

# UK Research Factsheet 2013-2017

Resources, Output, Growth,  
Impact, Collaboration, Mobility



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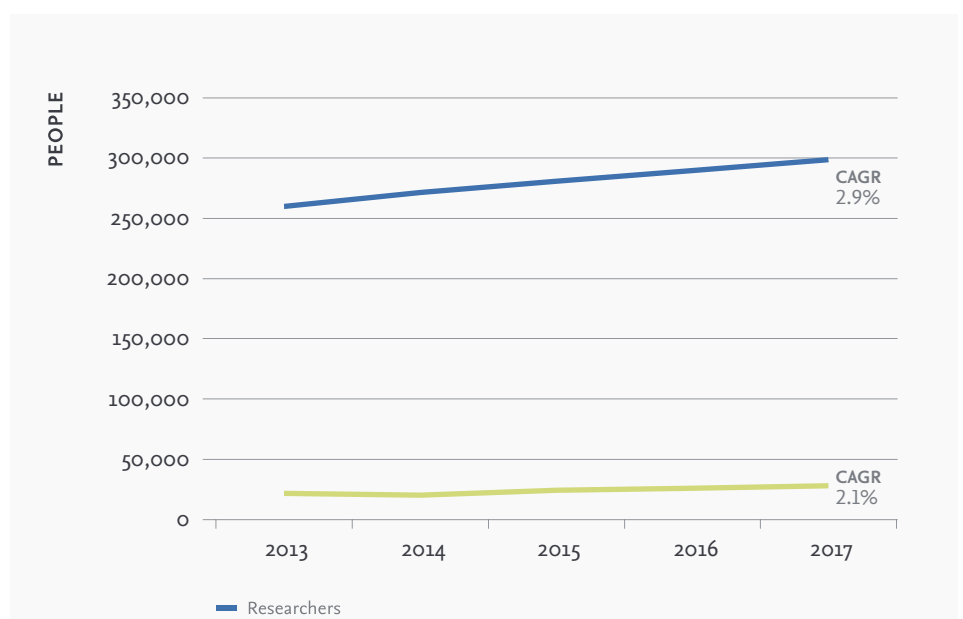
# Indicators to illustrate any effects of the UK's intended withdrawal from the European Union on UK research

The following pages collate data from public and commercial sources since 2013. Data are presented as familiar indicators, used by institutions, funders, and governments. These pages will be updated annually as new data are published, to illustrate any effect which might be attributable to the UK's intended withdrawal from the European Union ('Brexit') and thereby provide evidence to support strategies which might be developed appropriately.

The graphs below illustrate a few of the more than 50 indicators on which we are reporting.

The UK's research workforce has been growing at a Compound Annual Growth Rate (CAGR)<sup>1</sup> of 2.9%. In 2017 there were close to 300,000 researcher FTEs<sup>2</sup> in the UK, while over 28,000 PhD students graduated that same year. As in the previous factsheet update (Q1 2017) the growth rate of the researcher workforce is slightly higher than the growth rate of the number of PhD graduates.

**FIGURE 1 – NUMBER OF TOTAL RESEARCHERS (FTE) AND ANNUAL PHD GRADUATES IN THE UK, 2013-2017**



Source: OECD<sup>3</sup>, HESA<sup>4</sup>

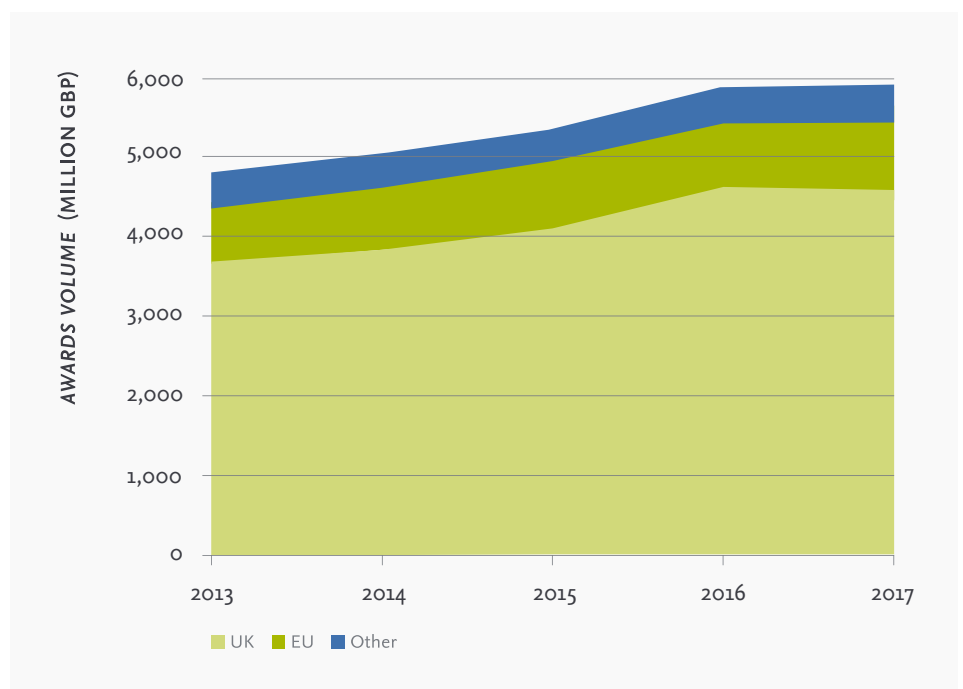
1. *Compound Annual Growth Rate (CAGR)*: the mean annual growth rate over a specified period of time. Starting with the first value in any series and applying this rate for each of the time intervals yields the amount in the final value of the series.
2. *Full Time Equivalent employment (FTE)*: the number of full-time equivalent jobs, defined as total hours worked divided by average annual hours worked in full-time jobs.
3. *Organisation for Economic Co-operation and Development*: OECD is an international economic organisation that collects internationally comparable data on research and development, available in the Main Science and Technology Indicators database.
4. *Higher Education Statistics Agency*: HESA collects a range of data every year UK-wide from universities, higher education colleges and other differently funded providers of higher education.

*Awards Volume* calculates the value of awards from external funding bodies using aggregated values of awards over the award lifetime (i.e. it considers the total value awarded at the time of award and not the value (to be) spent in any particular time period).

The UK's total *Awards Volume* has been growing at a compound annual growth rate of 5.9%, to just over £5.9 billion in 2017.

Funding from the UK accounted for 77.2% of this total in 2017 and has grown at 5.8% CAGR during 2013-2017, while funding from the EU represented 14.8% and has grown at 6.2% CAGR.

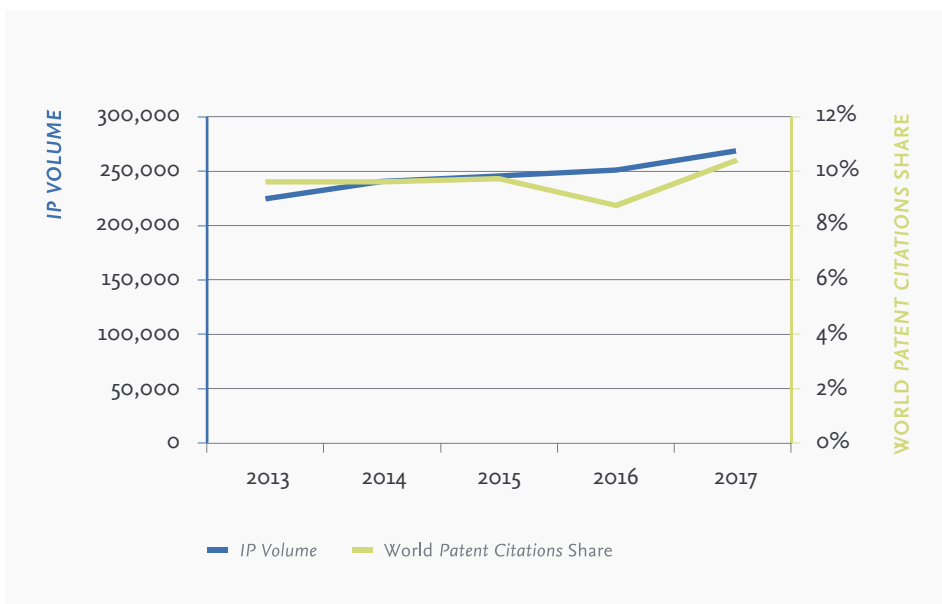
FIGURE 2 – AWARDS VOLUME FOR THE UK BY SOURCE, 2013-2017



Source: HESA

The UK's IP Volume has been growing between 2013 and 2017 at 4.1% CAGR, approaching 265,000. Its share of world patent citations (to scholarly output) has increased by around 0.8 percentage points to 10.4% of the world total in the five-year period.

**FIGURE 3 – INTELLECTUAL PROPERTY (IP) VOLUME<sup>5</sup> AND WORLD PATENT CITATIONS SHARE<sup>6</sup> OF THE UK, 2013-2017.**



Source: WIPO<sup>7</sup>, Scopus<sup>8</sup>

5. Intellectual Property Volume: IP Volume is the sum of patents filed, patents granted, and patents in force.
6. Patent citations: the number of citations from patents to scholarly output.
7. World Intellectual Property Office (WIPO) is a specialized agency of United Nations that administers the intellectual property and provides the world's largest database of 70 million patent documents, including 3.3 million published international patent applications.
8. Scopus is the largest abstract and citation database of peer-reviewed literature, covering 71 million documents published in over 23,700 journals, book series and conference proceedings by some 5,000 publishers.

## For further information

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- View more data points and indicators on the following pages
- Access relevant Research Intelligence reports:
  - International Comparative Performance of the UK Research Base [2011](#), [2013](#), and [2016](#)
  - International Comparative Performance of the Welsh Research Base [2013](#) and [2016](#) update
  - [Comparative Benchmarking of European and US Research Collaboration and Researcher Mobility](#)
  - UK Research Factsheet [2011-2015](#) Resources, Output, Growth, Impact, Collaboration, Mobility
  - [Elsevier's Brexit Resource Center](#)

Please note: The footnotes below refer to tabeled data on the following page

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9. As Scopus is a dynamic database that is constantly adding new data – including data for previous years – full completion of the 2017 publication year was not yet reached at the time of extraction. Data completeness for 2017 was approximately 95%. This is similar to the completeness of 2016 data at the same time last year. It therefore offers a valid preliminary view on scholarly output and related indicators. 2017 WIPO data may also be incomplete for patents in force. Therefore, while the related 2017 data points have some utility, we caution the reader from drawing conclusions from comparisons between 2017 data and 2013-2016 data points.
10. *Funding* for research and development is categorised according to the sector of the funder, giving us four types:
  - GERD: *Gross Expenditure on Research & Development*.
  - BERD: *Business Enterprise Expenditure on Research & Development*.
  - HERD: *Higher Education Expenditure on Research & Development*.
  - GOVERD: *Government Expenditure on Research & Development*.

*PPP: Purchasing Power Parity*: a rate of currency conversion that equalises the purchasing power of different currencies by eliminating the differences in price levels between countries.

*Scholarly output*: an article, review, or conference proceedings indexed in the Scopus database.

*Citation*: a formal reference to earlier work made in an article or *patent*, frequently to other journal articles. The number of *citations* received by an article from subsequently-published articles is a proxy of the *impact* of the reported research.

*FWCI: Field-weighted citation impact* indicates how the number of *citations* received by an entity's publications compares to the average number of *citations* received by all other similar publications. In doing so, it accounts for differences in *citation* rates between subject fields, document types, and publication years. As a benchmark, the FWCI of the "world", or the entire Scopus database, is 1.00.

*Download*: the event by which a user views the full-text HTML of an article or *downloads* the full-text PDF of an article from ScienceDirect, Elsevier's full-text journal article platform. Views of an article abstract alone, and multiple full-text HTML views or PDF downloads of the same article during the same user session, are not included.

*FWDI: Field-weighted download impact* is the equivalent of *FWCI* for *downloads*.

*Patent*: a government authority or license conferring a right or title for a set period, especially the sole right to exclude others from making, using, or selling an invention.

*Collaboration*: any publication with two or more authors. *Internationally collaborated* publications have authors in at least two countries, *nationally collaborated* ones have authors in at least two institutions within a country, and *institutionally collaborated* ones have authors within the same institution.

# 1 | UK RESEARCH FACTSHEET 2013-2017: RESOURCES, OUTPUT, GROWTH, IMPACT, COLLABORATION, MOBILITY<sup>9</sup>

CATEGORY	INDICATOR	2013	2014	2015	2016	2017
PEOPLE	Population	64,641,110	65,015,686	65,397,080	65,803,943	66,197,518
	Researchers	267,699	276,584	284,483	291,416	299,548
	PhD graduates	25,900	24,690	26,640	27,370	28,155
	Postgraduate students (UK)	337,700	335,050	333,445	332,755	355,670
	Postgraduate students (EU)	45,900	46,455	46,230	45,335	45,985
	Postgraduate students (non EU)	152,645	157,640	158,265	154,390	149,565
	Postgraduate students (total)	536,715	539,440	538,185	532,975	551,595
	Undergraduate students (UK)	1,577,100	1,528,640	1,495,750	1,509,565	1,519,455
	Undergraduate students (EU)	79,430	78,840	78,350	82,100	88,845
	Undergraduate students (non EU)	146,845	152,270	153,745	156,185	157,975
	Undergraduate students (total)	1,803,755	1,759,920	1,727,895	1,747,855	1,766,285
	Higher education students (total)	2,340,470	2,299,360	2,266,080	2,280,830	2,317,880
FUNDING IN MILLION 2010 USD PPP	GDP	2,368,168	2,440,498	2,497,750	2,543,666	2,587,827
	GERD	38,981	40,612	41,784	42,949	44,382
	BERD	24,904	26,458	27,593	28,793	30,121
	HERD	10,298	10,470	10,582	10,546	10,735
	GOVERD	3,079	2,949	2,771	2,726	2,609
FUNDING IN MILLION GBP	Awards volume	4,709	5,084	5,912	5,886	5,916
	UK BEIS	1,533	1,656	1,791	1,958	1,947
	UK Other	2,110	2,171	2,316	2,649	2,623
	UK Total	3,643	3,827	4,106	4,607	4,570
	EU Government	593	682	720	715	730
	EU Other	96	101	111	126	147
	EU Total	689	783	831	841	877
	Non-EU	240	242	260	292	315
	Non-EU other	137	136	132	146	155
OUTPUT	World scholarly output share	6.5%	6.4%	6.7%	6.6%	6.5%
	World citations share	10.9%	10.8%	10.9%	11%	10.8%
	Field-Weighted Citation Impact (FWCI)	1.57	1.57	1.58	1.62	1.62
	Output in top cited percentiles (1%)	15.6%	16%	15.8%	15.5%	13.9%
	Output in top cited percentiles (5%)	12.8%	12.6%	12.8%	12.4%	11.6%
	Output in top cited percentiles (10%)	11.6%	11.4%	11.6%	11.3%	10.5%
	World downloads share	9.9%	9.7%	9.9%	9.9%	9.6%
	Field-Weighted Download Impact (FWDI)	1.21	1.22	1.23	1.25	1.23
	IP volume (patents filed)	51,300	52,605	53,393	52,882	53,768
	IP volume (patents granted)	20,642	20,897	21,482	23,907	23,879
	IP volume (patents in force)	153,277	164,131	170,774	175,236	187,180
	IP volume (total)	225,219	237,633	245,649	252,025	264,827
World patent citations share	9.6%	9.4%	9.3%	8.7%	10.4%	
PRODUCTIVITY	Scholarly output per researcher	0.6	0.59	0.58	0.57	0.55
	Scholarly output per GDP million 2010 USD PPP	0.07	0.07	0.07	0.07	0.06
	Scholarly output per GERD million 2010 USD PPP	4.09	4.01	3.96	3.9	3.72
COLLABORATION	Single author publications country %	15.1%	14.1%	13.6%	12.5%	11.7%
	Single institution publications country %	18.2%	17.7%	16.5%	15.6%	14.7%
	National publications country %	17.4%	16.3%	16%	16%	15.6%
	International publications country %	49.3%	51.9%	53.8%	55.9%	58%
	Single author publications FWCI	0.91	0.9	0.89	0.9	0.92
	Single institution publications FWCI	1.26	1.27	1.27	1.26	1.25
	National publications FWCI	1.36	1.35	1.34	1.34	1.33
International publications FWCI	1.95	1.94	1.94	1.93	1.93	



## 2 | Top 30 International Collaboration Partners <sup>11</sup>

More than half of the UK's international collaborations involve countries from the European Union, and the resulting scholarly output is cited more than twice the global overall average. The UK's top 30 most prolific international collaboration partners show an even split between EU and non-EU countries (15 within the EU). Likewise, among the UK's top 10 most prolific collaboration partners, 5 belong to the EU (3 out of the top 5). Among these prolific collaboration partners, 8 of the top 15 by FWCI are within the EU. Share of collaborations with EU has declined by 0.4% compared to the last update. Share of collaborations with China have increased by nearly 1.5 percentage point, and with Brazil have increased by 0.4 percentage point. Compared to the previous factsheet, Israel is not in the list of the UK's top 30 prolific collaborators whereas Singapore appeared into the list, accounting for 1.7% of the international collaborations of the UK.

Collaboration Partner	Share of UK International Collaborations	Field-Weighted Citation Impact
<b>European Union</b>	<b>53.0%</b>	<b>2.20</b>
United States	30.0%	2.76
<b>Germany</b>	<b>15.8%</b>	<b>2.88</b>
<b>France</b>	<b>11.3%</b>	<b>3.06</b>
China	10.9%	2.25
Italy	10.8%	2.94
Australia	10.0%	2.96
<b>Netherlands</b>	<b>8.9%</b>	<b>3.21</b>
<b>Spain</b>	<b>8.7%</b>	<b>2.91</b>
Canada	7.5%	3.47
Switzerland	6.4%	3.38
<b>Sweden</b>	<b>5.5%</b>	<b>3.27</b>
<b>Belgium</b>	<b>4.6%</b>	<b>3.43</b>
Japan	4.1%	3.28
<b>Denmark</b>	<b>3.9%</b>	<b>3.54</b>
Brazil	3.1%	3.17
<b>Ireland</b>	<b>3.0%</b>	<b>2.69</b>
Norway	2.9%	3.49
<b>Greece</b>	<b>2.9%</b>	<b>2.78</b>
<b>Austria</b>	<b>2.8%</b>	<b>3.43</b>
India	2.8%	2.90
<b>Poland</b>	<b>2.7%</b>	<b>3.31</b>
<b>Finland</b>	<b>2.6%</b>	<b>3.51</b>
<b>Portugal</b>	<b>2.5%</b>	<b>2.84</b>
Russian Federation	2.5%	3.14
South Africa	2.4%	3.08
New Zealand	1.9%	3.20
South Korea	1.8%	3.95
<b>Czech Republic</b>	<b>1.7%</b>	<b>3.24</b>
Singapore	1.7%	3.00
Malaysia	1.6%	2.22

Source: Scopus

11. Our analyses use whole rather than fractional counting. For example, if a publication has been co-authored by one author from the UK, one author from Germany, and one author from France, then that publication counts towards the publication count of the UK as well as the respective publication counts of Germany and France. Hence in the table the sum of shares of the UK's international collaborations add to more than 100%, because publications with authors in multiple countries are counted once for each country.

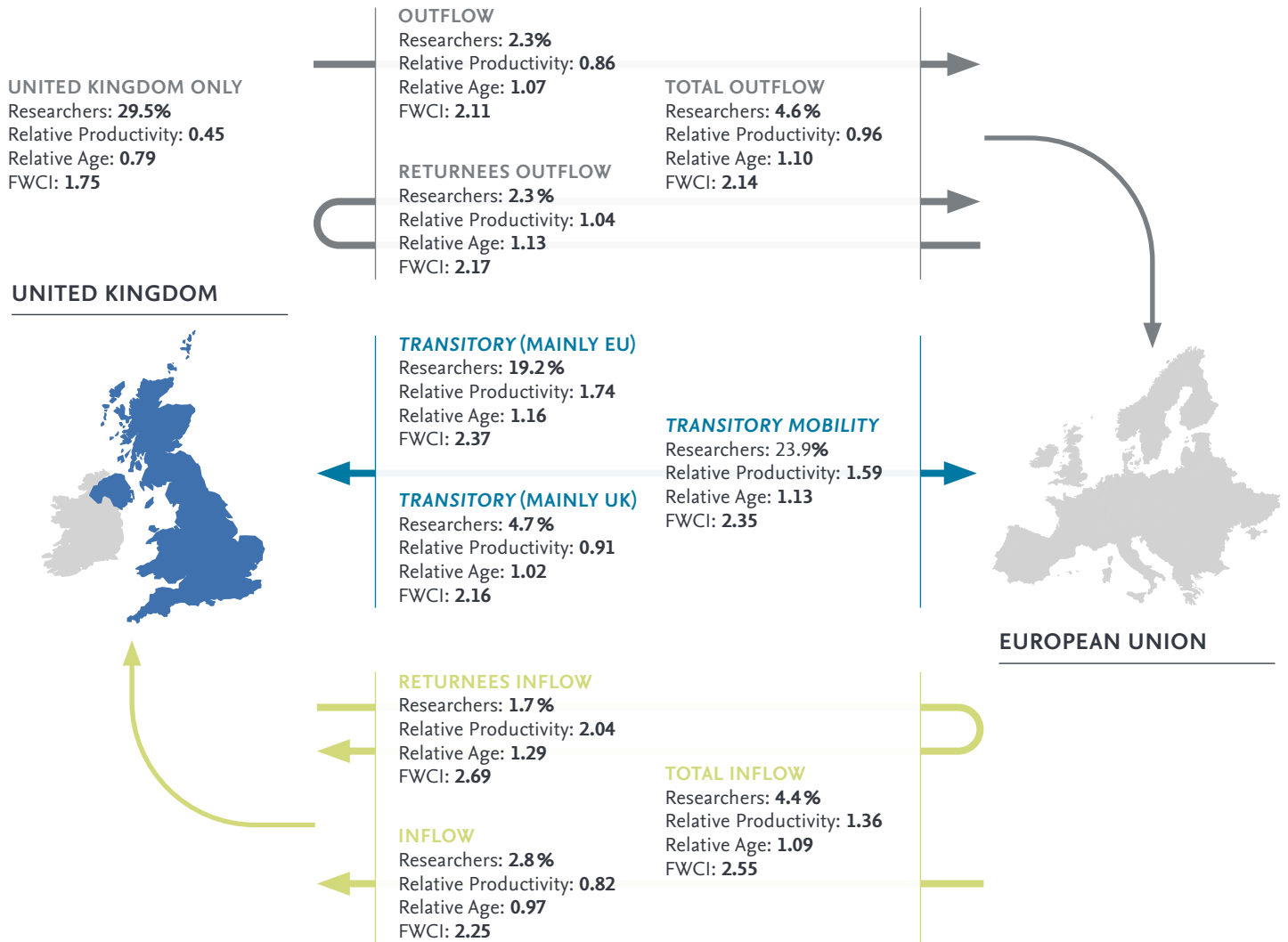
12. *Mobility*: UK authors were identified as those that had listed a UK affiliation on at least one publication (articles, reviews and conference proceedings) published across the sources included in Scopus. A productivity filter was implemented to restrict the analysis to those authors with a certain number of publications in the whole period and the five most recent years, to restrict the analysis to authors likely to be active researchers. In this study, stays overseas of 2 years or more were considered migratory and were further subdivided into those where the researcher remained abroad or where they subsequently returned to their original country. Stays overseas of less than 2 years were deemed transitory and were also further subdivided into those who mostly published under a UK or an EU affiliation. Researchers without any apparent mobility based on their published affiliations were considered sedentary.



# 3 | Researcher Mobility between the United Kingdom and the European Union

## UNITED KINGDOM

1996-2018 | 369,419 Active Researchers



Source: Scopus

- UK researchers show a high degree of mobility.<sup>12</sup> Over 70% of them have published with affiliations outside of the UK, leaving 29.5% of sedentary researchers. Sedentary researchers achieve an FWCI that is well above the world average (cited 70% more often) but lower than the FWCI of the UK's mobile researchers.
- A third of the UK's researchers show mobility to or from European Union countries, with nearly a quarter exhibiting transitory mobility patterns. Publications by these researchers are highly cited: their FWCI of 2.35 indicates a citation rate of more than twice the global overall average. On top of this, transitory researchers are the UK's most productive in terms of scholarly output, publishing 59% more publications than the average researcher in the UK. This is largely thanks to those with mainly EU affiliations, as the mainly UK-affiliated transitory researchers have a relative productivity that is 9% below the UK's average.
- Researchers coming to the UK from the EU and staying for more than 2 years without leaving (inflow researchers) are the most impactful among the UK's mobility categories, being cited over two and a half times more than the global overall average.

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