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Assessment of a Research Funding Organization for International Mobility by Bibliometric Means. Implementation, Results and Challenges of Responsible Research Evaluation

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Abstract

Using the German Academic Exchange Service (DAAD) as an example, the study examines which of the three bibliometric databases (Dimensions, Scopus and Web of Science) has the best coverage for funding acknowledgement information. Web of Science provides most comprehensive data on funding acknowledgements, followed by Scopus and Dimensions. A special feature of the DAAD is the promotion of global academic mobility. In this respect, it is the largest funder in the world. The publications funded by the DAAD are examined regarding their worldwide distribution, their degree of internationalization and their excellence rate. A logistic regression is applied to investigate which factors influence the excellence rate of DAAD-funded publications. For this purpose, the funding acknowledgement data is linked with data from the research funding organization. The results reveal that the excellence rate depends on the funded academic group (graduates, doctoral candidates, postdocs, and faculty members), the gender, and the country of origin and destination of the grantee. The paper concludes with a discussion of how the results should be treated in the context of responsible research evaluation.

Introduction

Research performing organizations, especially universities, have long been subject of evaluations that also use bibliometric data (e.g. ARWU "Shanghai" Ranking, QS World University Rankings, Times Higher Education (THE) World University Rankings). In addition, there are rankings that are mainly based on bibliometric data, e.g. the Leiden Ranking and the Scimago Institutions Ranking. Comparable rankings for research funders do not exist. There are various reasons for this.

For the investigation of research performing organizations, the publications are assigned to the organizations via the address affiliations. Address affiliations are an integral part of the scientific publication system and are thus included in bibliometric databases for a long time. In contrast, publications are assigned to research funding organizations via the acknowledgement section of the publications, in which not only research funders but also other institutions and individuals are acknowledged. The natural-language funding acknowledgement texts lack a uniform notation of both the name of the funding agency and the funding program. In their literature review on funding acknowledgements, Álvarez-Bornstein and Montesi call this a "lack of data

normalization" (Álvarez-Bornstein and Montesi 2021), which leads to misassignments of publications to respective funders.

To obtain a valid dataset for bibliometric analysis, extensive data cleaning of the natural language texts is necessary. Sirtes (2013) and Möller (2019), for example, found over six thousand name variants for the German Research Foundation (DFG) in just one publication year in the funding organization field of the Web of Science. Möller also shows that the number of spellings varies between different funding bodies. One reason for this is that research funders have a wide range of guidelines, from none to very detailed ones, on how grantees should acknowledge the source of funding. The "dirty" (Sirtes 2013) funding acknowledgement data requires a great effort in cleaning and normalization to conduct sophisticated bibliometric studies on research funders. Because of this effort, many studies focus on a single or a small number of research funders (e.g., Costas and Yegros-Yegros 2013; Meier et al. 2023; Möller, Schmidt, and Hornbostel 2016; Sirtes 2013; Wang, Jesiek, and Zhang 2024). In addition, there are a few studies that link funding acknowledgement data with data provided by the research funders. A first study focusing on the Austrian Science Fund (FWF) showed that only a portion of the publications listed in the final project reports provided to the agency could be identified in Web of Science via a funding acknowledgement analyses (Costas and Yegros-Yegros 2013; van Wijk and Costas-Comesaña 2012). It is well known that the Web of Science, as well as any other bibliometric database, does not cover all publications, but the fact that only 72% of publications from project final reports have a funding acknowledgement (Costas and Yegros-Yegros 2013) illustrates that funding acknowledgement analyses cannot identify all funded publications. However, it should be noted that the coverage of funding acknowledgement data has improved substantially in recent years (Clarivate Analytics 2022). The results of the previous FWF study published in 2012/13 are therefore somewhat outdated. A more recent study on the German Research Foundation (DFG) also uses data from final reports and compares these with funding acknowledgement information (Meier et al. 2023; Möller, Scheidt, and Meier 2024). 92% of publications mention the name of the DFG as the funding source. However, the grant number was only provided in 74% of cases (Möller et al. 2024).

This study builds on the above research strand by investigating funding acknowledgements and data provided by a funding agency. However, the aim is not to point out the differences between the two data sources as done previously. Instead, the bibliometric data on funding acknowledgement is supplemented by data from a research funding agency to carry out more sophisticated analysis. The object of the study is the German Academic Exchange Service (Deutscher Akademischer Austauschdienst, DAAD), which, according to its own statement, is the world's largest funding organization for the international exchange of students and academics (DAAD 2024a). Möller (2019) shows that most research funders only provide funding to academics from their home country. The originality of this study lies on the one hand, in linking bibliometric funding acknowledgement data with data from the research funder; on the other hand, in the international orientation of the funding body, which not only supports academics from Germany and their

international mobility, but also academics from a wide range of countries and their mobility.

After explaining the methodological approach, we investigate in the *Results* section the coverage of DAAD-funded publications in three bibliometric databases (Dimensions, Scopus and Web of Science). Then we focus on the internationality of the DAAD-funding and the impact they achieved. By linking bibliometric funding acknowledgement data with data from the research funder, we are capable to analyze to what extent the impact (excellence rate, PP top 10%) of the funded publications depends on the different DAAD-funding programs, the belonging to an academic group and the grantee's country of origin and destination. In the context of a responsible bibliometric evaluation, it is further explored and discussed to what extent bibliometric impact indicators do adequate justice the funding objectives of the different programs of the research funder.

Methods

Research funding organizations usually have extensive knowledge about their funded projects and grantees, including the amount of funding and the funding period. This knowledge forms the basis for the monitoring of funding and is published in annual reports and special evaluations (e.g., DAAD 2024b). However, there is often a lack of reliable information regarding the output of the funding, in particular which scientific publications are the outcome of research funding. One reason for this is that the funding recipients do not, or not completely, report the publications they have produced to the research funders. Publication notifications are made during the funding period or immediately afterwards in the final reports. Many publications appear years later and thus after the final report was submitted. The research funders are not informed about these publications. In addition, the lists of publications in final reports are usually unstructured, making an evaluation laborious. This effort is usually not feasible by the employees of research funding organizations.

In 2008, the bibliometric database Web of Science (WoS) began to include funding information for the first time. This was achieved by extracting the funding acknowledgement from the general acknowledgements section, in which colleagues, scientific institutions and research funding organizations are thanked for their support or financial assistance. Acknowledgements are short, unstructured texts in natural language written by the authors.

Many research funding organizations (e.g. the German Research Foundation (DFG), see Meier et al. 2023: 13ff) provide their funding recipients with detailed guidelines on how to indicate the funding source in a publication. However, the DAAD has no general standards in this regard, neither about the naming (Deutscher Akademischer Austauschdienst or German Academic Exchange Service) nor about the use of a grant number. The DAAD uses a personal code internally and in communication between the DAAD and its grantees. In only a few cases, this personal code was also mentioned in the funding acknowledgements.

Regardless of the specific requirements for how research funding should be indicated, acknowledging the funding source has become an established academic

publication practice. An online survey conducted by the German Centre for Higher Education and Science Research in 2016 showed that 94% of the scientists and scholars always or usually cited research funding (Möller et al. 2024: 1). Analyses of the funding context of publications are therefore a suitable instrument for examining the publication output of funding, even in the absence of specific guidelines of single funders.

In the context of this study, DAAD-funded publications are defined as publications that include a reference to the DAAD in the acknowledgements, e.g. "This study was funded by the German Academic Exchange Service (DAAD)". Text mining methods were used to identify DAAD-funded publications. 148 variations of the DAAD name were found. These include the two official German and English names (Deutscher Akademischer Austauschdienst and German Academic Exchange Service), the acronym DAAD and a wide range of grammatical forms of the official spellings. In addition, many "unofficial" spellings were found, for example, instead of German Academic Exchange Service, the terms German Academic Exchange Program/ Foundation/ Council or Office.

The result of the above search was quality-assured in a subsequent step. This involved checking whether the designations (especially from the unofficial spellings) really refer to the German Academic Exchange Service. Does a research funding organization with a similar name exists or does another research funding organization also use the abbreviation DAAD? The checks showed that the US Army Research Office has an extensive funding program that also uses the abbreviation DAAD. Almost one thousand publications that were initially identified only by the acronym DAAD were excluded from the final dataset during the quality assurance procedure. The findings of the analyses of this first data set are presented in the *Results* section. As a first step, the coverage of DAAD-funded publications in three bibliometric databases (Dimensions, Scopus and Web of Science) was compared. Then publication, collaboration and impact indicators were applied (rate of excellence or PP top 10%) on the bibliometric database with the best coverage (Web of Science).

Furthermore, a second data set was created to supplement the first data set by additional variables, which allows a differentiated analysis of the DAAD funding portfolio. For this purpose, the DAAD-funded publications in the Web of Science were linked to the DAAD database on personal funding. The linkage was done at the author level and was based on various fields: the name, email address, research field, the country of origin and destination of the grantees, as well as the funding period. Of the 33,812 DAAD-funded publications between 2010 and 2020 of the first dataset (Web of Science), 5,346 publications could be allocated to funding recipients. There are several reasons for – at a first glance – relatively small number of matches. Firstly, the DAAD database only includes individual scholarships awarded by the DAAD directly. No data is available for the extensive so-called project-related DAAD funding, in which the DAAD awards funding to institutions who then pass it to individual beneficiaries. Secondly, the DAAD database only contained personal funding from 2014 onwards. As publications usually appear a while after the start of a grant, only a small proportion of DAAD publications from 2014 could be linked.

The number of linked publications increased steadily over the years, reaching its peak in 2020 – from 165 in 2014 to 1,262 in 2020. Thirdly, the linkage was guided by high-quality criteria to exclude false assignments. This quality orientated approach also reduced the number of validated linked publications. The second data set allows for differentiated analyses of funding programs, academic status (graduate, doctoral candidate, postdoc, faculty member), and country of origin and destination (mobility).

Results

Comparison of bibliometric databases

Figure 1 shows the number of DAAD-funded publications between 2010 and 2020 for the bibliometric databases Dimensions, Scopus and Web of Science. The procedure described in the method section for identifying DAAD-funded publications was used for the Scopus and Web of Science databases. In the case of Dimensions, only the assignment made by the database provider could be used. It was therefore not possible to verify whether the US-DAAD program was excluded from the total DAAD-funded publications in the Dimensions database.

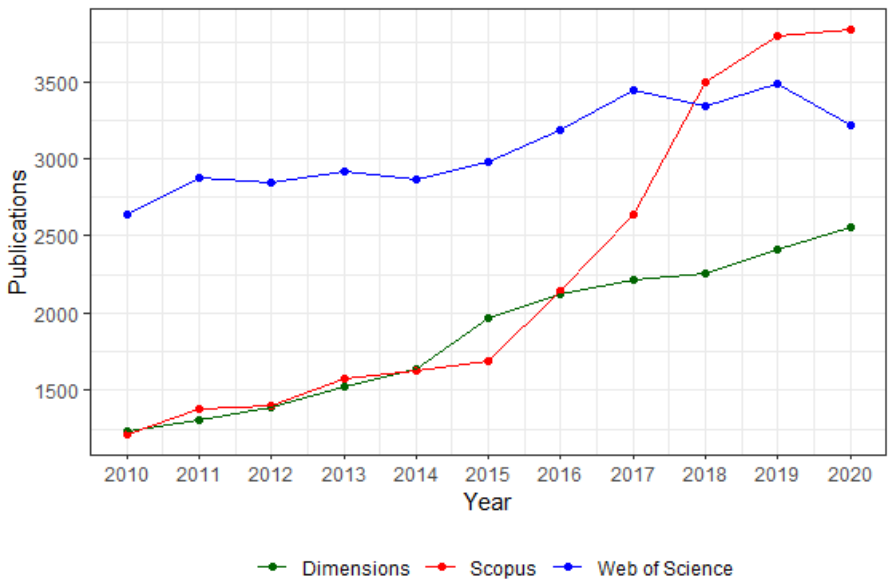

Figure 1. DAAD-funded publications in bibliometric databases (2010-2020).

The largest number of DAAD-funded publications could be identified in the Web of Science[1] (33,812), followed by Scopus (24,820) and Dimensions (20,635). The results show that the Web of Science contains the highest number of DAAD-funded publications in the period covered by the study. Scopus has caught up since 2015 and

[1] The following indexes were included in our study: Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (AHCI), and Conference Proceedings Citation Index (CPCI).

has exceeded the Web of Science in the absolute number of DAAD-funded publications since 2018. The number of DAAD-funded publications is also increasing in Dimensions, but overall, it lags behind the two other databases.
How should the increases in Figure 1 be interpreted? Are there more and more DAAD-funded publications? The main cause of the increases is the improved coverage of funding information in bibliometric databases. In the Web of Science, funding information was initially only included in the database for certain publications (articles and reviews in journals) from the natural and life sciences. From 2015, publications from the social sciences were added, followed by the humanities from 2017, along with conference publications (Clarivate Analytics 2022: 25). Thus, the proportion of publications with funding information in the Web of Science has increased from 37% in 2010 to 56% in 2020. A similar development can be seen in Scopus. Although Scopus overtakes Web of Science in terms of the absolute number of DAAD-funded publications, the database is also somewhat larger. During the period under investigation (2010-2020), Web of Science contains 27.8 million publications, Scopus 33.6 million and Dimensions even 50.5 million. The proportion of DAAD-funded publications out of the total number of publications in the respective database (Figure 2) is higher in the Web of Science (0.11%) than in Scopus (0.10%) or Dimensions (0.04%).

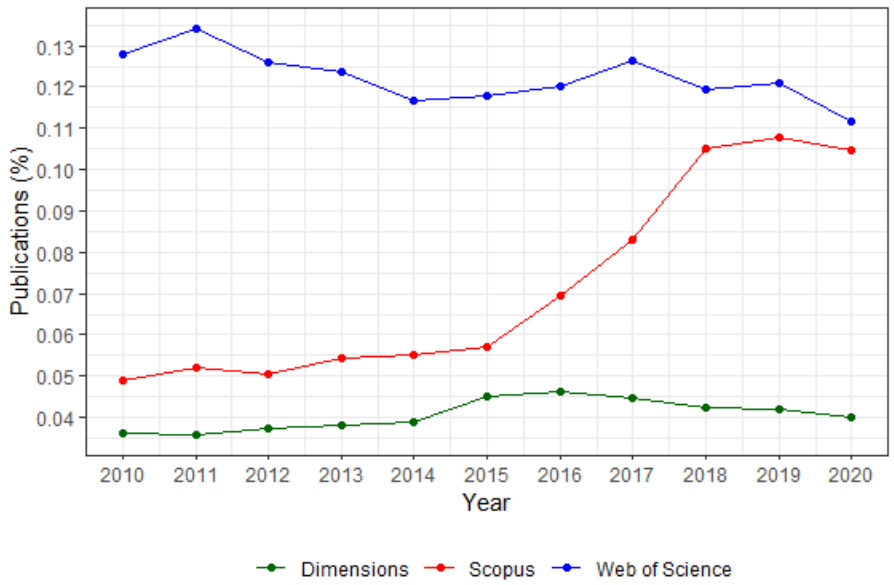

Figure 2. Proportion of DAAD-funded publications in bibliometric databases (2010-2020).

Regarding the coverage of funding information in bibliometric databases and the possibilities for further analysis, it can be concluded that the Web of Science offers the best data basis overall. For more recent analyses (from 2018 onwards), Scopus can also be used. In comparison, the Dimension database is much less suitable. Since

this study examines DAAD-funded publications from 2010 to 2020, the results in the following sections are based on the Web of Science.

DAAD-funded publications by country

According to official information from the German Academic Exchange Service, the DAAD is the largest funding organization worldwide for the international exchange of students and scholars (DAAD 2024a). Applications for funding programs do not only come from Germany, but from all over the world. Figure 3 shows the number of DAAD-funded publications per country. The assignment of a DAAD-funded publication to a country is based on the affiliations of the authors given in the publication. A DAAD-funded publication can thus be assigned not only to one, but to several countries. It is not possible to distinguish whether an author was funded by the DAAD in the respective country or worked and published with a person from that country. Figure 3 thus shows both funding and collaboration effects.

Of the DAAD-funded publications from 2010 to 2020, a total of 33,768 could be assigned to one or more countries. A total of 73,373 publication-country links were included in Figure 3, which results in an average of 2.2 countries per DAAD-funded publication.

The first thing that stands out when looking at Figure 2 is that there are hardly any white areas on the world map, i.e. there are only a few countries without a DAAD-funded publication between 2010 and 2020. The publications come from a total of 169 countries. Most DAAD-funded publications have at least one German address (27,812), followed by the USA (5,302). This means that authors in Germany are involved in 82% of all DAAD-funded publications. In particular, large countries or countries with a strong higher education and research system have numerous DAAD-funded publications. Fewer publications come from countries in Africa, Central and South America, and Asia.

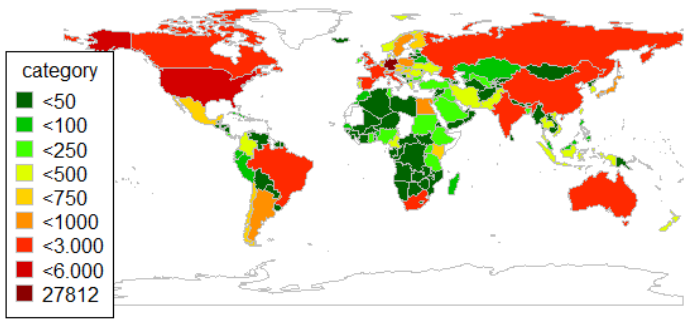

Figure 3. Number of DAAD-funded publications per country (multiple counting for international publications, 2010-2020).

While Figure 3 presents the absolute number of DAAD-funded publications, Figure 4 shows the share of these publications in relation to the country's total output. DAAD-funded publications accounted for 0.12% of total global output between 2010 and 2020. The largest number of DAAD-funded publications came from Germany, accounting for 1.6% of the total publication output from Germany. This makes the DAAD the fourth largest research funding organization in Germany after the German Research Foundation (DFG), the Federal Ministry of Education and Research (BMBF) and the Alexander von Humboldt Foundation (AvH) (see Möller 2019).

The USA, the second-largest country of DAAD-funded publications after Germany, is considerably below the global percentage (0.07% in the USA compared to 0.12% worldwide). The more than 5,000 DAAD-funded publications in which authors from the USA were involved are marginal from the perspective of the US academic system. The larger countries or countries with a strong international higher education and research system tend to have a low proportion of DAAD-funded publications. By contrast, the proportion in countries in Africa, parts of Central and South America and Asia are above the world average. Some DAAD programs are specifically aimed to support students and academics from less developed higher education systems. Figure 4 makes it apparent how important DAAD funding is, especially for countries that do not have a highly developed science and science funding system. The share of DAAD-funded publications can be seen as an indication of the importance of DAAD funding for the respective country. Despite many USA-publications, DAAD funding is less important for the USA-science system. It is much more important in Africa, parts of Central and South America and Asia.

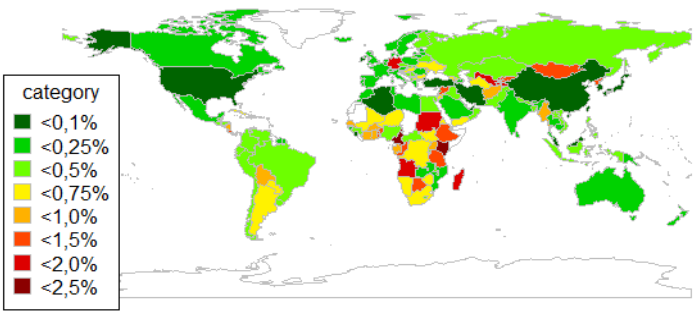

Figure 4. Proportion of DAAD-funded publications among the total publications of a country
(multiple counting for international publications, 2010-2020).

Share of international publications

Figure 5 compares the share of international publications for the DAAD, Germany and the world. Publications in which authors from more than two countries were involved are classified as international publications. Overall, the percentage of international publications has increased since 2010. However, there are some significant differences between the units of analysis: publications with at least one German address show a degree of internationalization that is more than twice as high (2020: 57%; Germany) as that of all worldwide publications (2020: 25%; World). It should be noted here that worldwide indicators are more strongly influenced by very large countries (especially the USA) and their publication output. Larger countries tend to have lower proportions of international publications because there are more national opportunities for collaboration than in smaller countries.

The publications funded by the German Academic Exchange Service (DAAD) have an international share of 75% (2020), which indicates that they have an even stronger international focus than all publications from Germany or all worldwide publications. We have differentiated the DAAD publications into those with a German affiliation and those without, reflecting the fact that the DAAD funds mobility from Germany to other countries as well as from other countries to Germany. The DAAD also finances scholarship in other countries even if the scholarship holders do not come to Germany. For DAAD publications with a German affiliation (DAAD with Deu), the internationalization share is 81% (2020), and for those without a German affiliation (DAAD without Deu), it is 46% (2020). Both percentages are considerably higher than those of the respective comparison groups (Germany and the World). The results show that the internationally oriented DAAD funding (see Figures 3 and 4 above) is not only manifested in publications in many countries. It is also underpinned by a high proportion of international collaborative co-authorships.

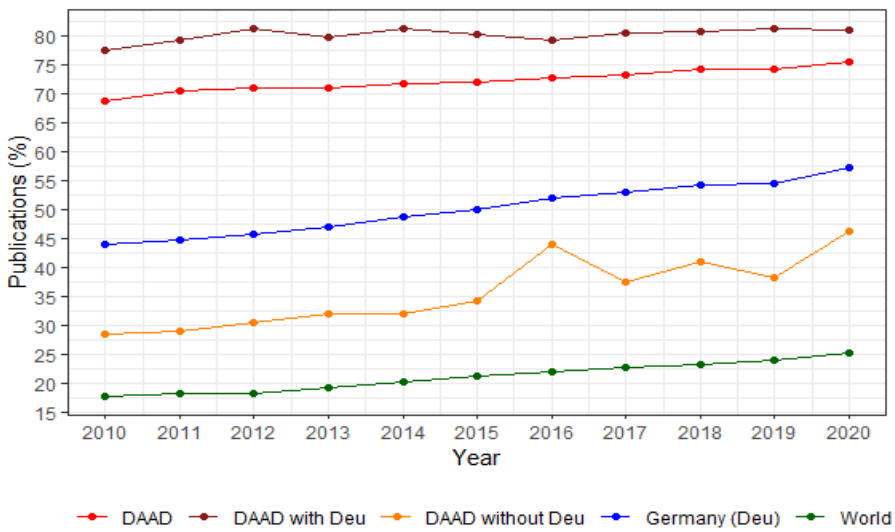

Figure 5. Share of international publications.

Excellence rate

The excellence rate (PP top 10%) presented in Figure 6 shows the percentage of DAAD-funded publications that are among the top 10%-highly cited publications worldwide. The citation indicator is calculated in two steps. First, the ten percent of journal articles and reviews with the highest citation rates are determined for each subject area and year separately. The citations are counted over a three-year period. The full-counting method is applied. Figure 6 shows that the excellence rate for worldwide publications is – as expected – 10% (world benchmark). Our calculation exactly corresponds to the 10% benchmark due to an elaborate method that uses fractionated count if more than one publication is on the PP top 10% threshold or if a publication is not top 10% highly cited in all its subject fields.

The excellence rate of Germany (Deu) was 14.1% in 2010 and 12.4% in 2020. Although the excellence rate is still higher than the global excellence rate of 10% (world benchmark)., there are various reasons for the decline: On the one hand, the data basis of the Web of Science has changed; on the other hand, the excellence rate of emerging science countries, especially China, has increased in recent years. Overall, this has led to a decline in the excellence rates of most Western European countries and of the USA (see Stephen and Stahlschmidt 2022:7).

The excellence rate of DAAD-funded publications also decreased during the period under investigation, from 12.6% to 10.2%. If we differentiate DAAD-funded publications according to whether they have a German affiliation (DAAD with Deu) or do not have a German affiliation (DAAD without Deu), we see differences in the excellence rate. The larger number of publications (DAAD with Deu) shows a similar trend as the DAAD-funded publications as a whole. DAAD-funded publications without a German affiliation initially have a higher rate of excellence, which drops sharply from 2016 onwards, falling below the global benchmark of 10%.

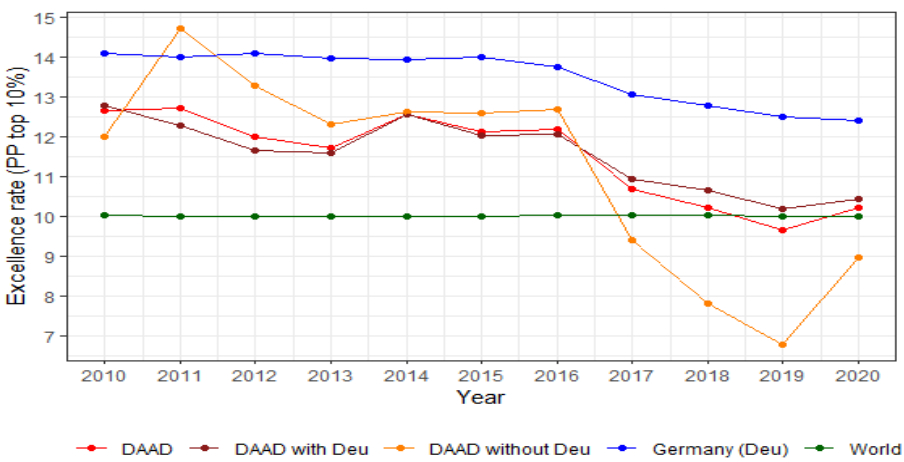

Figure 6. Excellent rate (PP top 10%) of DAAD-funded publications in comparison with Germany and the world.

The trends in the excellence rates of the DAAD-funded publications raise questions: Why is there a strong decline in the excellence rate of the DAAD-funded publications without a German affiliation? How do the different DAAD funding programs and the academic degree of the funding recipients (graduates, doctoral candidates, postdocs, faculty members), but also the country of origin and destination, affect the excellence rate?

Excellence rate by academic groups and funding programs

To answer the above questions, the bibliometric data of the DAAD-funded publications were supplemented by data from funding recipients provided by the research funder (see *Method* section). The descriptive results for various publication sets are shown in Table 1.

A total of 5,016 DAAD-funded publications were included in the analysis, given that only journal publications of the type of article and review are considered for the calculation of the excellence rate. The number of publications added up for the academic groups (row 3) and the funding program groups (row 8) is slightly higher, because some individuals received multiple funding, and it was not always possible to clearly assign the publications to a single academic group or a single funding program. In these cases, publications were assigned to multiple publication sets. First, it is noticeable that the excellence rate of the linked publications is higher (row 2, 14.3%) than that of all DAAD-funded publications (row 1, 11.5%). DAAD individual funding has a higher impact than the entire DAAD project funding. Furthermore, the excellence rate of individual funding depends on the academic status of the funding recipients (see rows 4–7). The lowest excellence rate was found among graduates (2.7%), although this group only accounts for 92 publications. Most publications were produced by doctoral students (3,153), with an excellence rate of 11.5%, and by postdocs (1,995), with an excellence rate of 19.4%. Faculty members produced 108 publications, with an excellence rate of 17.2%. In summary, it can be stated that the rate of excellence – as expected – increases with the academic degree. The faculty members are an exception with a lower excellence rate than the postdocs.

Table 1. Excellence rate of DAAD-funded publications by academic group and program.

No	Publication sets	Pub.	PP top 10%
1	DAAD-funded publications (Web of Science, 2010-2020)	31,978	11.5%
2	DAAD-funded publications linked to the DAAD scholarship database (from 2014)	5,016	14.3%
3	**Academic group**	**5,348**	
4	Graduates (Grad)	92	2.7%
5	Doctoral candidates (Doc)	3,153	11.5%
6	Postdocs (Postdoc)	1,995	19.4%
7	Faculty members (Faculty)	108	17.8%
8	**Funding program (funded group(s), origin)**	**5,581**	
9	Binationally supervised dissertations (Doc, not Deu)	132	9.7%
10	Third-country scholarships / Sur place (SPDL) (85% Doc, 14% Grad, not Deu)	240	7.3%
11	EPOS program (82% Doc, 18% Grad, not Deu)	22	4.5%
12	Research grants for dissertations (Doc, Deu)	408	15.1%
13	Research grants for dissertations in Deu (Doc, not Deu)	495	10.6%
14	Research grants - short-term (75% Doc, 23% Postdoc, not Deu)	170	15.3%
15	Research grants - long-term (85% Doc, 14% Postdoc, not Deu)	792	12.2%
16	Graduate School Scholarship Program (Doc, not Deu)	191	12.1%
17	Co-financed program (64% Doc, 31% Postdoc, not Deu)	1,202	13.6%
18	Postdoc grants from Germany to abroad (Postdoc, Deu)	915	23.0%
19	Postdoctoral Researchers International Mobility Experience (P.R.I.M.E.) (Postdoc, Deu)	265	15.1%
20	Special research programs (65% Postdoc, 35% Doc, 80% not Deu, 20% Deu)	445	13.7%
21	Other (38% Doc, 35% Postdoc, 21% Faculty, 52% not Deu, 48% Deu)	304	10.7%

A distinction according to the academic group of the funding recipients over time (not shown in Table 1) provides the following results: While in 2014, 71% of DAAD-funded publications came from the postdocs or faculty members, in 2020 this share was only 25%. During the same period, the share of publications by doctoral candidates increased from 27% to 73%. In addition, there were also changes in the countries from which the funding recipients came. In 2014, 87% of the funding recipients came from countries with an excellent rate above the global benchmark. In 2020, this was only 53%. At the same time, the excellence rate decreased from 21.1% (2014) to 11.2% (2020). These findings are relevant when interpreting the decreasing excellence rates of DAAD-funded publications shown in Figure 6. If the publication structure of individual scholarship funding corresponds to that of the total dataset of DAAD-funded publications, then the falling excellence rates for the DAAD could also be attributed to changes in the DAAD funding portfolio. A reduced funding of postdocs and faculty members in favor of doctoral students from less research-intensive countries would be a plausible explanation for the decline in the DAAD excellence rates in Figure 6.

The rows 9 to 21 show the excellence rates of the DAAD funding program groups for individual funding. The individual programs were clustered into program groups

that were established with the support of the DAAD. As the rate of excellence depends on the academic group, we show the proportion of publications by academic group in each program. Shares below 10% are omitted. We also make a broad distinction between the origin of the submitted applications (Germany (Deu) or not Germany (not Deu)).

We cannot go into all the programs in detail but concentrate on specific examples. The EPOS program (development-related postgraduate studies, row 11) has the lowest number of publications (22) and the lowest excellence rate (4.5%). The aim of the program is to qualify specialists and leaders from emerging countries as future decision-makers (DAAD, 2024b). The program is not intended to research purposes and thus the excellence rate is small and not an appropriate measurement to assess the program. Furthermore, the number of publications is too low to achieve meaningful results and only a small proportion of the funding recipients have even published anything at all. The EPOS program is a good example of why program objectives and indicators should be evaluated in relation to each other to avoid inappropriate conclusions.

The program group Postdoc Scholarships from Germany to abroad (row 18) is a different case. This category includes both short-term scholarships (three to six months) and one-year scholarships for postdoctoral researchers. The program aims to carry out (self-selected) research projects abroad (DAAD, 2024b) and is dedicated to research. Scientific publications are therefore the expected results. The Postdoc Scholarships from Germany to abroad has 915 publications and the highest excellence rate (23.0%) of all DAAD programs. In contrast to the EPOS program, the excellence rate is a suitable indicator for the program's objectives and indicates a high level of research excellence.

The program group Postdoc Scholarships from Germany to abroad has gradually been phased out in recent years. The P.R.I.M.E. program (Postdoctoral Researchers International Mobility Experience, line 19) has taken its place with a similar funding objective. It is designed for postdocs from Germany who would like to pursue an annual own research project at a research institution abroad and, after their return to Germany, receive 6 months of funding at a German university. Like its predecessor, it is therefore a funding program specifically geared towards research. The success rate of the P.R.I.M.E. program (15.1%) is among the highest of the program groups listed. However, it is lower than that of its predecessor program.

A special aspect of the two postdoc fellowship programs mentioned above is that the grantees come from Germany and move abroad. In most of the other programs, the grantees come from abroad. They either receive funding directly in their country of origin (e.g., in the case of third-country fellowships, row 10) or move to Germany for the funding period (e.g., research fellowships for doctoral studies in Germany, row 13).

The results indicate that the excellence rate of the funding programs is influenced by various factors: (a) The excellence rate depends on the funded academic group (graduates, doctoral candidates, postdocs and faculty members). (b) DAAD funding programs are not always primarily focused on research. They can also pursue other funding objectives, such as strengthening the higher education and science systems

of the Global South or sustainability aspects (cf. in Table 1 e.g., EPOS, line 11, and Third Country Scholarships & SPDL, line 10). Funding programs that are not primarily research-oriented tend to have lower excellence rates. (c) The research conditions of those funded abroad are not always comparable with those in Western countries. These affect, for example, the training and supervision of doctoral candidates as well as the financial opportunities to publish in internationally renowned journals. This can have both positive and negative effects on the excellence rate. (d) Research topics could also be country-specific or regional and influence access to international journals and perception by the global scientific community. For example, publications that deal with specific crops and the climatic conditions in a particular region may be less relevant for international journals and their global audience than other international research topics.

Modeling the factors influencing the excellence rate

The descriptive results above suggest that the excellence rate depends on various factors. In order to analyze this in more detail, we calculated various logistic regression models with the excellence rate (pp top 10%) of the scholarship holders' publications as the dependent variable. Table 2 presents the model with the independent variables academic grade, gender, and the excellence rate of the country of origin and destination. The reference category is male doctoral candidate.

Table 2. Logistic regression. Excellence rate (PP top 10%) of DAAD-funded publications by academic group, gender, country of origin and country of destination.

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-3.47755	0.38855	-8.950	< 2e-16	***
Graduates	-1.82520	0.71682	-2.546	0.010889	*
Postdocs	0.42550	0.08439	5.042	4.61e-07	***
Faculty members	0.36689	0.24934	1.471	0.141171	
Gender (female)	-0.20582	0.08160	-2.522	0.011658	*
Country of origin (PP top 10%)	3.83276	1.55842	2.459	0.013917	*
Country of destination (PP top 10%)	8.96088	2.71467	3.301	0.000964	***

Sig.: '***' 0.001, '**' 0.01, '*' 0.05, '.' 0.1

We see statistically significant differences in the academic group. Graduates have a lower rate of excellence than the reference group, while postdocs and faculty members have a higher rate. The result is not significant for the faculty members. Women have a significantly lower excellence rate, after controlling for the other variables. The excellence rate of a grantee's publication is also influenced by the excellence rate of the country of origin and destination. In both cases, the excellence rate increases significantly, whereby the country of destination has a greater influence than the country of origin. Grantees who come from higher education and science systems with a higher excellence rate or who move to such a system tend to achieve a higher excellence rate with their publications.

We have calculated further models (not included in this paper) in which the funding programs were included as an independent variable. The funding programs themselves had no significant influence on the excellence rate of DAAD-funded publications when the other independent variables listed above were included in the model. This result indicates that the funding programs themselves have no direct influence on the excellence rate. However, the programs do lead to certain funded academic groups from certain countries of origin and destination. This mediated influence leads to impact differences between the funding programs.

Discussion and conclusion

The present study shows that – although the DAAD does not generally ask funding recipients to acknowledge the funding source – a large number of DAAD-funded publications could be identified in bibliometric databases. The Web of Science contains more DAAD-funded publications (33,812, 2010-2020) than Scopus and Dimensions (Figures 1 and 2).

The DAAD-funded publications published between 2010 and 2020 were affiliated with institutions from 169 countries (Figure 3). 82% of these publications also contained a German affiliation. Most DAAD-funded publications have affiliations with institutions in large and/or research-intensive countries (Figure 3). These are the countries that also account for the majority of global publications. However, if we look at the share of DAAD-funded publications in the total output of each country, it becomes clear that the higher education and science systems in Africa, Central America and parts of South America and Asia benefit particularly strongly from DAAD funding (Figure 4). In addition, the DAAD-funded publications have an above-average proportion of international collaborations (affiliations from more than two countries) compared to German or worldwide publications (Figure 5).

The excellence rate of DAAD-funded publications was almost consistently above the global benchmark during the research period (Figure 5). However, as in Germany and other Western countries, the DAAD's excellence rate declined at the end of the reporting period.

Individual DAAD funding has a higher rate of excellence than overall DAAD funding. The differentiated analysis according to academic groups and programs show that the excellence rate of DAAD-funded publications increases with the academic degree (from graduates through doctoral students to postdocs). Publications by Faculty members, on the other hand, have a slightly lower excellence rate than postdocs. If the grantees come from countries with a higher excellence rate or go to such a country, the excellence rate tends to be higher.

The excellence rate is not suitable for every group of funding recipient or every funding program. The excellence rate is a suitable indicator for funding programs that are specifically geared towards research. Some programs are targeted at graduates and doctoral students from countries with less developed higher education and science systems or would like to expand or deepen the competencies of decision-makers in the domestic higher education sector. Here, the excellence rate is a less suitable measure for evaluating these programs. In the context of responsible, evaluative bibliometrics, the aim is to correlate program objectives and indicators to

appropriately assess the scope of the conclusions (see Leiden Manifesto for research metrics, Hicks et al. 2015). Nevertheless, or precisely because of this, we believe it is essential to examine the output dimension of research funding using various methods, including the bibliometric method of funding acknowledgement analysis. Bibliometric analyses provide additional insights that place the monitoring of research funders and their performance on a broader, evidence-based information foundation.

Although the DAAD does not specify how funding should be acknowledged, a high number of DAAD-funded publications were identified. However, it would be useful if not only the DAAD, but also all research funders, asked their grantees to acknowledge the funding in a specific form. For this purpose, a standard text should be provided that includes the official spelling of the research funding organization in the local language and English, the acronym and a grant number. It would be advantageous if both the name and the acronym of the research funder were unique in the international context. This also applies to the funding number. This helps to identify the publications of the respective funder and the allocation to specific projects and funding programs would be feasible.

Due to the high effort required to identify the funded publications, valid rankings of research funders are much more difficult to realize than the international university rankings mentioned in the introduction. In addition, most research funders are nationally oriented. Since national funders only select their applicants from the pool of domestic researchers, the impact of the respective country also has a high influence on the impact of the respective funder. An international ranking of research funders would thus indirectly replicate the country-specific differences.

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