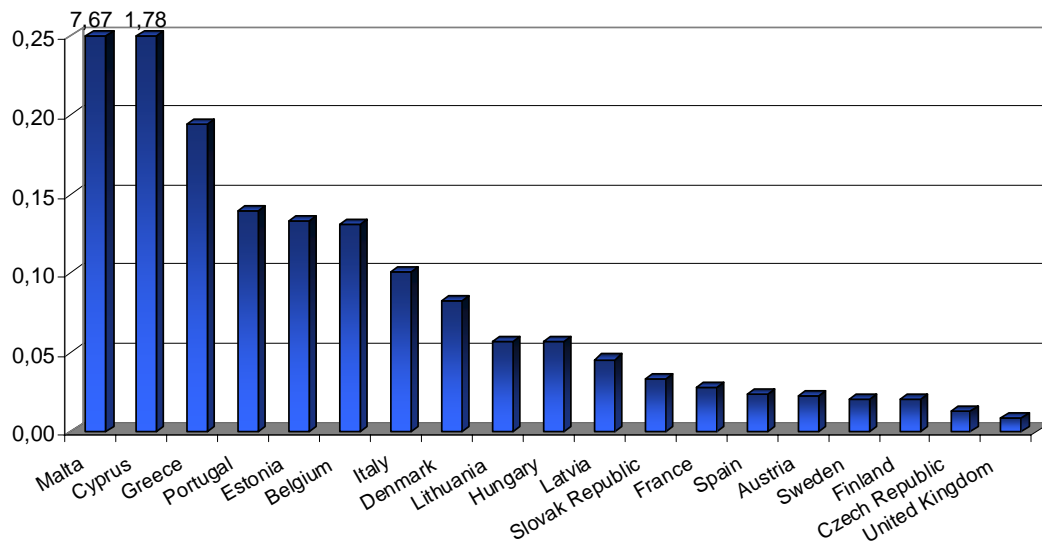
The ratio is the lowest for the United Kingdom (0.008).

⁴ Obviously, this was only possible for the 16 EU countries providing data.

⁵ It is found that doctoral candidates from Malta doing a doctorate in other EU countries (115) represent 7.7 times the number of Malta citizens pursuing a doctorate in Malta (15).

⁶ For example, there are 3,663 Greeks' doctoral candidates who pursue a doctorate in other EU countries and 18,907 Greeks who undertake doctoral studies in Greece, therefore, the ratio between the two numbers is 0.19.

Figure 8. Ratio of the number of doctoral candidates from the considered country expatriates in the EU to the number of nationals' doctorate candidates

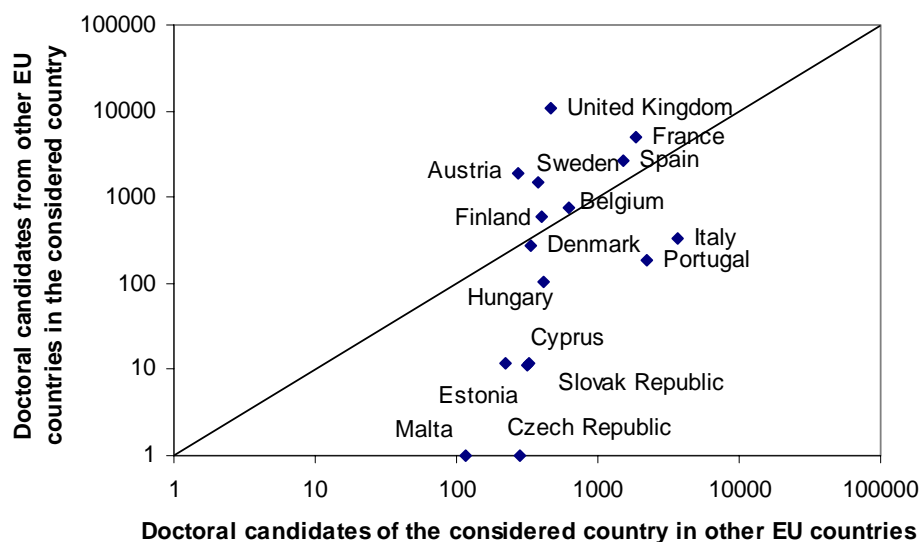


Source: IPTS. Eurostat data.

Intra-EU exchanges of doctoral candidates: gains and losses

On the following graph, countries above the first bisector experience a positive difference between the number of doctoral candidates they receive from other EU countries (y axis) and the number of doctoral candidates they send to other EU countries (x axis). This is the case of the UK, France, Austria, Sweden, Spain, Finland, Belgium and Denmark.⁷

Figure 9. Origin and destination of doctoral candidates of EU origin in EU countries

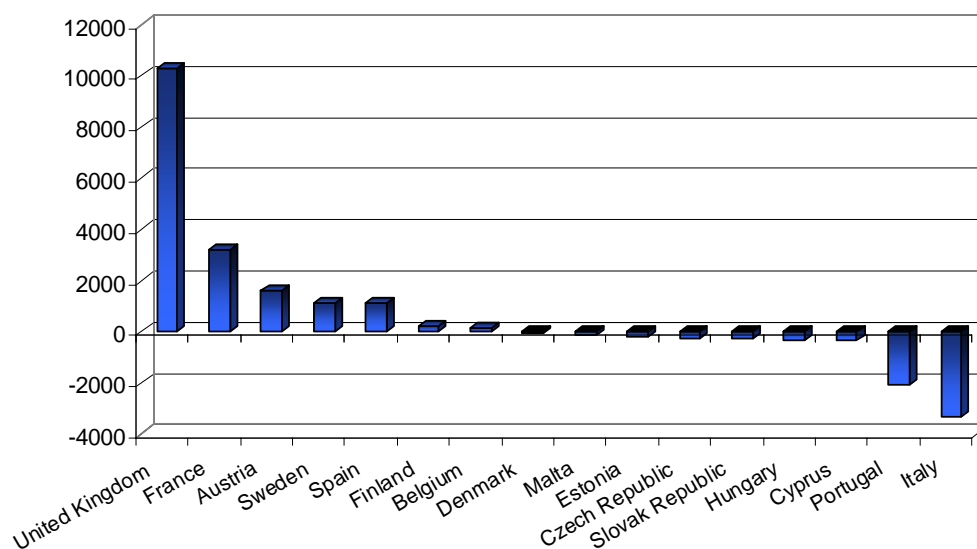


Source: IPTS. Logarithmic scales for both axes.

⁷ However, one has to remind that these calculations are based on only 16 EU countries that provide data. In particular, the lack of data for Germany may have an impact (notably on Austria).

The picture is clearer on the Figure 10 which gives the net intra-EU gains of doctoral candidates for each country, in absolute terms. The United Kingdom is the most important net gainer of the intra-EU exchanges of doctoral candidates, while Portugal and Italy experience the highest losses.

Figure 10. Intra-EU “net gain” of doctoral candidates: differences between the number of doctoral candidates of EU origin in the considered country and the number of citizens of this particular country doctoral candidates in other EU countries



Source: IPTS with Eurostat data.

Junior researchers in life sciences in the EU25

Origin of doctoral graduates

8,800 doctorates in life sciences have been granted in EU-25 countries in 2003, according to Eurostat data. By comparison, 5,700 doctorates in biological sciences were granted in the United States in 2003 according to NSF data (65% of the total for EU-25 countries).

In 2003, among the 5,700 doctorate recipients in biological sciences from U.S. universities, 1,700 were not U.S. citizens (29%).⁸ The same year, in the EU-25, we estimate⁹ that 1,500 doctorates in life sciences (17%) were awarded to non-EU nationals.

Table 3. Doctoral graduates in life sciences in the EU-25 and the U.S., according to nationality (2003)

| | EU-25 | | U.S. | |
|---------------|---------|-----|---------|-----|
| | Numbers | % | Numbers | % |
| Nationals | 7 300 | 83 | 4 000 | 71 |
| Non-nationals | 1 500 | 17 | 1 700 | 29 |
| Total | 8 800 | 100 | 5 700 | 100 |

Source: IPTS. Our estimations with data from Eurostat, NSF and the NetReAct survey. U.S.: sum of non U.S. citizens with permanent visas and temporary visas.

We also estimate that 10% of the doctorates granted in life sciences in the EU-25 in 2003 were EU nationals who worked in a Member State of which they did not hold the nationality (intra-EU mobility).

Table 4. Origin of doctoral graduates in life sciences in EU universities (2003)

| | EU | | | Non EU | | Total |
|---------|-------------|------------------|-------------------------------------|---------------|---------------|-------|
| | Own country | Other EU country | Other European country (outside EU) | USA or Canada | Other country | |
| Numbers | 6 400 | 900 | 220 | 170 | 1 100 | 8 800 |
| % | 73 | 10 | 3 | 2 | 12 | 100 |

Source: IPTS. Our estimations from the NetReAct survey and Eurostat data.

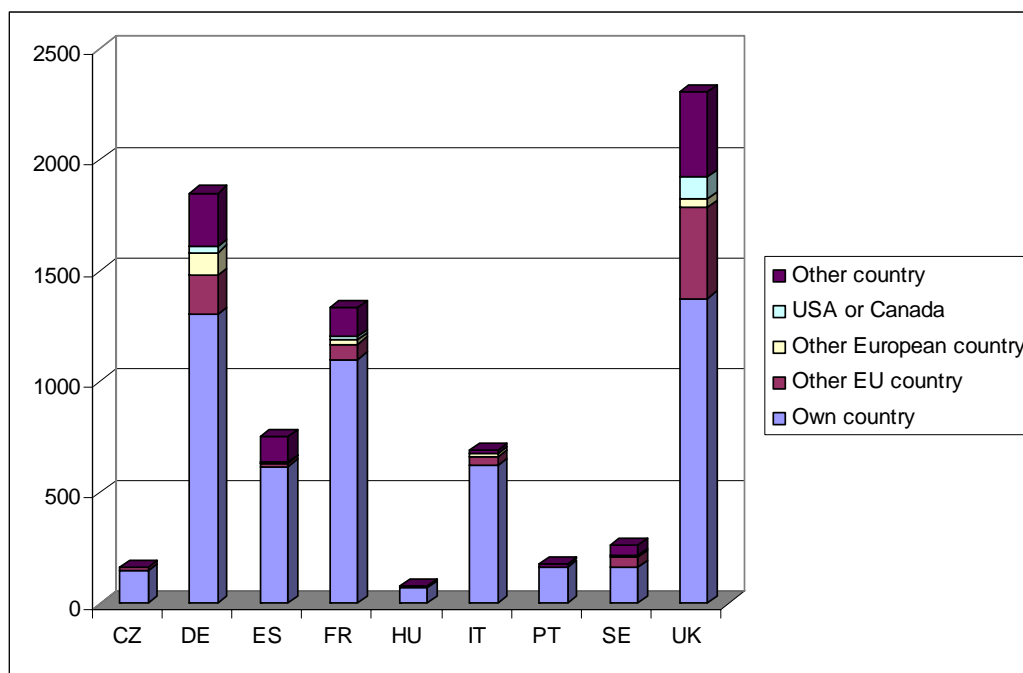
EU-25 attracts few doctoral recipients from Canada and the United States (167 according to our estimations, about 2%) and they are mainly in the United Kingdom (99).

The UK also attracts many EU doctoral candidates. Indeed, we estimate that 409 individuals from EU countries (other than the UK) were granted a Doctorate in life sciences in this country in 2003.

⁸ 265 were non-U.S. citizens with permanent visas and 1,401 were non-U.S. citizens with temporary visas.

⁹ In combining NetReAct and Eurostat data.

Figure 11. Number of doctoral graduates in life sciences awarded in nine EU countries, according to their country of origin (2003)



Source: IPTS. Our estimations from the NetReAct survey and Eurostat data.

Origin of postdoctorates

The number of postdocs in biological sciences in the U.S. was nearly 18,000 in 2002. In the EU-25, we estimated that there were approximately 19,000 postdoctorates in the field of life science in 2003. Most of them (5,700) were working in the UK (29.5% of the EU-25 total).

In 2002, 57% of the postdocs in biological sciences in the U.S. were temporary visa holders (10,100). In 2003, it is estimated that 25% of postdoctorates in life sciences working in the EU-25 were non-EU nationals (4,800).

Table 5. Number of postdoctorates in life sciences in the EU-25 and the U.S., according to nationality (2003)

| | EU-25 | | U.S. | |
|---------------|---------|-----|---------|-----|
| | Numbers | % | Numbers | % |
| Nationals | 14 600 | 75 | 7 800 | 43 |
| Non-nationals | 4 800 | 25 | 10 100 | 57 |
| Total | 19 400 | 100 | 17 900 | 100 |

Source: IPTS. Our estimations with data from Eurostat, NSF and the NetReAct survey.

We also find that 19% of postdoctorates were EU nationals working in a Member State of which they did not hold the nationality. Nearly 1,000 came from another European country outside EU and another 1,000 came from Canada or the U.S. Other countries contributed to about 3,000.

Table 6. Origin of postdoctorates in life sciences in EU universities (2003)

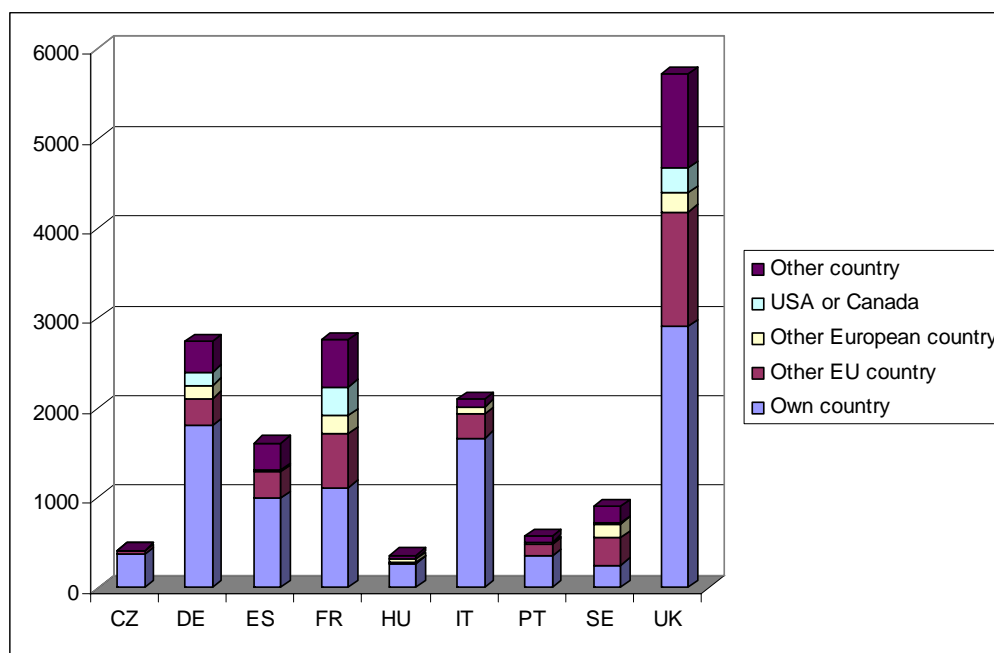
| | EU | | Non EU | | | Total |
|---------|-------------|------------------|-------------------------------------|---------------|---------------|--------|
| | Own country | Other EU country | Other European country (outside EU) | USA or Canada | Other country | |
| Numbers | 11 000 | 3 600 | 1 000 | 900 | 2 900 | 19 400 |
| % | 57 | 19 | 5 | 5 | 15 | 100 |

Source: IPTS. Our estimations with data from the NetReAct survey and Eurostat.

The UK attracts many postdoctorates from EU-25 origin. Indeed, we estimate that 1,300 postdoctorates from EU-25 countries (other than the UK) were working in the field of life sciences in UK labs in 2003. France, the second country on the list, attracted only 600 postdoctorates from other EU countries.

Countries attracting the highest number of postdoctorates from North America rank like this: France (300 postdocs from this region), the UK (300) and Germany (150).

Figure 12. Number of postdoctorates in life sciences in nine EU countries, according to their country of origin (2003)



Source: IPTS. Our estimations with the NetReAct survey and Eurostat data.

Definitions & Methodological Notes

Doctoral candidates in the EU

Data are from Eurostat. They have been extracted on November 29th, 2006.

Calculations are based on 16 countries only as data on the remaining countries are not available (and notably for Germany). These 16 countries are: Belgium, Czech Republic, Denmark, Estonia, Spain, France, Italy, Cyprus, Hungary, Malta, Austria, Portugal, Slovak Republic, Finland, Sweden, United Kingdom.

However, for Czech Republic, Cyprus and Malta the number of foreign doctoral candidates provided is zero. Therefore, for some calculations, these three countries have been dropped from the analysis.

Junior researchers in life sciences

Three main sources of data have been combined:

- Eurostat provides statistics on the number of ISCED6 graduates in life sciences (the classification field EF42) in the EU-25 countries.
- The NetReAct survey (“The role of Networking in Research Activities”) commissioned by the Institute for Prospective Technological Studies of the European Commission’s Joint Research Centre aims at describing and analysing the patterns, dynamics, impacts and strategies of networking in research activities in life sciences. It provides detailed information on the doctoral candidates and post-docs population in 10 European countries (The Czech Republic, France, Germany, Hungary, Italy, Norway, Portugal, Spain, Sweden, and the UK) collected through a questionnaire-based survey addressed to the heads of research teams. The research population identified by the NetReAct project consists of 7,732 teams working in life sciences, from 359 universities. The field of life sciences has been identified using the K.U. Leuven-IRO Subject Classification, considering five main fields: biology, bio-sciences, bio-medicine, neuro-sciences and other disciplines.
- The US National Science Foundation provides statistics in the SESTAT system on the number of post-doctorates in biological sciences in the US. The field “biological sciences” is taken into account in this note (the field health has not been included as it is too large to be compared with the field life sciences in Eurostat and NetReAct data). The NSF “biological sciences” field is composed of the following disciplines: Anatomy, Biochemistry, Biology, Biometry/epidemiology, Biophysics, Botany, Cell biology, Ecology, Entomology/parasitology, Genetics, Microbiology, immunology, and virology, Nutrition, Pathology, Pharmacology, Physiology, Zoology, Biosciences, nec.