

FACTSHEET  
Q3 | 2016

# UK Research Factsheet 2011-2015

## Resources, Output, Growth, Impact, Collaboration, Mobility

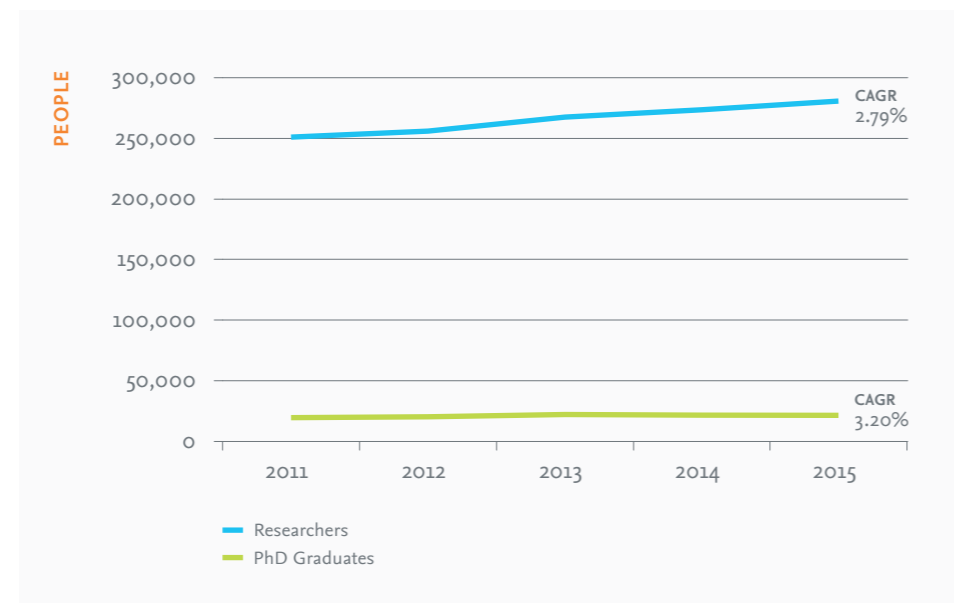


# Indicators to illustrate any effects of the UK's intended withdrawal from the European Union on UK research Q3 2016

The following pages collate data from public and commercial sources since 2011. Data are presented as familiar indicators, used by institutions, funders, and governments. These pages will be updated quarterly 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.

**FIGURE 1 – NUMBER OF TOTAL RESEARCHERS (FTE) AND ANNUAL PHD GRADUATES IN THE UK, 2011-2015**

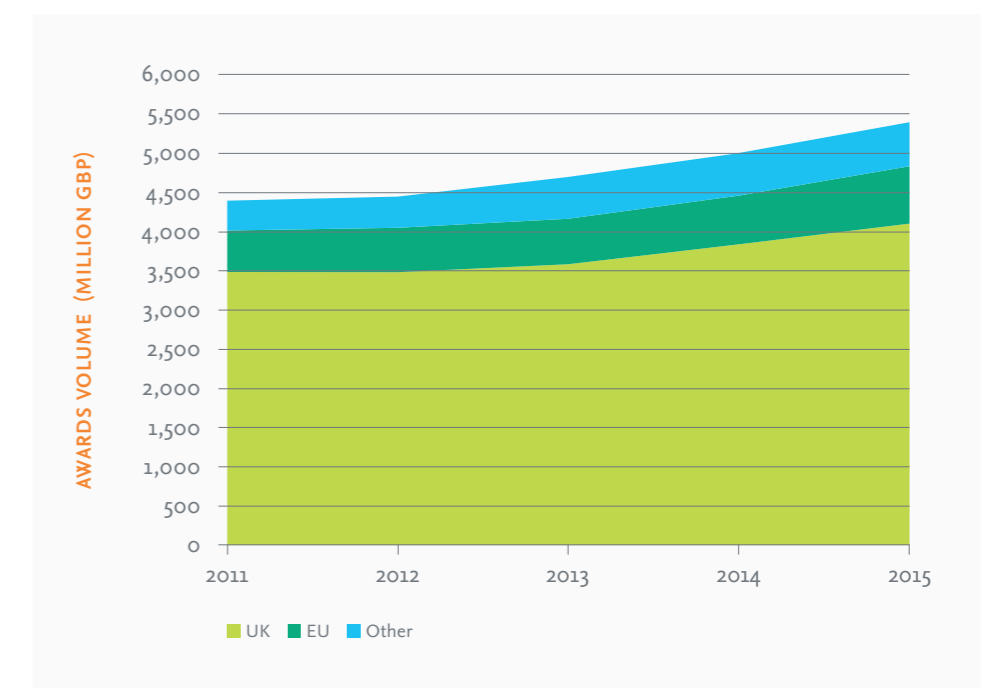


Source: OECD<sup>3</sup> & HESA<sup>4</sup>

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. FTE: Full Time Equivalent employment: 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.

The UK's research workforce has been growing at a compound annual growth rate (CAGR)<sup>1</sup> of 2.8%. In 2015 there were over 280,000 researcher FTEs<sup>2</sup> in the UK, while nearly 23,000 PhD students graduated that same year with the number of PhD graduates growing at a slightly higher rate than the researcher workforce.

**FIGURE 2 – AWARDS VOLUME FOR THE UK BY SOURCE, 2011-2015**



Source: HESA

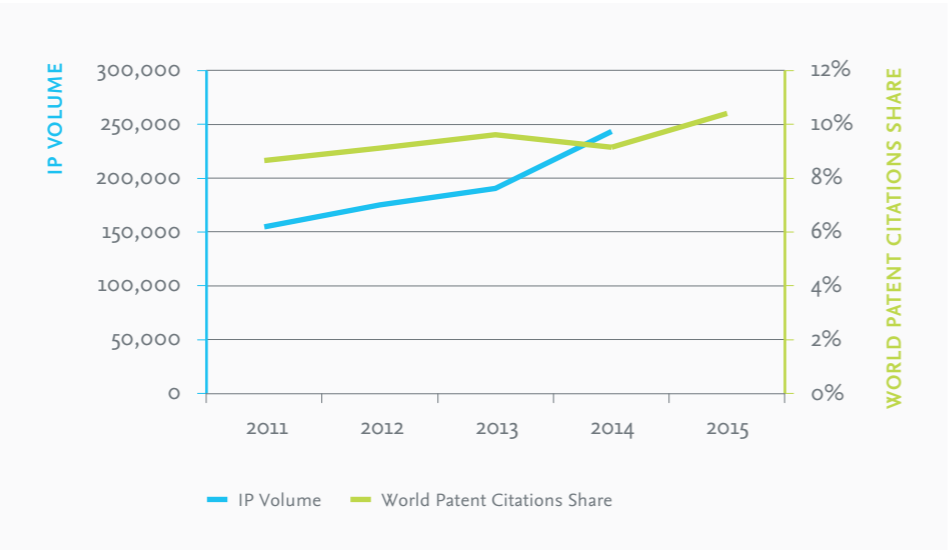
Awards Volume calculates the value of awards from external funding bodies using aggregated values of awards over the award lifetime (i.e. it considers the total value awarded at the time of award and not the value (to be) spent in any particular time period).

The UK's total Awards Volume has been growing at a compound annual growth rate of 5.1%, to just over £5.3 billion in 2015.

Funding from the UK accounts for 76.4% of this total and has grown at 3.6% CAGR, while funding from the EU represents 15.5% and has grown at 13% CAGR.

## For further information

**FIGURE 3 – INTELLECTUAL PROPERTY (IP) VOLUME<sup>5</sup> AND WORLD PATENT CITATIONS SHARE<sup>6</sup> OF THE UK, 2011-2015**



Source: WIPO<sup>7</sup> & Scopus<sup>8,9</sup>

The UK's IP Volume has been growing rapidly between 2011 and 2014 at 16.4% CAGR, nearing 250,000. Its share of world patent citations (to scholarly output) has increased by 2 percentage points to 11.0% of the world total between 2011 and 2015.

- View more data points and indicators on the following pages
- Access relevant Research Intelligence reports:
  - International Comparative Performance of the UK Research Base [2011](#) and [2013](#)
  - International Comparative Performance of the Welsh Research Base [2013](#)
  - [Comparative Benchmarking of European and US Research Collaboration and Researcher Mobility](#)
  - [A Review of the UK's Interdisciplinary Research using a Citation-based Approach](#)

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

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 year. As a benchmark, the FWCI of the "world", or the entire Scopus database, is 1.00.

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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.

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 30 million patent documents, including 2.2 million published international patent applications.

8. Scopus is the largest abstract and citation database of peer-reviewed literature, covering 62 million documents published in over 22,500 journals, book series and conference proceedings by some 6,000 publishers.

9. As Scopus is a dynamic database that is constantly adding new data – including data for previous years – full completion of the 2015 publication year was not yet reached at the time of extraction. Data completeness for 2015 was approximately 95%. This is similar to the completeness of 2014 data at the same time last year. It therefore offers a valid preliminary view on scholarly output and related indicators. Therefore, while the publication-related 2015 data points (i.e. "outputs" and "collaboration") have some utility, we caution the reader from drawing conclusions from comparisons between 2015 data and 2011-2014 data points.

# 1 | Uk Research Factsheet 2011-2015: Resources, Output, Growth, Impact, Collaboration

• For definitions of the below indicators, please refer to the footnotes<sup>10</sup> on the previous pages, the [SciVal Metrics Guidebook](#) or the [Snowball Metrics Recipe Book](#).

CATEGORY	INDICATOR	2011	2012	2013	2014	2015*	2011-2015 CAGR	SOURCE	NEXT UPDATE
PEOPLE	Population	62,435,200	62,858,800	63,237,940	63,650,010	64,059,219	↗ 0.6%	OECD (2015 estimation)	2017
	Researchers	251,358	256,156	267,699	273,560	280,619	↑ 2.8%	OECD (2015 estimation)	2017
	PhD graduates	20,080	20,435	22,160	21,240	22,780	↑ 3.2%	HESA	2017
	Postgraduate Students (UK)	366,655	350,940	331,490	329,190	331,935	↘ -2.5%	HESA	2017
	Postgraduate Students (EU)	49,280	48,935	45,510	46,190	46,195	↘ -1.6%	HESA	2017
	Postgraduate Students (Non-EU)	162,025	158,725	152,100	157,305	158,225	↘ -0.6%	HESA	2017
	Postgraduate Students (Total)	577,960	558,600	529,100	532,685	536,355	↘ -1.9%	HESA	2017
	Undergraduate Students (UK)	1,678,300	1,683,025	1,563,455	1,496,215	1,464,805	↓ -3.3%	HESA	2017
	Undergraduate Students (EU)	79,835	82,705	79,340	78,780	78,205	↘ -0.5%	HESA	2017
	Undergraduate Students (Non-EU)	133,525	141,725	146,655	152,345	153,695	↑ 3.6%	HESA	2017
	Undergraduate Students (Total)	1,891,660	1,907,455	1,789,450	1,727,340	1,696,705	↓ -2.7%	HESA	2017
	Higher Education Students (Total)	2,469,620	2,466,055	2,318,550	2,260,025	2,233,060	↘ -2.5%	HESA	2017
FUNDING IN MILLION 2010 USD PPP	GDP	2,296,465	2,323,542	2,373,728	2,443,522	2,502,420	↗ 2.2%	OECD (2015 estimation)	2017
	GERD	38,825	37,683	39,506	41,557	41,793	↗ 1.9%	OECD (2015 estimation)	2017
	BERD	24,685	23,870	25,240	26,762	27,461	↑ 2.7%	OECD (2015 estimation)	2017
	HERD	10,106	10,063	10,437	10,859	11,190	↑ 2.6%	OECD (2015 estimation)	2017
	GOVERD	3,331	3,032	3,121	3,224	2,960	↓ -2.9%	OECD (2015 estimation)	2017
FUNDING BY SOURCE IN MILLION GDP	Awards Volume (Total)	4,408	4,493	4,755	5,032	5,372	↑ 5.1%	HESA	2017
	UK BIS	1,550	1,502	1,533	1,656	1,791	↑ 3.7%	HESA	2017
	UK Other	2,011	2,021	2,110	2,171	2,316	↑ 3.6%	HESA	2017
	UK Total	3,561	3,523	3,643	3,827	4,106	↑ 3.6%	HESA	2017
	EU Government	430	506	593	682	720	↑ 13.8%	HESA	2017
	EU Other	80	92	96	101	111	↑ 8.4%	HESA	2017
	EU Total	510	598	689	783	831	↑ 13.0%	HESA	2017
	Non-EU	290	323	377	367	374	↑ 6.5%	HESA	2017
	Other	47	48	46	54	61	↑ 6.7%	HESA	2017
	OUTPUTS	World Scholarly Output Share	6.3%	6.4%	6.5%	6.3%	6.8%		Scopus
World Citations Share		10.8%	11.0%	10.8%	10.7%	11.3%		Scopus	Q4 2016
Field-Weighted Citation Impact (Fwci)		1.54	1.55	1.56	1.57	1.58		Scopus	Q4 2016
Outputs In Top Percentiles (1%)		14.9%	16.0%	15.6%	15.2%	14.1%		Scopus	Q4 2016
Outputs In Top Percentiles (5%)		12.4%	12.5%	12.4%	12.1%	11.5%		Scopus	Q4 2016
Outputs In Top Percentiles (10%)		11.3%	11.3%	11.2%	10.9%	10.6%		Scopus	Q4 2016
World Download Share		9.6%	9.8%	9.9%	9.9%	10.0%		Scopus	Q4 2016
Field-Weighted Download Impact (Fwdi)		1.16	1.19	1.20	1.19	1.17		Scopus	Q4 2016
IP Volume (Patents Filed)		50,805	51,562	51,321	52,612		↗ 1.2%	WIPO (2011-2014 CAGR)	2017
IP Volume (Patents Granted)		18,350	20,256	20,962	21,222		↑ 5.0%	WIPO (2011-2014 CAGR)	2017
IP Volume (Patents In Force)		85,487	103,587	118,108	169,878		↑ 25.7%	WIPO (2011-2014 CAGR)	2017
IP Volume (Total)		154,642	175,405	190,391	243,712		↑ 16.4%	WIPO (2011-2014 CAGR)	2017
World Patent Citations Share		8.9%	9.2%	9.7%	9.1%	11.0%		Scopus	Q4 2016
PRODUCTIVITY	Scholarly Output Per Researcher	0.58	0.59	0.58	0.57	0.48		OECD (2015 estimation); Scopus	Q4 2016
	Scholarly Output per GDP Million 2010 USD PPP	0.06	0.06	0.07	0.06	0.05		OECD (2015 estimation); Scopus	Q4 2016
	Scholarly Output per GERD Million 2010 USD PPP	3.74	3.99	3.96	3.72	3.23		OECD (2015 estimation); Scopus	Q4 2016
COLLABORATION	Single Author Publications Country %	16.2%	15.4%	14.7%	13.7%	12.9%		Scopus	Q4 2016
	Single Institution Publications Country %	20.7%	20.1%	18.9%	19.3%	17.2%		Scopus	Q4 2016
	National Publications Country %	16.4%	16.5%	16.6%	14.8%	14.7%		Scopus	Q4 2016
	International Publications Country %	45.4%	47.0%	48.8%	51.3%	54.4%		Scopus	Q4 2016
	Single Author Publications FWCI	0.94	0.93	0.92	0.92	0.93		Scopus	Q4 2016
	Single Institution Publications FWCI	1.22	1.22	1.22	1.23	1.24		Scopus	Q4 2016
	National Publications FWCI	1.34	1.34	1.33	1.33	1.33		Scopus	Q4 2016
	International Publications FWCI	1.98	1.98	1.97	1.95	1.93		Scopus	Q4 2016

## 2 | International Collaboration partners<sup>11</sup>

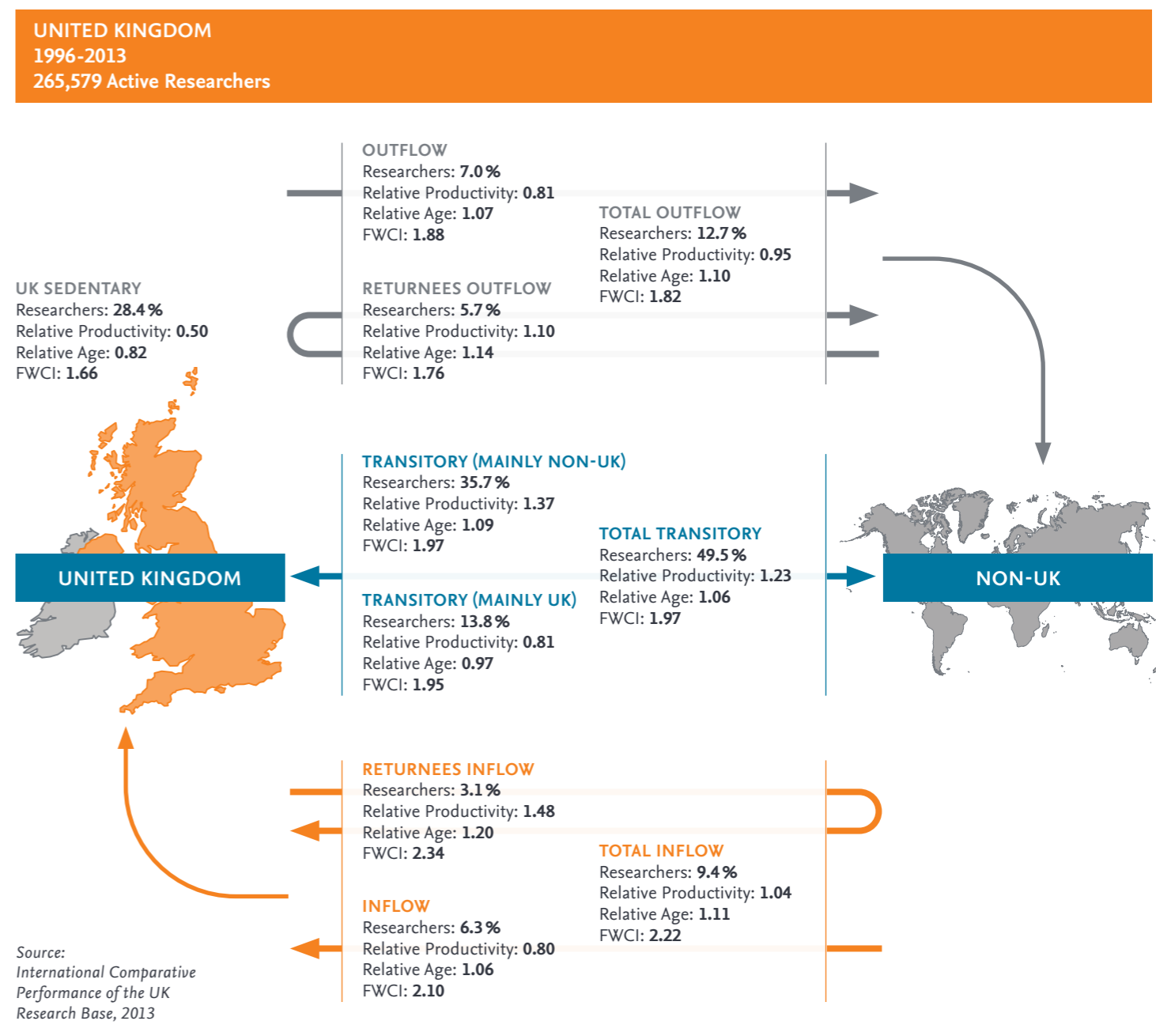
COLLABORATION PARTNER	Share of UK international collaborations	Field-Weighted Citation Impact
United States	30.2%	2.75
<b>Germany</b>	<b>15.9%</b>	<b>2.80</b>
<b>France</b>	<b>11.5%</b>	<b>3.01</b>
<b>Italy</b>	<b>10.2%</b>	<b>2.87</b>
China	9.4%	2.15
Australia	9.4%	2.86
<b>Netherlands</b>	<b>8.8%</b>	<b>3.14</b>
<b>Spain</b>	<b>8.7%</b>	<b>2.78</b>
Canada	7.4%	3.36
Switzerland	6.3%	3.34
<b>Sweden</b>	<b>5.2%</b>	<b>3.18</b>
<b>Belgium</b>	<b>4.4%</b>	<b>3.28</b>
Japan	4.1%	2.94
<b>Denmark</b>	<b>3.6%</b>	<b>3.51</b>
<b>Ireland</b>	<b>3.0%</b>	<b>2.50</b>
<b>Greece</b>	<b>2.8%</b>	<b>2.65</b>
<b>Austria</b>	<b>2.7%</b>	<b>3.31</b>
Brazil	2.7%	2.82
Norway	2.7%	3.31
India	2.6%	2.62
<b>Poland</b>	<b>2.6%</b>	<b>3.08</b>
<b>Finland</b>	<b>2.5%</b>	<b>3.16</b>
<b>Portugal</b>	<b>2.4%</b>	<b>2.46</b>
Russian Federation	2.3%	2.90
South Africa	2.2%	2.95
New Zealand	2.0%	2.83
South Korea	1.7%	3.50
<b>Czech Republic</b>	<b>1.7%</b>	<b>3.22</b>
Israel	1.5%	3.85
Malaysia	1.4%	1.70

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 career 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 a non-UK affiliation. Researchers without any apparent mobility based on their published affiliations were considered sedentary.

## 3 | Researcher Mobility



- UK researchers show a high degree of mobility<sup>12</sup>. Over 70% of them have published with affiliations outside of the UK, leaving 28% of sedentary researchers. Sedentary researchers achieve an FWCI that is well above the world average (cited 66% more often), but is at least 10 percentage points lower than the FWCI of the UK's mobile researchers.
- Nearly half of the UK's researchers show transitory mobility, the largest part of the UK's total researcher population. Publications by these researchers are highly cited: their FWCI of 1.97 indicates a citation rate of nearly twice the world average. On top of this, transitory researchers are the UK's most productive, publishing 23% more publications than the average researcher in the UK. This is largely thanks to those with mainly non-UK affiliations, as the mainly UK-affiliated transitory researchers have a relative productivity that is actually 19% below the UK's average.
- Researchers coming to the UK and staying for more than 2 years without leaving (inflow researchers) are the most impactful among the UK's mobility categories, being cited 122% more than the world average. Inflow researchers are however less productive than outflow researchers (by about 9 percentage points), despite having nearly equally long publication histories.

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