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DZHW German Centre for
Higher Education Research and Science Studies

This is an excerpt from the publication

“Wissenschaft weltoffen 2021”

Since 2001, the DAAD has been analysing data on the internationalisation of studies, research and higher education from Germany as well as from particularly relevant countries and regions such as the USA, the United Kingdom or Asia. The current edition presents the most important results and graphics.

These include figures on international students in Germany, data on mobility behaviour, an overview of students' countries of origin and host countries as well as developments in the field of doctorates. Special data analyses shed light on the status quo and trends at universities and research institutes during the Covid-19 pandemic.

The study integrates international data from OECD and UNESCO as well as national data from the Federal Statistical Office in Germany. In combination with other indicators, it provides a valid basis for long-term analyses.

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A guest contribution by Dr Dimity Stephen and Dr Stephan Stahlschmidt



Dr Dimity Stephen is a post-doctoral researcher in the Research System and Science Dynamics Department at the German Centre for Higher Education Research and Science Studies (DZHW). Dr Stephen conducted the analysis for the broader study through which these results were produced and wrote the English version of this article.



Dr Stephan Stahlschmidt is a post-doctoral researcher at the German Centre for Higher Education Research and Science Studies (DZHW). As part of the interim management of the Research System and Science Dynamics Division, he heads the Performance Measurement and Indicators Unit. Dr Stahlschmidt designed the broader study through which these results were produced and prepared the ORCID and Dimensions data for the study.

As in former issues of *Wissenschaft Weltoffen*, the international researcher mobility flows presented in this section are based on data from Elsevier's Scopus database. This database contains bibliometric data for millions of publications published in over 22,000 academic journals. Elsevier algorithmically disambiguates authors in Scopus by clustering all publications into profiles based on author names, co-authors, affiliations, publication dates, journal title, and subject area, and assigns each profile a unique Author ID. Researcher mobility can be examined based on changes in the country affiliations in the set of publications associated with an Author ID over time.

To examine mobility using Scopus data in this report, all affiliations of each Author ID between 2000 and 2019 were extracted from the German Competence Centre for Bibliometrics' in-house version of the Scopus database. In some instances authors were affiliated with two or more countries in one year. In such cases, these years were removed as retaining a previous

affiliation might suggest an author's change in affiliations was not accompanied by physical relocation. As authors typically do not publish every year, missing affiliations were filled based on the last available affiliation. Having established a complete time series, each author's affiliation was compared to the previous year to identify instances of mobility and the sending and receiving countries.¹ Annual counts of these mobility events between countries were then aggregated to the reference periods.

For indicators pertaining to incoming and outgoing mobility in comparison to non-mobile authors, all authors who published in the reference year were identified, and their affiliation in the reference year was compared to their affiliation in their most recent previous publication, whenever that was between 2000 and the last year prior to the reference year. Authors who published for the first time in the reference year were excluded as they could not reliably be identified as either mobile or stable. Non-mobile authors were defined as authors whose affiliation was the same on their reference year and pre-reference year publications. Incoming authors to the reference country were defined as those affiliated with the reference country in the reference year, but affiliated with a different country in their pre-reference year publication. Outgoing authors were defined as those whose pre-reference year affiliation was the reference country, but whose affiliation in the reference year was not the reference country.

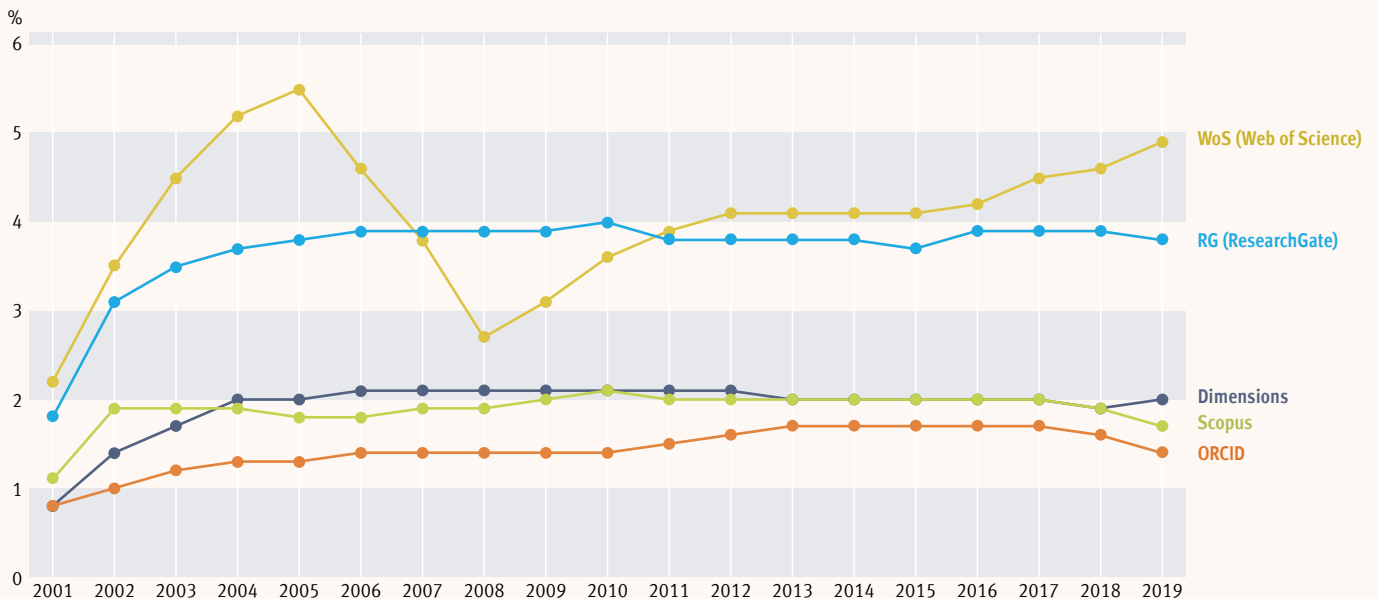
There are some limitations and considerations to using bibliometrics data to analyse mobility, however. For instance, mobility based on publications may appear later than it actually occurred due to delays in publishing, and some instances of

“ Some instances of mobility, such as research stays abroad that did not result in a publication, will not be captured through bibliometric data.

mobility, such as research stays abroad that did not result in a publication, will not be captured through bibliometric data. Further, in interpreting mobility flows it should be considered that mobility between countries represents both researchers leaving or returning to their home countries and also mobility of

guest researchers in a host country. For instance, a researcher may already have moved to a host country at the time of their first publication and any subsequent outgoing mobility may reflect a return to their home country or onward movement to a third country. The potential influence of these supposedly random inaccuracies of a bibliometric approach to measure scientific mobility seems limited when examining data at the high aggregation level of countries.²

AS1 Proportions of all academic authors identified as mobile in each data source, 2001–2019



Sources: Respective databases and networks; DZHW calculations

However, it should also be considered that the journals indexed in Scopus do not represent all publications globally but have a particular focus on English-language journals and specific scientific disciplines. As such, some countries with a strong focus on English-language publications may be over-represented in Scopus-indexed publications, which can influence the level of mobility these countries represent. Researchers in disciplines that do not use journal articles as the primary means of communication are also under-represented. As authors must have two publications in Scopus-indexed journals for mobility to be detected, mobility in early career researchers or other researchers who publish infrequently may be under-represented in these publication-based data. Finally, while Elsevier's approach for disambiguating authors has generally been found to be accurate,³ a small percentage of profiles may contain incorrect publications or be missing publications, which can influence the detection or direction of mobility.

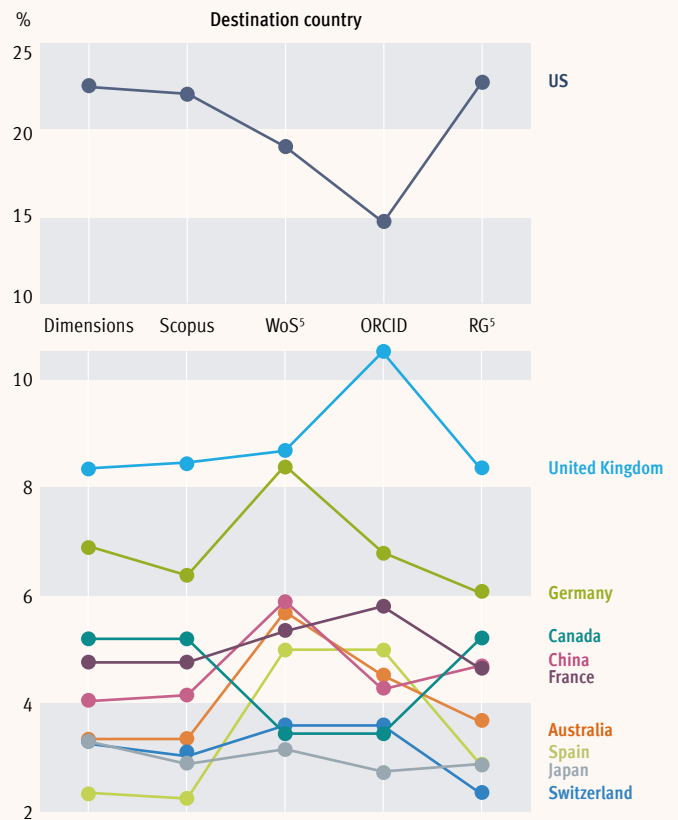
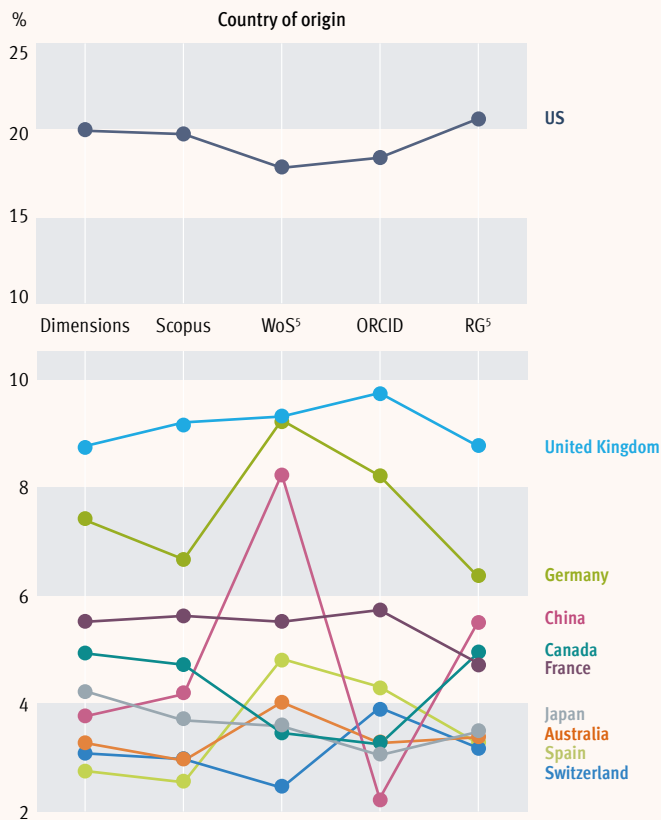
Hence, different data sources hold particular structural characteristics that reflect their approach to coverage, author disambiguation, and other features, which can influence the picture of international mobility derived from their data. For example, Fig. AS1 shows the percentage of all authors in Scopus

and four other data sources who were identified as mobile in 2001 to 2019, and Fig. AS2 shows the ranking of countries based on the average percentage of total outgoing or incoming mobility they accounted for during 2000 to 2019. This analysis used essentially the same process as was previously described for Scopus data for each source (see above or p. 24) and allows the effect of the sources' particular characteristics on mobility to be observed.

“ Different data sources hold particular structural characteristics, which can influence the picture of international mobility derived from their data.

In terms of source-specific characteristics, Dimensions applies a similar method to Scopus to automatically disambiguate authors and indexes publications with similar attributes. Conversely,

AS2 Average proportions of global mobility of academic authors for key countries of origin and destination countries, according to various data sources, 2001–2019⁵



Country of origin	Dimensions	Scopus	WoS ⁶	ORCID	RG ⁶
	Proportion in %, by data source				
US	20.0	19.8	17.8	18.4	20.7
United Kingdom	8.8	9.2	9.3	9.7	8.8
Germany	7.4	6.7	9.2	8.2	6.4
France	5.5	5.6	5.5	5.7	4.8
Canada	4.9	4.7	3.5	3.3	4.9
Japan	4.2	3.7	3.6	3.1	3.5
China	3.8	4.2	8.2	2.3	5.5
Australia	3.3	3.0	4.0	3.3	3.4
Switzerland	3.1	3.0	2.5	3.9	3.2
Spain	2.8	2.6	4.8	4.3	3.3

Destination country	Dimensions	Scopus	WoS ⁶	ORCID	RG ⁶
	Proportion in %, by data source				
US	22.5	22.1	19.0	14.6	22.7
United Kingdom	8.4	8.5	8.7	10.4	8.4
Germany	6.9	6.4	8.3	6.8	6.1
France	4.8	4.8	5.3	5.7	4.7
Canada	5.1	5.1	3.5	3.5	5.1
Japan	3.2	2.9	3.1	2.8	2.9
China	4.1	4.2	5.8	4.3	4.7
Australia	3.4	3.4	5.6	4.5	3.7
Switzerland	3.2	3.0	3.5	3.5	2.4
Spain	2.4	2.3	4.9	4.9	2.9

Sources: Respective databases and networks; DZHW calculations

Web of Science (WoS) applies stricter criteria for indexing high impact journals⁴, and their author identifier only captures authors who have registered themselves for a Researcher ID. As such, WoS induced scientific mobility is derived from a sample of researchers predominantly based in Europe, who published repeatedly in high impact journals. ORCID and ResearchGate's users also self-registered a profile, however lower entry barriers apply. While ResearchGate relies on institutional e-mail addresses (or publications) to define its users group, ORCID registration is unrestricted and encouraged, respectively required by some journal publishers, institutions or funders. The data here for ResearchGate are drawn from affiliations in the publications users assigned to their profile, while ORCID data are based on employments recorded by users.

In these figures, the effect of the characteristics of each data source on the overall mobility detected, and the rankings and

percentage of mobility for which a country accounted become evident. Broadly it can be observed in Fig. AS1 that percentages of mobile authors in the user-verified profiles of WoS and ResearchGate doubled compared to automated approaches of Scopus and Dimensions. Further, Scopus, Dimensions and

“ Scopus, Dimensions and ResearchGate present a similar profile of country rankings and mobility percentages, while WoS and ORCID feature higher visibility of European countries and less visibility of North America.

ResearchGate present a similar profile of country rankings and mobility percentages, while WoS and ORCID feature higher visibility of European countries and less visibility of North America. In contrast, ORCID and WoS disagree on the role of China, with WoS assigning a relatively high relevance to China in international mobility, while

ORCID presents a low relevance. Especially the until recently pronounced use of WoS-indexed journals in the Chinese research evaluation procedures might have motivated Chinese authors to attentively curate their WoS profile. Conversely, uptake of ORCID profiles seems to lag in Asia (and North America) but is strong in Africa and South America, increasing the visibility of scientific activities in the Global South.

* Footnotes

- 1 Hereinafter we deliberately refrain from using “host country” as a term as a bibliometric analysis of mobility of academics and researchers does not allow us to determine whether a given country really is the host country of the academic or researcher concerned or their home country, to which they are returning after a period abroad.
- 2 See Moed/Halevi (2014).
- 3 See e.g. Aman (2018), Campbell/Struck (2019), Kawashima/Tomizawa (2015).
- 4 A publication's impact here refers to the visibility of a publication's content and its subsequent use by the scientific community. To assess this, bibliometric analysis gathers and evaluates citations of a given publication in scientific works by other academics and researchers.
- 5 Only countries that account for at least 3.0% of incoming and/or 3.5% of outgoing mobility of academic authors according to at least one of the data sources under review.
- 6 RG = ResearchGate, WoS= Web of Science.