Facts & Figures

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Rathenau Instituut

International mobility of researchers

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In this publication, the Rathenau Instituut examines policy measures and statistics pertaining to the international mobility of researchers. Researcher mobility is a conscious policy aim and widely viewed as an indicator of the quality of individual researchers. But mobility is also feared. Many university administrators and politicians are afraid of a 'brain drain'. The figures show, however, that researcher inflow and outflow are even in the Netherlands, both in number of individuals and quality. To gain a better understanding of this issue, the Rathenau Instituut analysed various sources of data on researchers in the Netherlands. It also tracked the mobility of Dutch and foreign researchers by comparing international data.

Content

1 Introduction

Researchers are becoming more mobile all the time. The Dutch government, Dutch universities and the European Union all actively encourage international researcher mobility. When outstanding researchers move to the Netherlands from abroad, their arrival is announced with pride. On the other hand, worried voices are regularly heard lamenting the departure of outstanding Dutch researchers for other countries.

The lack of data on researcher mobility makes it difficult to track and interpret their mobility patterns. Is there a brain gain, a brain drain, or a brain exchange in the Netherlands? And what about the quality of researcher inflow and outflow?

In this Facts & Figures, the Rathenau Instituut presents the most recent information on the international mobility of researchers who come to and leave the Netherlands. Based on the information collected, we have concluded as follows:

- Dutch researchers are among the most mobile researchers in the world. They rank among researchers from other countries with a highly mobile research population, such as Germany, Switzerland, Canada and the United Kingdom.
- Researcher inflow and outflow are even. Dutch researchers are very mobile compared with their counterparts in other countries, but the Netherlands also attracts foreign researchers. Looking at the overall system, the Netherlands is experiencing neither a brain drain nor a brain gain.
- Academic staff at Dutch universities are growing increasingly international. The percentage of academic staff who are foreign nationals has increased from 20% in 2005 to 33% in 2015. There are especially large numbers of foreign researchers in Engineering and Technology, Natural Science and Economics, but the increase is evident across all domains. These foreign researchers come mainly from Germany (5% of total academic staff), Italy (3%), China (3%), Belgium (2%) and India (2%), followed by the United Kingdom, the United States, Spain, Iran and Greece.
- There is also a qualitative balance. We lose talent to other countries, but we also gain talented researchers from abroad. The citation impact scores of incoming and outgoing researchers are similar. In addition, both groups have high scores compared to other researchers in the Netherlands.
  We see the same balance between quality inflow and quality outflow in Switzerland, Germany, Sweden and Denmark. By comparison, incoming researchers in the United Kingdom and the United States tend to have higher citation impact scores than outgoing researchers.

2 Policy encouraging the international mobility of researchers

International researcher mobility is encouraged at several different levels. In this section, we briefly review European, Dutch and Dutch university policy in this area. Each level has other reasons for encouraging mobility and uses other policy measures to do so.

This section makes a distinction between short-term and long-term mobility and between mobility that does or does not involve a change of employer. Short-term mobility refers to a researcher moving abroad for anywhere from three months to one or two years (depending on the source). The researcher may continue to be employed by his or her institution of origin during this time period. Long-term mobility refers to a researcher moving abroad for two or more years; in many cases, the researcher leaves his or her job for employment in another country. The final category consists of researchers who work in multiple countries, combining a position in the Netherlands with a position elsewhere.

2.1 European policy

Three reasons are given for encouraging researcher mobility in Europe. Greater researcher mobility, whether short term or long term, should lead to:

- better knowledge sharing and dissemination
- more attractive career prospects and broader horizons for researchers
- a better quality of researchers thanks to the opportunity to build experience, gain exposure to different viewpoints and acquire new skills.

Since 2000, the European Union has been developing a European Research Area (ERA). The ERA makes it easy for researchers to move to another ERA country and to collaborate with researchers in other ERA countries.

The aim is to reinforce the science system of the member states, improve competitiveness and allow researchers in the ERA to collaborate more effectively.

The EU has introduced several policy measures in this regard. EURAXESS, an initiative of the European Commission and EU Member States, was set up to facilitate researcher mobility, remove obstacles to mobility and open up the academic job market to researchers from other countries. For example, EURAXESS makes it possible for Member States to streamline the work permit issuance process and for researchers to transfer their pension entitlements to their new place of residence.

European researchers can apply for a grant under the Marie Skłodowska-Curie Actions (which have a budget of €6.2 billion in Horizon 2020) to support transnational, intersectoral and interdisciplinary mobility. The grants are awarded to outstanding researchers at every stage of their career (European Commission 2011).

The grants awarded by the European Research Council or ERC (a budget of €13.1 billion in Horizon 2020) are meant primarily to promote research excellence. They are awarded to the best research proposals in an open competition and offer scientists the opportunity to conduct 'frontier research'. A second aim is to encourage European mobility. Researchers can apply for an ERC Grant to fund their research at a European institution. Throughout the grant period, recipients will retain their grant if they transfer to another European research institution, not only during the application process but also later, even if their project has been up and running for a while. In reality, however, ERC mobility is limited (see Section 4.2 below). The third aim of the ERC Grants is to attract researchers to Europe from outside the ERA. They too may apply for a grant, but they must conduct their research at a European research institution (ERC 2015).

2.2 Dutch national policy

Dutch academic mobility policy is based on two underlying principles:

- mobility fosters knowledge circulation
- talented foreign researchers are good for the national economy and the national science system.

The Dutch government's policy paper *Vision for Science 2025* (2014), co-authored by the Minister and State Secretary for Education, Culture and Science and the Minister of Economic Affairs, devotes an entire section to international researcher mobility, i.e. 'The Netherlands as the "preferred location" for scientific talent'. The argument is as follows: 'We wish to devote particular attention to attracting international top talent. Researchers of the highest calibre are needed to produce new insights, develop new knowledge and expertise, and to help in building our networks' (*Vision for Science 2025*, p. 67).

To put this policy into practice, the Dutch government expects knowledge institutions to 'devote attention to strengthening an attractive environment for international talent' (*Vision for Science 2025*, p. 68). The Netherlands Organisation for Scientific Research (NWO) is also expected to help make the Netherlands a preferred location for foreign talent by bringing the Innovational Research Incentives (*Vernieuwingsimpuls*) to the attention of a select group of international researchers. These are foreign researchers who can bring 'significant added value to the Netherlands' research landscape by virtue of their focus on the challenges of the National Research Agenda. They will complement the broad-based talent already working here' (*Vision for Science 2025*, p. 68).

In addition to the Innovational Research Incentives, NWO also runs programmes meant specifically to encourage international researcher mobility. These programmes focus on temporary outgoing and incoming mobility. Rubicon Grants allow recent PhDs to gain experience at a top foreign research Instituut. Visitor's Travel Grants support senior researchers from abroad who are making an important contribution to an ongoing Dutch research project and promote collaboration between Dutch and foreign researchers.

In addition to schemes meant specifically to support researchers, there are other policy instruments and measures focusing on high-skilled workers. The best-known is the '30 percent tax rule' for expats, which exempts them from paying tax on 30 percent of their income.

Finally, European science funding bodies adhere to the 'money follows researcher' arrangement, which allows researchers to transfer their national funding to their new workplace if they accept a position in another European country. NWO has committed to this arrangement. Its purpose is to prevent national grants from impeding mobility, but also to avoid ending research projects unnecessarily when a researcher decides to move to a foreign research institution.

2.3 Dutch university policy

Dutch universities are keen to attract talented researchers from abroad. They regard the extent to which they have an international academic staff as an indicator of their research quality.

Other reasons that universities cite in strategic policy documents for promoting a larger percentage of international academic staff are: having instructors who serve as a distinct role model for international students; training students to be employees who deal well with cultural diversity; the positive impact of cultural diversity on creativity; the knowledge-sharing facilitated by mobility; and the desire to expand the networks of academic staff.

All Dutch universities are interested in having a more international academic staff and they are working hard to develop international mobility policies of their own. In their efforts to attract researchers from abroad, they are attempting to organise their campuses in such a way that everyone feels at home there, regardless of cultural background.

In terms of policy measures, universities are most interested in permanent incoming mobility, with researchers switching employers. University policy documents make no mention of any measures meant specifically to retain international talent or to encourage temporary incoming mobility without a change in employer (incoming sabbaticals).

University policy on international mobility is a relatively recent phenomenon and continues to evolve. Universities have very little systematic, monitored data on the institutions that foreign researchers come from or where Dutch researchers go when they accept a position abroad. We also know very little about the effects of their mobility policy.

3 Foreign researchers in the Netherlands

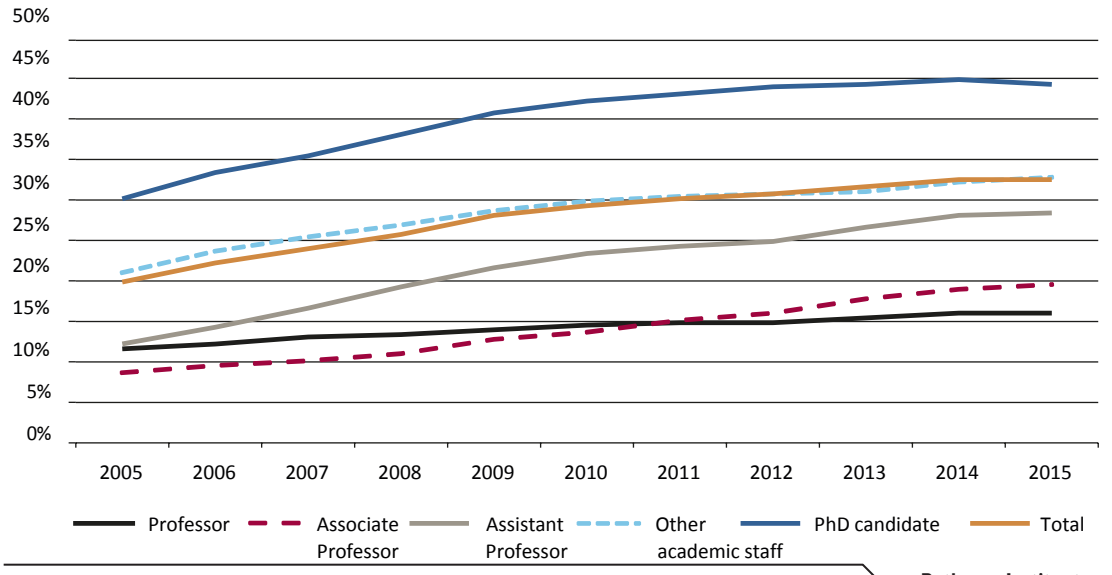
Researchers in the Netherlands work for a variety of different employers: research universities, research institutes (e.g. NWO and the Royal Netherlands Academy of Arts and Sciences), universities of applied sciences, public knowledge institutes (e.g. the Royal Netherlands Meteorological Institute and the Netherlands Institute for Public Health and the Environment), university hospitals and businesses. This publication focuses solely on academic staff at universities (not including university hospitals) because our data are limited to this category.

The number of researchers at Dutch universities who are foreign nationals is rising. The share of foreign academic staff has increased gradually from 20% (5,009 researchers) in 2005 to 33% (9,638 researchers) in 2015 (see Figure 1). The most rapid growth occurred between 2005 and 2008. This increase can be seen across all job categories. At the same time, growth in the number of Dutch researchers has virtually stagnated.

In 2015, there were differences between Dutch and foreign researchers in terms of the most common job and contract categories. The non-Dutch group included relatively more PhD candidates and other academic staff (often postdocs).

That also means that this group tended to have more temporary appointments (79% of the foreign group had a temporary contract, as opposed to 52% of Dutch academic staff). There was very little difference between the two categories in terms of percentage of women (40% Dutch category and 41% non-Dutch category).

Figure 1 Non-Dutch academic staff at Dutch universities, by job title, 2005-2015 (%) N=29,650



Source: WOPI-Flex 2015. Adapted by the Rathenau Instituut.

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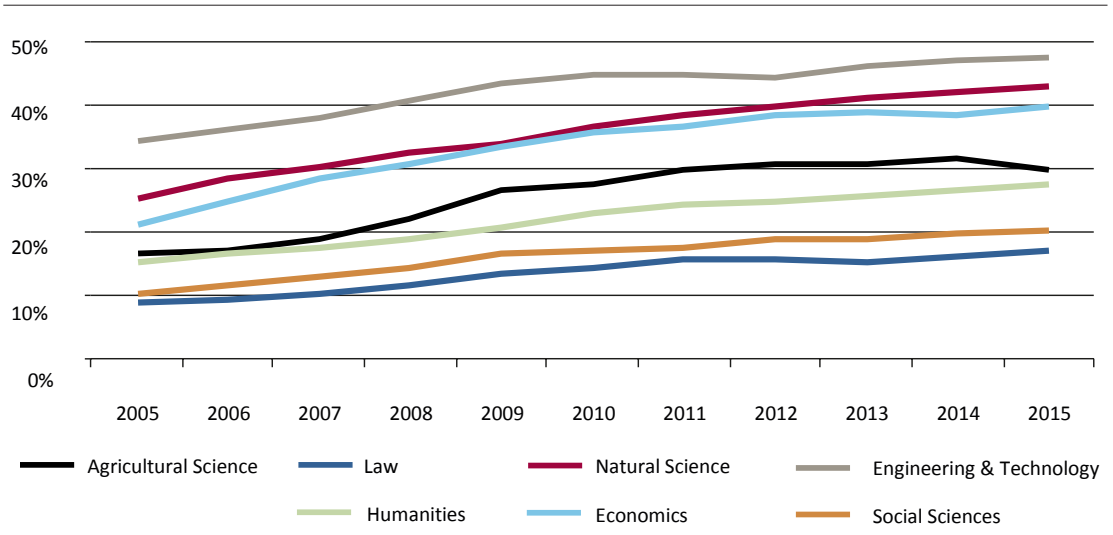
The percentage of non-Dutch academic staff increased across all fields of science. In 2015, that percentage was largest in Engineering & Technology (48%) and Natural Science (43%) and lowest in Law (17%) and Social Sciences (20%).

We see the same increase at all the Dutch universities. The universities of technology at Delft (48%) and Eindhoven (50%) have the largest share of non-Dutch researchers. The sharpest percentage-wise increase in foreign researchers between 2005 and 2010 occurred at the University of Groningen (from 9% to 36%), Delft University of Technology (from 32% to 48%) and Maastricht University (from 24% to 39%).

Figure 2 Non-Dutch academic staff at Dutch universities, by research area ('HOOP' area), 2005-2015 (%) N=29,650



Source: WOPI-Flex 2015. Adapted by the Rathenau Instituut.

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Origin

In 2015, 67% of academic staff at Dutch universities were Dutch nationals, 19% were from the European Union, 2% from a non-EU country in Europe, and 12% from outside Europe. The top five countries of origin in 2015 were Germany (1,514 individuals, 5% of total academic staff), Italy (860 individuals, 3%), China (742 individuals, 3%), Belgium (628 individuals, 2%) and India (483 individuals, 2%), followed by the United Kingdom, the United States, Spain, Iran and Greece.

The sharpest increase was among staff from the Middle East, southern Europe and India, but there was also at least a doubling of the number of researchers from Turkey, Germany and North America between 2005 and 2015. Breaking down the figures by job category reveals that the group of researchers from southern Europe saw the biggest percentage-wise increase in the category 'professor', while Indian and Middle Eastern researchers saw a sharper rise in the 'other academic staff' and 'assistant professor' categories. Researchers from China, India, Spain, Italy, Greece and Iran tend to work in the Engineering & Technology sector and somewhat less in Natural Science, while researchers from the United States, Germany and Belgium are more common in the Social Sciences and Humanities. British researchers in the Netherlands are more likely to work in Natural Science.

Other facts about foreign researchers at Dutch universities

Non-Dutch researchers are more likely to have a temporary appointment than their Dutch counterparts (79% versus 52%). This has to do with the much larger percentage of non-Dutch PhD candidates and postdocs, positions that are virtually always temporary in nature. But even in the other job categories, we see that foreign researchers work on temporary contract more often than Dutch researchers in the same category. In the assistant professor category, 44% of foreign researchers have a temporary appointment as opposed to 25% of Dutch researchers. This is likely because foreign assistant professors are, on average, younger than Dutch assistant professors and because the number of temporary contracts has increased considerably over time. In the associate professor category, 9% of foreign nationals have temporary appointments and 5% of Dutch nationals. In the professor category, the figures are 13% versus 11%. The age difference between the two groups is smaller in the associate and full professor categories.

The percentage of women in the non-Dutch group hovered around 40% throughout the entire period (from 39% in 2005 to 41% in 2015). In the group of Dutch academic staff, the percentage of women rose from 32% to 40% in the same ten-year period. The more senior the job category, the smaller the percentage of female academic staff. Dutch academic staff has a smaller percentage of female professors, associate professors and assistant professors than the non-Dutch academic staff (see also the Rathenau factsheet Academic Careers of Researchers). In 2015, 25% of all non-Dutch professors in the Netherlands were women, versus 17% of all Dutch professors. Among associate professors, the figures were 36% versus 25% and among assistant professors, 43% versus 39%.

All these trends resulted from three changes that arose simultaneously over the course of the past decade. There was:

- an absolute increase in the number of PhD, postdoc and other academic staff positions from 13,250 FTEs to 15,850 FTEs
- a growing percentage of women in research, from 33% to 40%, in part attributable to women coming from abroad, where the gender ratios are more even
- a rise in the percentage of foreign researchers at Dutch universities, from 22% to 33%.

4 The balance sheet: inflow, outflow and quality

Various studies show that Dutch researchers are very mobile. A study by Elsevier on researcher mobility in Canada, China, France, Germany, Italy, Japan, the Netherlands, the United Kingdom and the United States revealed that Dutch, UK and Canadian researchers are the most mobile in the world.

Almost a quarter of researchers working in the Netherlands in 2013 who had obtained their PhDs there had studied, worked or conducted research abroad in the preceding ten years, on either a short-term or a long-term basis. Among PhDs younger than 35, almost half had done so. The most popular destinations were the United States (23%), the United Kingdom (12%) and Germany (11%).

To compare inflow and outflow of academic staff in numbers and in quality, we looked at studies examining different groups of researchers. The picture of the Netherlands that emerges from these studies is consistent: inflow and outflow are roughly equal (with a slightly higher net outflow) and the quality of inflow and outflow scarcely differs (the quality of the inflow is slightly better than the outflow).

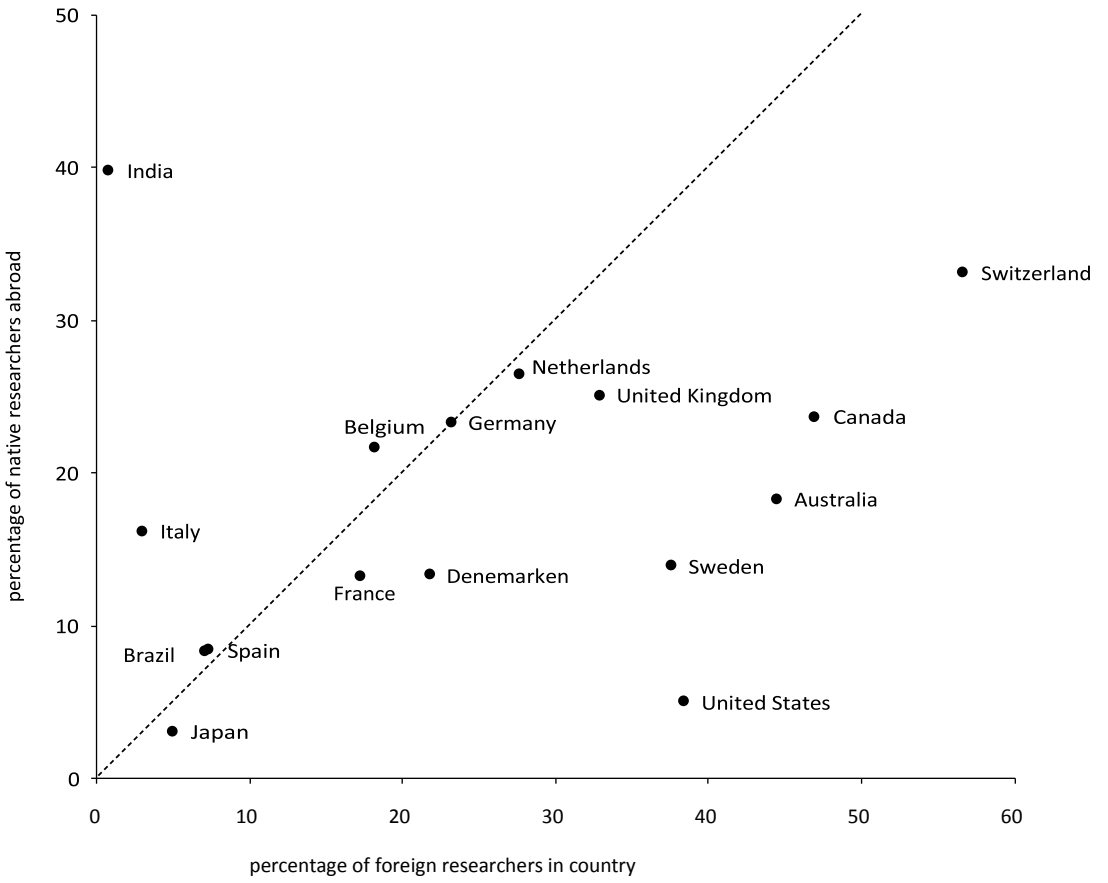
4.1 Inflow and outflow in numbers

This section analyses whether more researchers leave the Netherlands to go abroad than come to the Netherlands, or whether the opposite is the case. We also ask whether the Netherlands is more or less dynamic than other countries in that respect. We present data of differing origins (GlobSci and OECD), but they reveal the same pattern.

The balance sheet: data from the GlobSci Project

The Global Science Project (GlobSci) shows that countries differ considerably when it comes to researcher inflow and outflow. Figure 3 compares the percentage of foreign-born researchers working in four fields (Biology, Chemistry, Earth and Environmental Sciences, and Materials Sciences) across various countries with the percentage of native-born researchers working abroad. The GlobSci questionnaire was distributed to a sample active in these four fields. A total of 16,504 researchers responded, 345 from the Netherlands. The respondents' data was used to examine the number of researchers living in a specified country who, at the age of 18, had lived somewhere other than the country in which they were working or studying when they participated in the GlobSci survey in 2011. This number was shown as a percentage of the total number of respondents in the GlobSci survey who worked or studied in that country at that point. 'Native researchers abroad' refers to researchers who lived in a country at age 18 and worked or studied in another country when they participated in the GlobSci survey in 2011, shown as a percentage of all researchers who lived and remained in that country at age 18.

Figure 3 Percentage of foreign researchers active in four fields compared with percentage of native researchers abroad active in the same fields in 2011, according to the GlobSci survey, by country.



Source: Scellato, G., Franzoni, C. & Stephan, P. (2015). Migrant scientists and international networks. *Research Policy 44*, 108–120.

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The centre line indicates equivalence between the percentage of foreign researchers working in a country and the percentage of that country's native researchers working abroad. Countries situated near or on this line are Japan, Spain, Brazil, France, Belgium, Germany and the Netherlands. These countries are almost entirely in balance. For example, there are as many foreign researchers working in these four fields at Dutch universities as there are Dutch researchers working in the same four fields abroad. With this group, however, the Netherlands is also the country with the highest 'exchange' scores. Japan is in balance as well, for example, but the numbers are smaller: fewer than 5% of Japanese researchers work abroad and an equally small number of foreign researchers work in Japan.

The balance sheet: data from Elsevier/OECD

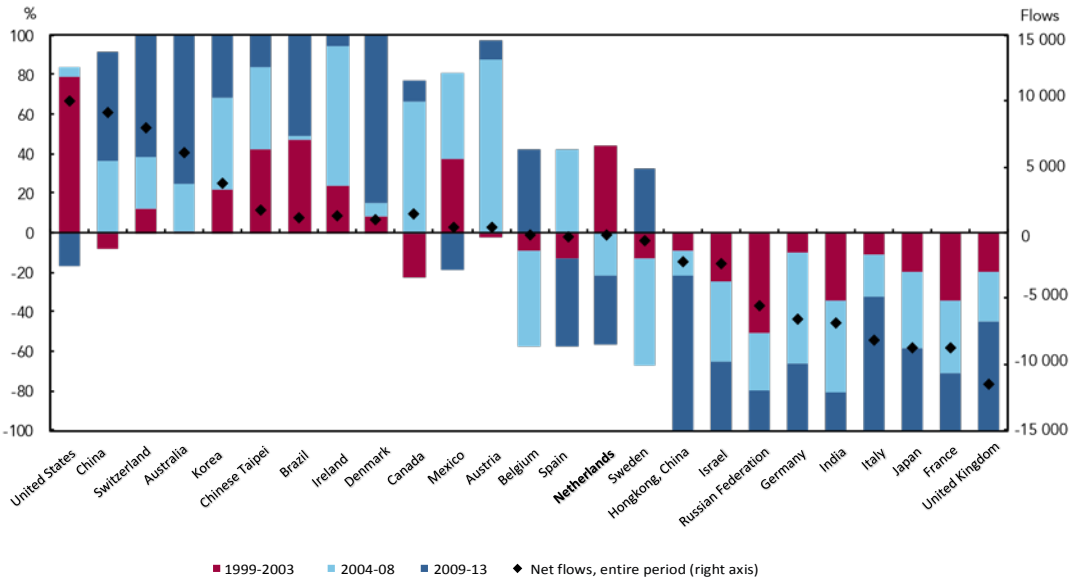
Another way to measure mobility is to look at scientometric data. Elsevier (Gurney et al. 2015) shows that the number of researchers who have left the Netherlands (10%) is somewhat larger than the number of incoming researchers (8.7%). This study divided all researchers who have had an affiliation in a certain country into three groups: long-term mobile researchers, short-term mobile researchers and non-mobile researchers.

About one in five researchers (18.7%) were mobile internationally for a lengthier period (the sum total of inflow and outflow for a period of more than two years). Almost half of international mobility concerned a stay of less than two years. A third of Dutch researchers (33.5 %) were non-mobile (at the time). Compared with other Western countries, the Netherlands has a relatively large number of researchers who are (or were) mobile for a short period.

The OECD also studied trends in international incoming and outgoing researcher mobility over the 1999-2013 period (see Figure 4). The figure shows that the Netherlands was in balance throughout the entire period, but that during the final two time periods – from 2004 to 2013 – outgoing mobility was slightly higher than incoming mobility. This figure suggests a trend towards more outgoing mobility. We must be careful about drawing conclusions, however, for the following reasons:

- The OECD figures are not broken down by job title, sector (university, public knowledge institute, business, etc.), traits (top versus other researchers, early or late career), or nationality. This means that inflow and outflow cannot be weighted.
- The numbers are very small: an average net outflow of 45 researchers per year between 2005 and 2008 and 71 researchers per year between 2009 and 2013 out of a total of more than 5,000 researchers.
- Foreign PhD candidates are not included in the inflow numbers here because their first publication identifies them as having a Dutch affiliation. If they leave the Netherlands after obtaining their PhD, however, they will be counted as part of the outflow and regarded as Dutch researchers at that point.

Figure 4 Net researcher migration flows based on affiliation, by country



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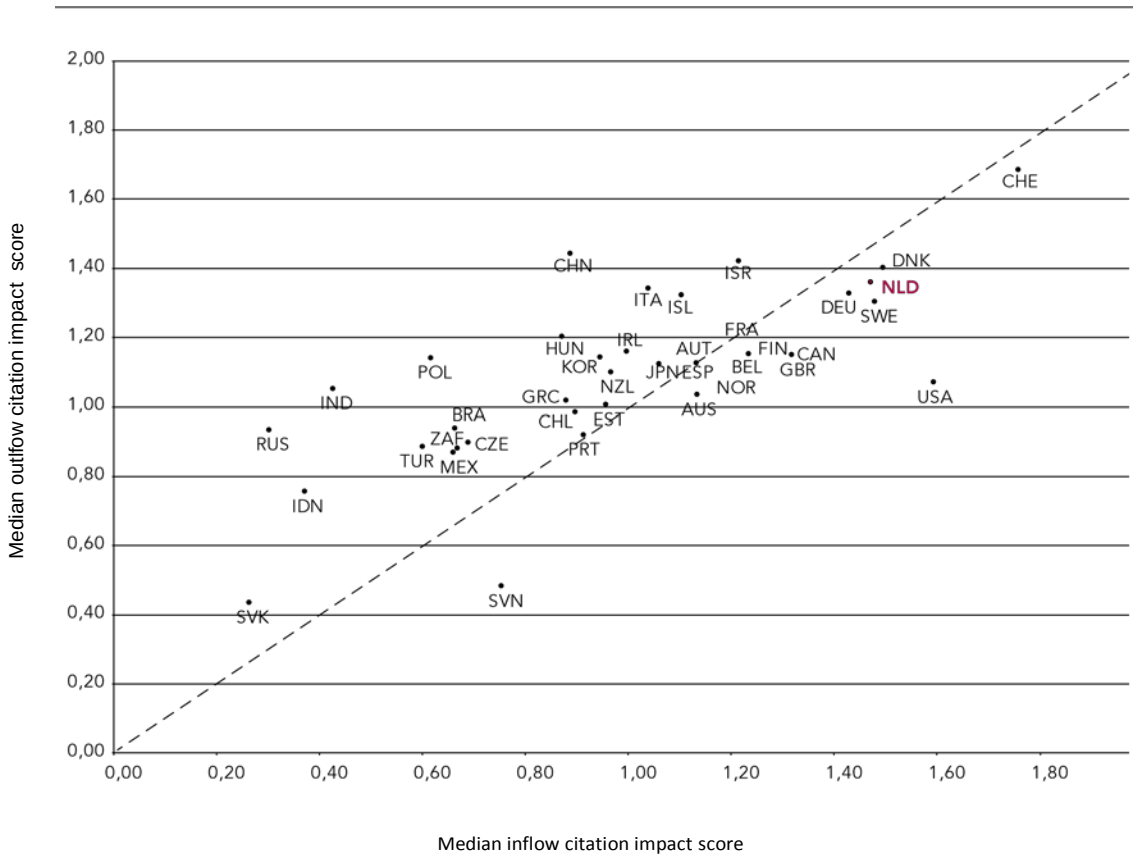
Source: OECD calculations based on Scopus Custom Data, Elsevier, version 4.2015.
http://dx.doi.org/10.1787/888933273360

The OECD study also looked at the largest flows between countries. Its data show that the Netherlands is a net recipient of researchers from Germany, France and Italy and a net supplier of researchers to the United Kingdom, the United States, Belgium and Switzerland. Overall, Dutch inflow and outflow are virtually equal.

4.2 Quality of researcher inflow and outflow

One of the indicators of research quality – especially in Biomedical Science and Natural Science – is the number of citations that an article receives (the citation impact score). In the following figure, the median inflow citation impact score (excluding returnees) is contrasted with the median outflow citation impact score. We see immediately where individual countries stand. The average citation impact score worldwide is 1. Figure 5 compares the citation impact scores of various countries.

Figure 5 Anticipated citation impact score of scientific authors, by mobility profile, in 2013 (Median Scimago Journal Rank scores for 2013)



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Source: OESO Science, Technology and Industry Scoreboard 2015.
OECD calculations based on Scopus Custom Data, Elsevier, version 4.2015 and Scopus journal title list, consulted May 2015, http://oe.cd/scientometrics, June 2015. Adapted by the Rathenau Instituut.

We see here that the Netherlands, top right, is almost on the equilibrium line: incoming researchers have a fractionally larger impact than outgoing researchers. The difference between inflow and outflow is small, and both groups have high citation impact scores. This also applies for Germany, Denmark, Sweden and Switzerland. There too, the quality of incoming and outgoing researchers is about the same. The United States is notable in this figure as a country that welcomes high-quality inflow but loses very little quality in outflow.

Departure of recent PhDs

A relatively large proportion of outgoing researchers are departing foreign PhD graduates. Between 2009 and 2013, an annual average of 8,788 PhD candidates worked at Dutch universities, with more than 42% of them being foreign nationals. A year after their contract ended, about 38% of the foreign PhDs had left the Netherlands; after five years, that figure had grown to almost 60%, and after ten years to around 68% (Rud et al. 2015). If we assume that most PhD programmes take four years to complete, then we can estimate the number of researchers who leave the Netherlands every year at about 370. About half of these return to their native country.

In addition, 23% of Dutch PhD candidates go abroad after obtaining their PhD. Applying the same formula, this would come to about 293 per year. About 22% of them go to the United States, 17% to the United Kingdom, 13% to Germany, 6% to Switzerland, 5% to Belgium and 4% to France. An unknown proportion end up returning to the Netherlands.

Incoming professors: between which universities do they migrate?

In 2013, the Rathenau Instituut studied newly appointed professors in the Netherlands (Van Wijngaarden 2015). Of all those appointed in 2013, 39 had previously been affiliated with a foreign university. That is 12% of the total number of professors appointed that year. Of these 39 professors, 18 came from a university ranked higher on the CTWS Leiden ranking than their current Dutch affiliation. In 13 cases, they even came from a university ranked in the top 50. In seven cases, the prior affiliation had a similar ranking to the Dutch university (in the top 200). In five cases, the appointee had moved to a university that was considerably higher in the university rankings. In the remaining cases, the prior affiliation did not appear in the top 200 ranking. Our conclusion is that the Netherlands is capable of attracting professors who are sought after by prestigious universities.

ERC Grant recipients: inflow and outflow are equal

ERC Grant recipients can use their grant in the European country of their choice. EU-funded mobility is limited in the Netherlands. Between 2007 and 2013, 89% of the grants utilised in the Netherlands (356 in all) were tied to applicants working in the Netherlands, which is about the same as the EU average. A total of 39 grants (11%) were awarded in support of research projects conducted in the Netherlands by researchers who lived outside the country when they submitted their proposal. Of these, about 33% (13 grants) were Dutch nationals. They can thus be regarded as 'returnees'.

Figure 6 Number of mobile recipients of ERC Grants between 2007 and 2013

2007-2013	Grant recipients	Mobility during application process	Mobility during grant period
Incoming, Netherlands	39	11	2
Outgoing, Netherlands	30	11	12

Source: ERC. Adapted by the Rathenau Instituut.

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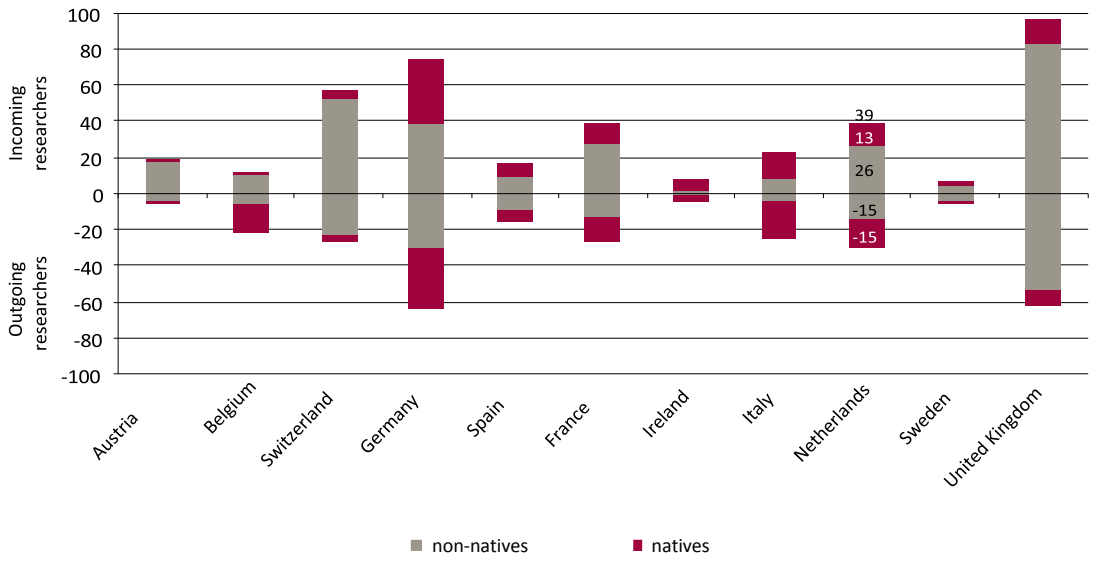
Slightly more 'talented' researchers (grant recipients) come to the Netherlands than go abroad, but the difference is so small that the two flows are in fact more or less equal, especially when we allow for mobility during the grant period. This does not apply to all European countries. The United Kingdom receives more ERC researchers than it loses, and Belgium loses more than it receives (see Figure 7).

Figure 7 Incoming and outgoing mobility based on ERC Grants, broken down into natives and non-natives



Source: ERC (2015) and ERC personal communication

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Where do they come from, the researchers who receive an ERC Grant to work in the Netherlands? The information we have is similar to previous data. Most of the grant recipients migrate from Belgium (11), Germany (10), the United Kingdom (5), Switzerland (3), the United States (3) and France (2). Many of the foreign applicants were already working in the Netherlands during the grant application process. If we generate the same figure based on nationality instead of prior affiliation, we see an increase in absolute numbers and Italy and France suddenly appear in the top five.

People who leave the Netherlands with an ERC grant tend to go to the United Kingdom (11), Germany (8) and Belgium (4). Dutch natives who do not utilise their grant in the Netherlands tend to carry out their research in the United Kingdom (26) and Germany (13) and, to a lesser extent, in France (5), Switzerland (5), Spain (4), Sweden (4) and Belgium (4). Here again, we see higher figures if we screen for nationality. This leads us conclude that most of the researchers' international mobility had occurred before they applied for an ERC Grant.

4.3 Conclusions

Based on the various figures that we have analysed, our conclusion is that researcher inflow and outflow are evenly balanced in the Netherlands, both in number of individuals and quality. The mobility made possible by the ERC Grant has led neither to gains nor losses for the Netherlands in numbers of talented researchers. Inflow and outflow are more or less equal, and it appears that researchers were likely to have been mobile before applying for their ERC Grant.

5 Appendix: the data

There is no one source that can provide full and reliable information on the population, the flows and the quality of internationally mobile researchers. Various studies indicate that information is lacking, and that terms and concepts – for example 'researcher' and 'foreigner'– are not consistently defined.

In this issue of Facts & Figures, we have used a number of databases and statistics that offer information on one aspect of the international mobility of researchers and that have not been analysed before.

The sources are very reliable; they were compiled by organisations of considerable repute in the realm of science statistics (e.g. the OECD, Statistics Netherlands, UNESCO and Eurostat) or have been taken from peer-reviewed science publications. Each of these sources provides a clear explanation of how it obtained its figures.

Definitions depend mainly on the purpose for which the source has been compiled and the technical options for operationalising international mobility within the source. Each source was compiled for a particular purpose, for example for an administrative overview of staff (WOPI), a complete overview of a population (CDH, DIOC), or a study of the traits of a certain type of researcher (GlobSci, MORE2).

Each source covers a different group or population, and that means that it defines the concepts 'international mobility' and 'foreign researcher' differently. The Netherlands' university staff information database (WOPI) defines a researcher as a member of the academic staff at a Dutch university. The definition of 'foreign' in this database is based on possession of a foreign passport. In the Careers of Doctorate Holders survey (CDH), Statistics Netherlands looks at those who have obtained their PhD in a country and still live there. The MORE2 survey uses the broad definition of the OECD Frascati Manual, with all researchers being counted regardless of where they live or their nationality.

Each source has its limitations. We describe some of the main shortcomings below.

- The data taken from WOPI relate solely to academic staff employed by Dutch universities. People who work at two different universities are counted twice. There is no comparable information currently available on the staff of Dutch university hospitals (UMCs), the NWO and Academy research institutes, or public knowledge institutes.
- Estimates based on scientometric data do not cover the entire field of science. In the two most prestigious publication databases – Thomson Reuters Web of Science and Elsevier Scopus – the Biomedical Sciences, Natural Science and Engineering & Technology are much better represented than the Social Sciences and the Humanities. These databases consist mainly of publications appearing in scientific journals and conference proceedings. Other forms of output, such as books, are not indexed. That is why we refer to quasi-populations in the case of sources based on scientometrics.
- These sources also work with affiliations. That means that individual authors are regarded as researchers of the country in which they had their first affiliation. The Netherlands is home to many foreign PhD candidates. The first article that they author – in many cases published as part of their PhD work – indicates a Dutch affiliation, regardless of their nationality.
- Different sources indicate whether a person was born in a different country, has a different nationality, or lived in a different country at a certain age. There is usually no information about when that person came to the relevant country and what nationality they were when they moved there. In other words, the sources do not provide direct, easily interpretable information on the annual inflow and outflow of researchers.
- The GlobSci and MORE2 surveys are not scaled up to the entire population. The results only describe the composition of the group of survey respondents.

Sources consulted

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- European Research Council, data obtained from ERC.
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- OECD/Statistics Netherlands, Careers of Doctorate Holders (CDH), see Auriol et al. (2013).
- OECD, Database on Immigrants in OECD and non-OECD Countries (DIOC). At http://www.oecd.org/els/mig/dioc.htm.

Acronyms and terms

CDH	Careers of Doctorate Holders, study by OECD/Statistics Netherlands
CWTS	Centre for Science and Technology Studies at Leiden University
DIOC	Database on Immigrants in OECD and non-OECD countries
ERA	European Research Area
ERC	European Research Council
Eurostat	The European Union's department of statistics
Frascati Manual	OECD document providing definitions of basic concepts, data collection guidelines, and classifications for compiling R&D statistics
GlobSci	Global Science survey by the National Bureau of Economic Research, Cambridge, USA
HOOP	Categorisation of Dutch academic staff into nine groups based on a classification of educational programmes
More2	Survey on researcher mobility in the EU under the Seventh Framework Programme
NWO	Netherlands Organisation for Scientific Research
OECD	Organisation for Economic Cooperation and Development
Scopus	Database of scientific peer-reviewed literature by Elsevier publishers
Unesco	The United Nations Educational, Scientific and Cultural Organization
VSNU	Association of Universities in the Netherlands
Web of Science	Database of scientific peer-reviewed literature by Thomson Reuters
WOPI	VSNU's University Staff Information Database

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About this publication

This is the twentieth publication in the Rathenau Instituut's *Facts & Figures* series. It examines statistics pertaining to the international mobility of researchers gathered from a range of different sources. For more information on this publication, please contact the authors: Elizabeth Koier (e.koier@rathenau.nl), Wout Scholten (w.scholten@rathenau.nl), Jos de Jonge (j.dejonge@rathenau.nl) or the head of research, Barend van der Meulen (b.vandermeulen@rathenau.nl).

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