

FACTSHEET
Q4 | 2016

UK Research Factsheet 2011-2015

Resources, Output, Growth, Impact, Collaboration, Mobility



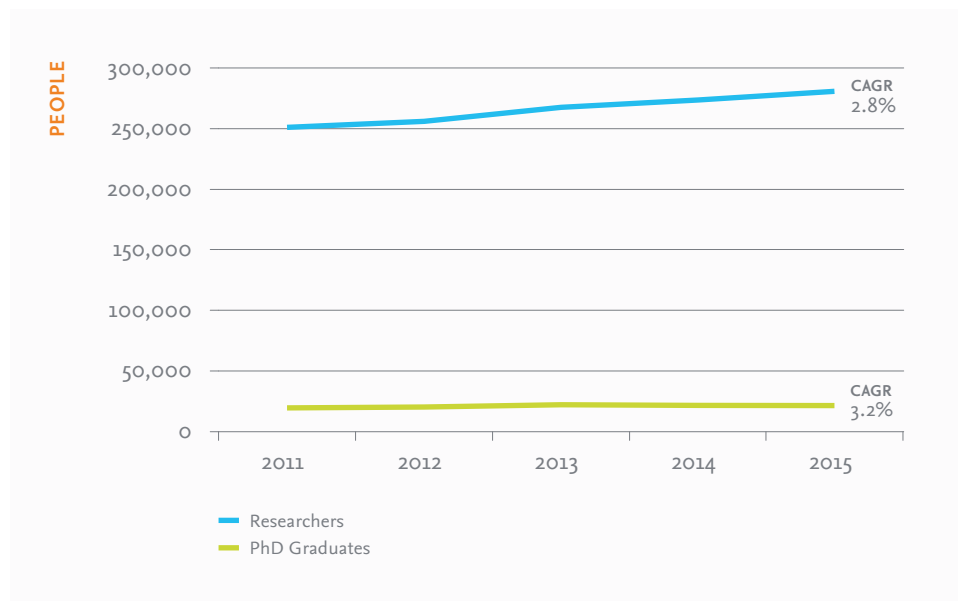
Indicators to illustrate any effects of the UK's intended withdrawal from the European Union on UK research Q4 2016

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

The UK's research workforce has been growing at a *Compound Annual Growth Rate (CAGR)*¹ of 2.8%. In 2015 there were over 280,000 researcher FTEs² 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.



Source: OECD³, HESA⁴

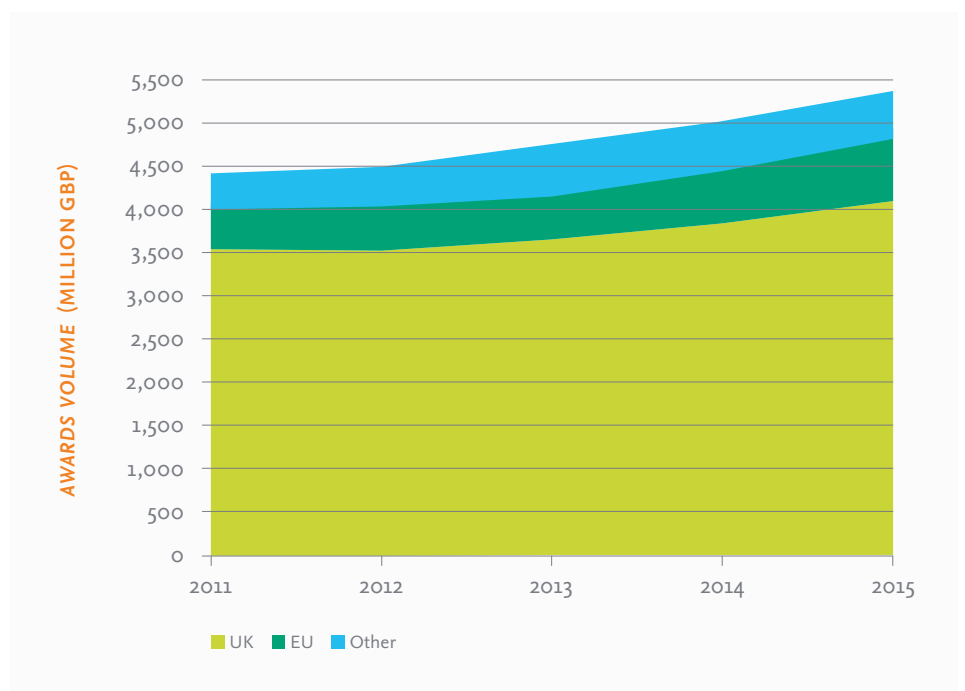
1. *Compound Annual Growth Rate (CAGR)*: the mean annual growth rate over a specified period of time. Starting with the first value in any series and applying this rate for each of the time intervals yields the amount in the final value of the series.
2. *Full Time Equivalent employment (FTE)*: the number 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)*: 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 5.1%, 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 13.0% CAGR.

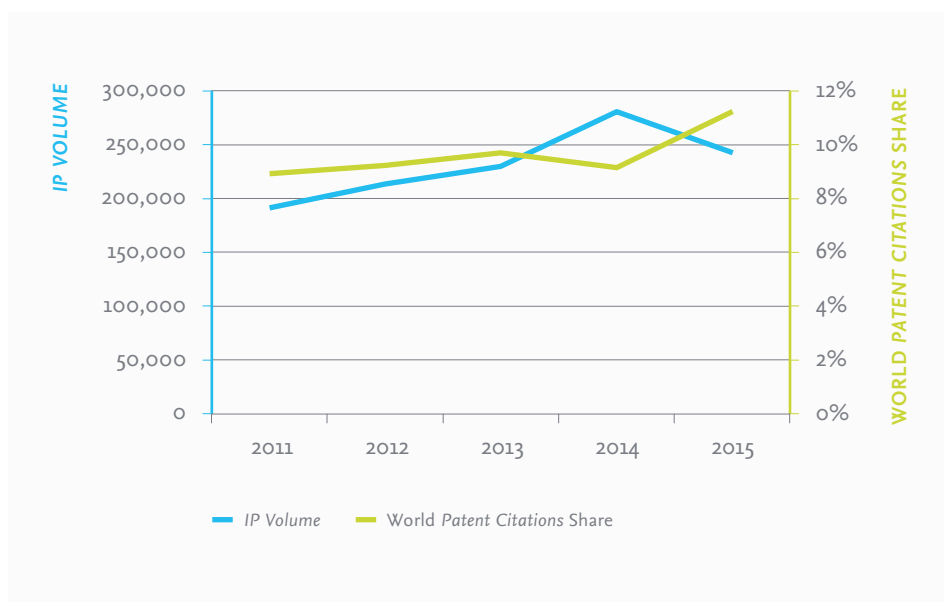
FIGURE 2 – AWARDS VOLUME FOR THE UK BY SOURCE, 2011-2015



Source: HESA

The UK's *IP Volume* has been growing between 2011 and 2015 at 6.0% CAGR, approaching 250,000. Its share of world *patent citations* (to *scholarly output*) has increased by more than 2 percentage points to 11.2% of the world total between 2011 and 2015.

FIGURE 3 – INTELLECTUAL PROPERTY (IP) VOLUME⁵ AND WORLD PATENT CITATIONS SHARE⁶ OF THE UK, 2011-2015



Source: WIPO⁷, Scopus⁸

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 *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.

For further information

- 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

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. 2015 WIPO data may also be incomplete for *patents in force*. Therefore, while the related 2015 data points have some utility, we caution the reader from drawing conclusions from comparisons between 2015 data and 2011-2014 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 2011-2015: Resources, Output, Growth, Impact, Collaboration, Mobility⁹

CATEGORY	INDICATOR	2011	2012	2013	2014	2015 ⁹
PEOPLE	Population	62,435,200	62,858,800	63,237,940	63,650,010	64,059,219
	Researchers	251,358	256,156	267,699	273,560	280,619
	PhD graduates	20,080	20,435	22,160	21,240	22,780
	Postgraduate Students (UK)	366,655	350,940	331,490	329,190	331,935
	Postgraduate Students (EU)	49,280	48,935	45,510	46,190	46,195
	Postgraduate Students (Non-EU)	162,025	158,725	152,100	157,305	158,225
	Postgraduate Students (Total)	577,960	558,600	529,100	532,685	536,355
	Undergraduate Students (UK)	1,678,300	1,683,025	1,563,455	1,496,215	1,464,805
	Undergraduate Students (EU)	79,835	82,705	79,340	78,780	78,205
	Undergraduate Students (Non-EU)	133,525	141,725	146,655	152,345	153,695
	Undergraduate Students (Total)	1,891,660	1,907,455	1,789,450	1,727,340	1,696,705
	Higher Education Students (Total)	2,469,620	2,466,055	2,318,550	2,260,025	2,233,060
	FUNDING IN MILLION 2010 USD PPP	GDP	2,296,465	2,323,542	2,373,728	2,443,522
GERD		38,825	37,683	39,506	41,557	41,793
BERD		24,685	23,870	25,240	26,762	27,461
HERD		10,106	10,063	10,437	10,859	11,190
GOVERD		3,331	3,032	3,121	3,224	2,960
FUNDING BY SOURCE IN MILLION GDP	Awards Volume	4,408	4,493	4,755	5,032	5,372
	UK BIS	1,550	1,502	1,533	1,656	1,791
	UK Other	2,011	2,021	2,110	2,171	2,316
	UK Total	3,561	3,523	3,643	3,827	4,106
	EU Government	430	506	593	682	720
	EU Other	80	92	96	101	111
	EU Total	510	598	689	783	831
	Non-EU	290	323	377	367	374
	Other	47	48	46	54	61
OUTPUT	World Scholarly Output Share	6.4%	6.5%	6.5%	6.4%	6.6%
	World Citations Share	10.8%	11.0%	10.9%	10.7%	10.9%
	Field-Weighted Citation Impact (FWCI)	1.55	1.56	1.55	1.57	1.58
	World Output in Top Percentiles (1%) Share	14.9%	16.0%	15.7%	15.9%	14.8%
	World Output in Top Percentiles (5%) Share	12.3%	12.6%	12.5%	12.3%	12.2%
	World Output in Top Percentiles (10%) Share	11.3%	11.4%	11.4%	11.1%	11.0%
	World Downloads Share	9.6%	9.8%	9.9%	9.9%	10.2%
	Field-Weighted Download Impact (FWDI)	1.16	1.20	1.19	1.23	1.26
	IP Volume (Patents Filed)	50,805	51,562	51,300	52,605	52,648
	IP Volume (Patents Granted)	18,350	20,256	20,939	21,203	21,335
	IP Volume (Patents In Force)	122,761	141,673	156,602	206,787	168,486
	IP Volume (Total)	191,916	213,491	228,841	280,595	242,469
	World Patent Citations Share	8.9%	9.2%	9.7%	9.1%	11.2%
PRODUCTIVITY	Scholarly Output per Researcher	0.58	0.59	0.59	0.59	0.56
	Scholarly Output per GDP Million 2010 USD PPP	0.06	0.07	0.07	0.07	0.06
	Scholarly Output per GERD Million 2010 USD PPP	3.75	4.01	3.98	3.86	3.78
COLLABORATION	Single Author Publications Country %	16.3%	15.5%	14.8%	13.9%	13.3%
	Single Institution Publications Country %	21.3%	20.6%	19.4%	19.7%	18.4%
	National Publications Country %	16.7%	16.8%	17.0%	15.2%	14.9%
	International Publications Country %	45.4%	46.9%	48.7%	51.2%	53.5%
	Single Author Publications FWCI	0.93	0.92	0.91	0.90	0.90
	Single Institution Publications FWCI	1.22	1.23	1.23	1.24	1.25
	National Publications FWCI	1.34	1.34	1.34	1.33	1.33
	International Publications FWCI	1.98	1.98	1.97	1.95	1.93

- For definitions of the below indicators, please refer to the footnotes¹⁰ on pg.5, the [SciVal Metrics Guidebook](#) or the [Snowball Metrics Recipe Book](#).

2011-2015 CAGR	SOURCE	NEXT UPDATE
↗ 0.6%	OECD (2015 estimation)	2017
↑ 2.8%	OECD (2015 estimation)	2017
↑ 3.2%	HESA	2017
↘ -2.5%	HESA	2017
↘ -1.6%	HESA	2017
↘ -0.6%	HESA	2017
↘ -1.9%	HESA	2017
↓ -3.3%	HESA	2017
↘ -0.5%	HESA	2017
↑ 3.6%	HESA	2017
↓ -2.7%	HESA	2017
↘ -2.5%	HESA	2017
↗ 2.2%	OECD (2015 estimation)	2017
↗ 1.9%	OECD (2015 estimation)	2017
↑ 2.7%	OECD (2015 estimation)	2017
↑ 2.6%	OECD (2015 estimation)	2017
↓ -2.9%	OECD (2015 estimation)	2017
↑ 5.1%	HESA	2017
↑ 3.7%	HESA	2017
↑ 3.6%	HESA	2017
↑ 3.6%	HESA	2017
↑ 13.8%	HESA	2017
↑ 8.4%	HESA	2017
↑ 13.0%	HESA	2017
↑ 6.5%	HESA	2017
↑ 6.7%	HESA	2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
↗ 0.9%	WIPO	2017
↑ 3.8%	WIPO	2017
↑ 8.2%	WIPO	2017
↑ 6.0%	WIPO	2017
	Scopus	Q1 2017
	OECD (2015 estimation); Scopus	Q1 2017
	OECD (2015 estimation); Scopus	Q1 2017
	OECD (2015 estimation); Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017
	Scopus	Q1 2017

2 | Top 30 International Collaboration Partners¹¹

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. 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, 9 of the top 15 by FWCI are within the EU.

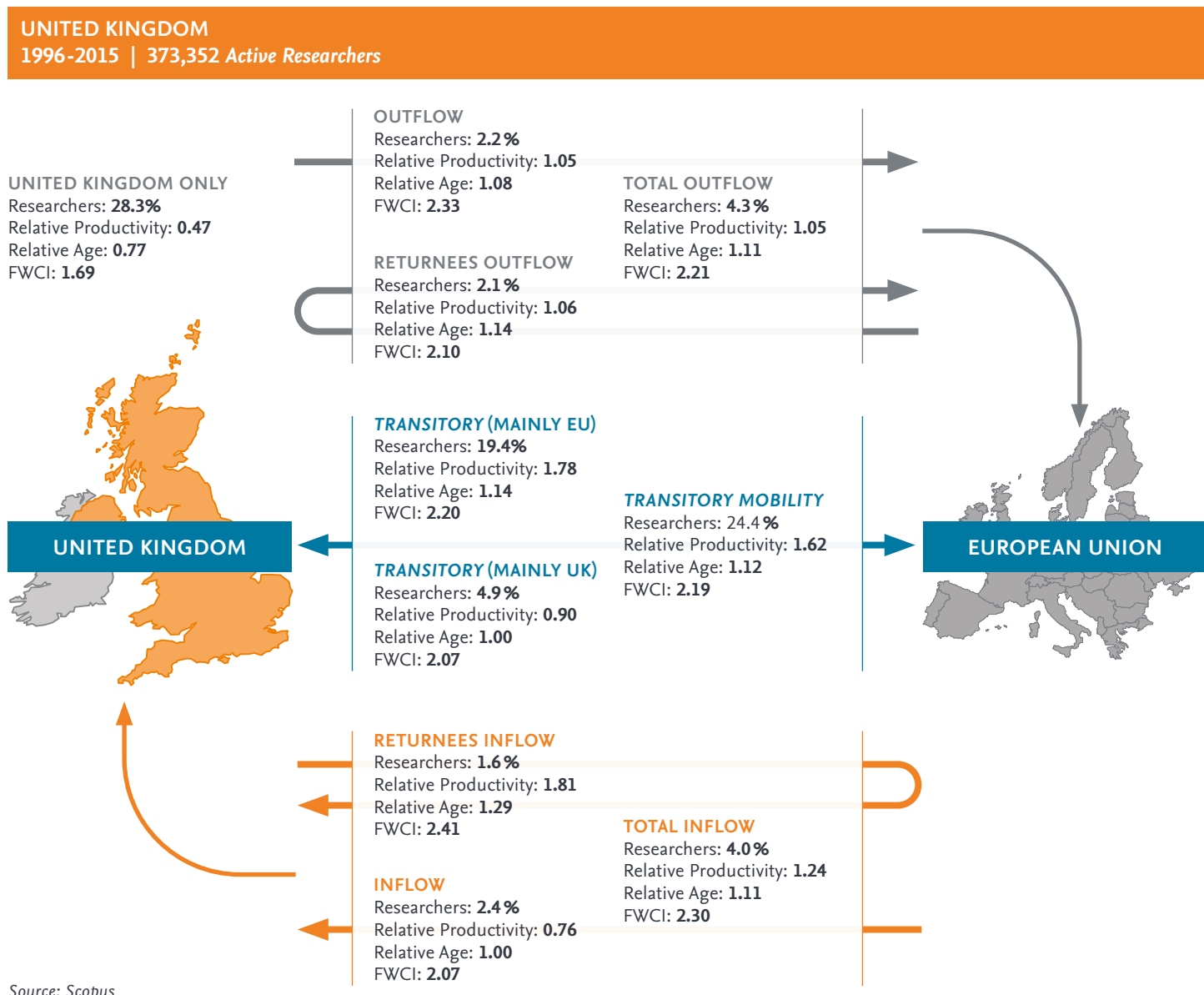
Collaboration Partner	Share of UK International Collaborations	Field-Weighted Citation Impact
European Union	53.5%	2.21
United States	30.2%	2.77
Germany	15.8%	2.82
France	11.5%	3.02
Italy	10.3%	2.90
China	9.4%	2.21
Australia	9.3%	2.91
Netherlands	8.9%	3.15
Spain	8.7%	2.82
Canada	7.4%	3.39
Switzerland	6.3%	3.34
Sweden	5.2%	3.24
Belgium	4.4%	3.31
Japan	4.2%	3.05
Denmark	3.6%	3.59
Ireland	3.0%	2.54
Greece	2.8%	2.72
Austria	2.8%	3.37
Brazil	2.7%	2.89
Norway	2.7%	3.41
India	2.6%	2.66
Poland	2.6%	3.07
Finland	2.5%	3.27
Portugal	2.4%	2.54
Russian Federation	2.3%	2.93
South Africa	2.2%	2.96
New Zealand	1.9%	2.97
South Korea	1.7%	3.59
Czech Republic	1.7%	3.21
Israel	1.5%	3.97
Malaysia	1.5%	1.78

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 are identified as those that list a UK affiliation on at least one publication (articles, reviews and conference proceedings) published across the sources included in Scopus. A productivity filter is 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 are considered *migratory* and are further subdivided into those where the researchers remain abroad or where they subsequently return to their original country. Stays overseas of less than 2 years are deemed *transitory*, and are also further subdivided into those who mostly publish under a UK or an EU affiliation. Researchers without any apparent mobility based on their published affiliations are considered *sedentary*.

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



Source: Scopus

- UK researchers show a high degree of *mobility*.¹² 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 69% more often), but is at least 10 percentage points lower than the *FWCI* of the UK's mobile researchers.
- Nearly 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 2.19 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 62% 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 actually 10% 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 130% more than the global overall average. Inflow researchers are also more productive in terms of *scholarly output* than outflow researchers (by about 19 percentage points), despite having equally long publication histories.

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