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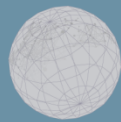
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Trade Journals in Bibliometric Databases and Their Influences on Indicator Calculations*

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Introduction

For many quantitative analyses and indicator calculations bibliometricians rely on citation databases. The underlying assumption that speaks for their use is that these indexes consist exclusively of scientific literature and therefore reflect a representation of science on various aggregation levels. This claim has not really been challenged.

A closer look at the list of covered titles of the two most prominent citation indexes, Elsevier's Scopus and Clarivate Analytics' Web of Science, unveils a diverse picture of a variety of different publication types. These are by far not as homogeneous with regard to their degree of scientific character as often assumed. While the term 'scientific character' is not well-defined and therefore hardly measurable, we can present indications that some publication types in the databases do not follow the same implicit social norms as others. This might be mainly because they seem to target another audience – i.e. not primarily other scientists.

Though many publication types can be put into question, such as popular science journals, practitioner periodicals, and political magazines, this study focusses on trade journals. This is partly because they are relatively easy identifiable through a Scopus classification and simultaneously because they seem to account for a large portion of what might be considered journals of a lower degree of scientific character. This might also be the reason why they have been excluded from certain indicators (Moed 2016). Yet mainly we want to focus on trade journals considering a remark from the coverage guide of one of the providers of citation databases:

„Trade journals are seldom refereed and do not always have an editorial board. Abstracts are usually short or nonexistent and few or no references are given. [...] Trade journals are included in Scopus because users and librarians consider selected articles to be scientifically relevant.“ (Elsevier, 2017: 7)

This passage shows that trade journals do not follow basic scientific publication norms (e.g. peer review, editorial boards, citing existing literature). At the same time it demonstrates the provider's perception of a need for justification concerning the decision to include this kind of periodical into a collection of scientific literature, something that is not provided for all publication types.

On the downside, a clear distinction between trade journals and other publication types is lacking just like unambiguous characteristics for the classification. The process of inclusion and classification of trade journals by the database providers is largely unknown. Some of the

* This analysis was conducted using the infrastructure of the Competence Centre for Bibliometrics funded through the German Federal Ministry of Education and Research (BMBF) under grant number 01PQ17001.

usual criteria (e.g. the existence of systems of peer review, reference lists, and abstracts) do not seem to be used in this case.

The purpose of this paper is to explore the uncharted territory of trade journals in the two citation databases Scopus and Web of Science. We uncover some of their key properties, the effect they have on the calculations of bibliometric indicators, and what happens if they are excluded from these calculations. Institutions publishing in trade journals will be identified and a target audience inferred. Lastly, we will address some implications for future scientometric studies.

Material and Methods

Trade journals were identified using Scopus' publication type classification. Since Clarivate does not offer such a detailed taxonomy, the ISSNs of publications marked as trade journals in Scopus were used to identify those that were also indexed in Web of Science. This search is obviously limited to trade journals covered by Scopus that have a registered ISSN which may exclude a number of publications but it appears to be the best way to compare the two data sources.

Some key bibliometric features of the identified trade journals, namely document type distribution, citation behaviour, and field differences will be presented and contrasted with 'academic' journals (another publication type within the Scopus classification scheme).

For the assessment of the influence trade journals have on bibliometric indicator calculations average citation frequencies by scientific field are used as an example. These scores are widely used in field normalisation procedures and therefore possess a high relevance for bibliometrics. If trade journals have a significant impact on them, they most likely also influence other indicators. For selected fields citations per paper will be calculated with and without trade journals respectively. All analyses were conducted using the infrastructure of the German Competence Centre for Bibliometrics. This did not only facilitate cross-database comparisons but also made possible the use of their validated and standardized affiliation names for German publications (Rimmert, Schwechheimer, & Winterhager, 2017). Hereby, the question of who is publishing in trade journals can be answered and presumptions about targeted audiences can be made. All analyses cover the timespan from 1980 to 2015 for Web of Science data and 1996 to 2015 for Scopus data¹.

Trade Journals in Bibliometric Databases

Coverage

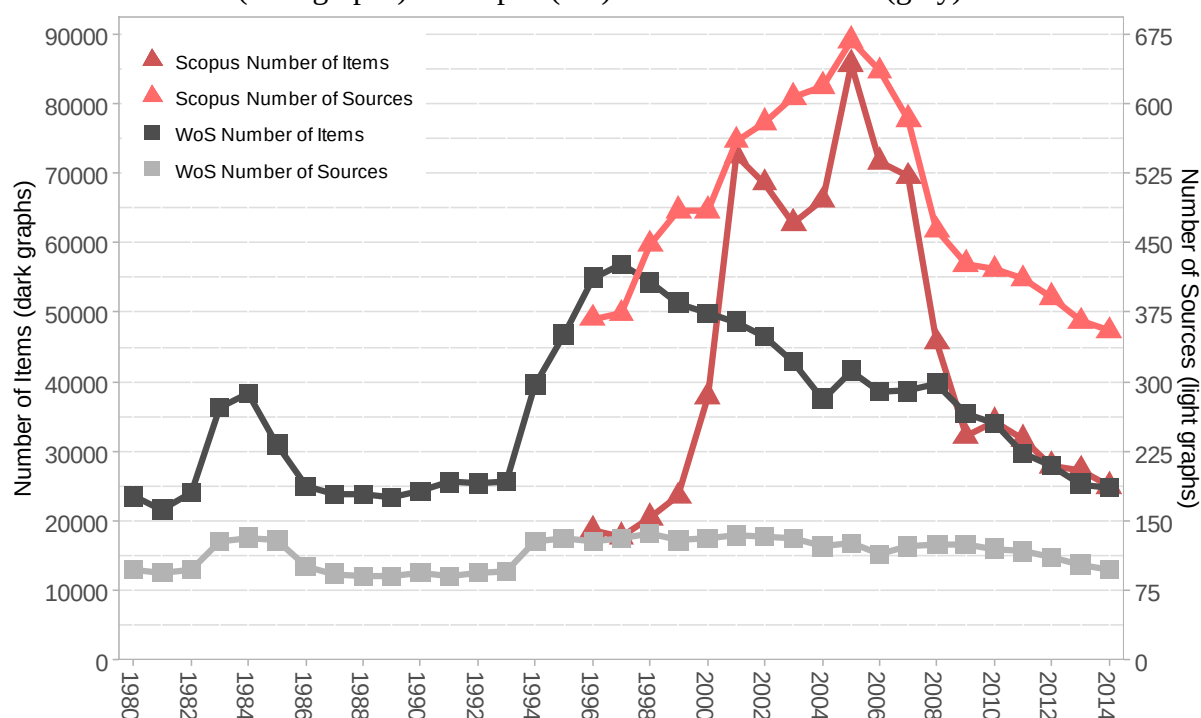
In Scopus well over 850,000 entries are attributed to more than 900 different trade journals. In Web of Science we only find about a quarter (223) of the periodicals classified as trade journals by Elsevier, but over one million documents are covered.

These numbers are plausible considering the longer timespan and assuming Web of Science includes all documents of the incorporated sources, which is the practice for academic journals. Yet, the inclusion criteria for trade journals remain unclear.

Figure 1 shows the development of the trade journal coverage in Scopus and Web of Science. Scopus included more and more trade journals for the first decade of its existence peaking at just over 85,000 items in more than 650 periodicals in 2005. From 2006 on growing numbers of trade journals were no longer included in the index and item counts dropped by 70%.

In contrast, the number of trade journals included in the Web of Science is relatively stable at around 100 sources each year. Still, the amount of items issued by these titles fluctuates substantially. In the mid-90s a sharp increase is observable, followed by a constant decrease in the last 15 years.

Figure 1: Number of active trade journals (light graphs) per year and their published items (dark graphs) in Scopus (red) and Web of Science (grey).



Types of Documents

One key difference between trade journals and academic journals is the distribution of their respective documents in different document types (see table 1). Though the classification systems of Scopus and the Web of Science are quite different, some similarities can be observed. While academic journals publish mainly articles, the landscape of document types is much more divers in trade journals. Different forms of short and presumably rather rarely peer-reviewed communications (such as notes, news items, short surveys, special reviews², and editorial material) are published much more frequently than in their academic counterparts. Scopus even has a document type ‘business article’ that is almost exclusive to trade journals, but makes up only a small portion of their output.

Table 1. Shares of selected document types for academic journals and trade journals.

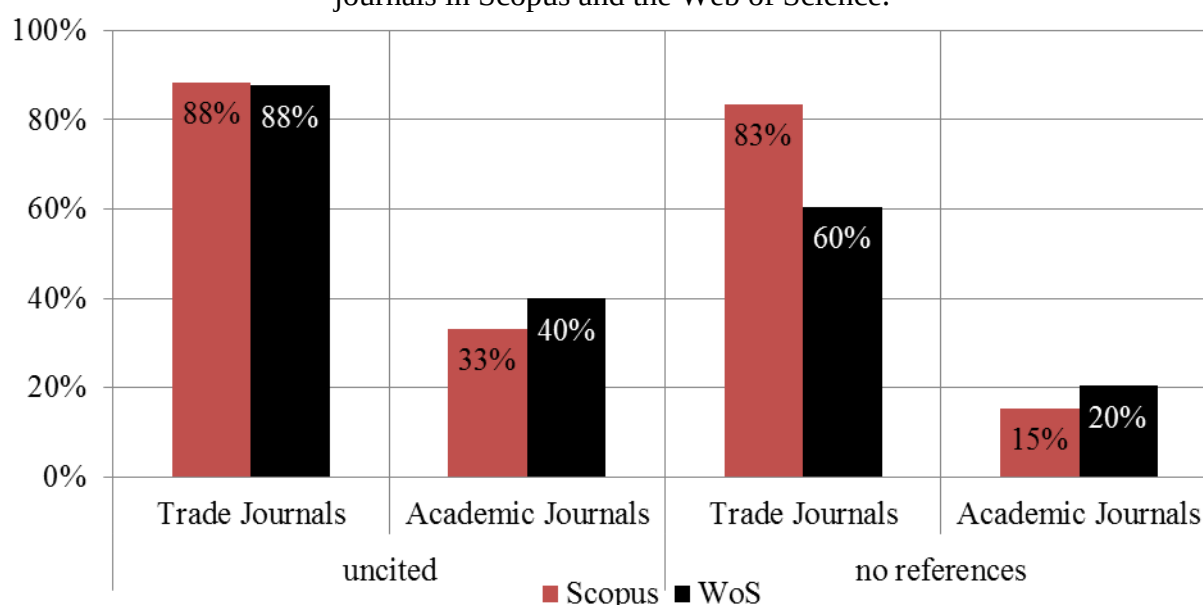
Document type	Academic journals	Trade journals	Difference (%-points)
Scopus			
Article	79.3%	54.9%	-24.4
Note	2.4%	15.6%	+13.2
Short Survey	1.3%	8.5%	+7.2
Business Article	0.01%	4.3%	+4.3
Web of Science			
Article	65.8%	36.1%	-29.7
Editorial Material	4.3%	14.3%	+10.0
News Item	0.7%	15.2%	+14.5
Special Reviews ²	7.2%	20.1%	+12.9

Having said that, we should also acknowledge that most of the documents published by trade journals fall into categories few would label unscientific. Articles are still the single largest group of documents; reviews and book reviews are common as well³. Consequently, debasing trade journals as an unscientific publication format does not do them justice.

Citation Behaviour

One way of analysing whether trade journals form part of the scientific discussion is to look at citation traffic. Both the attention trade journals give scientific publications (by referencing them) and the attention they gain from scientists (via incoming citations) can be observed this way. Academic journals provide a basis for comparison.

Figure 2: Shares of documents without citations or references in trade journals and academic journals in Scopus and the Web of Science.



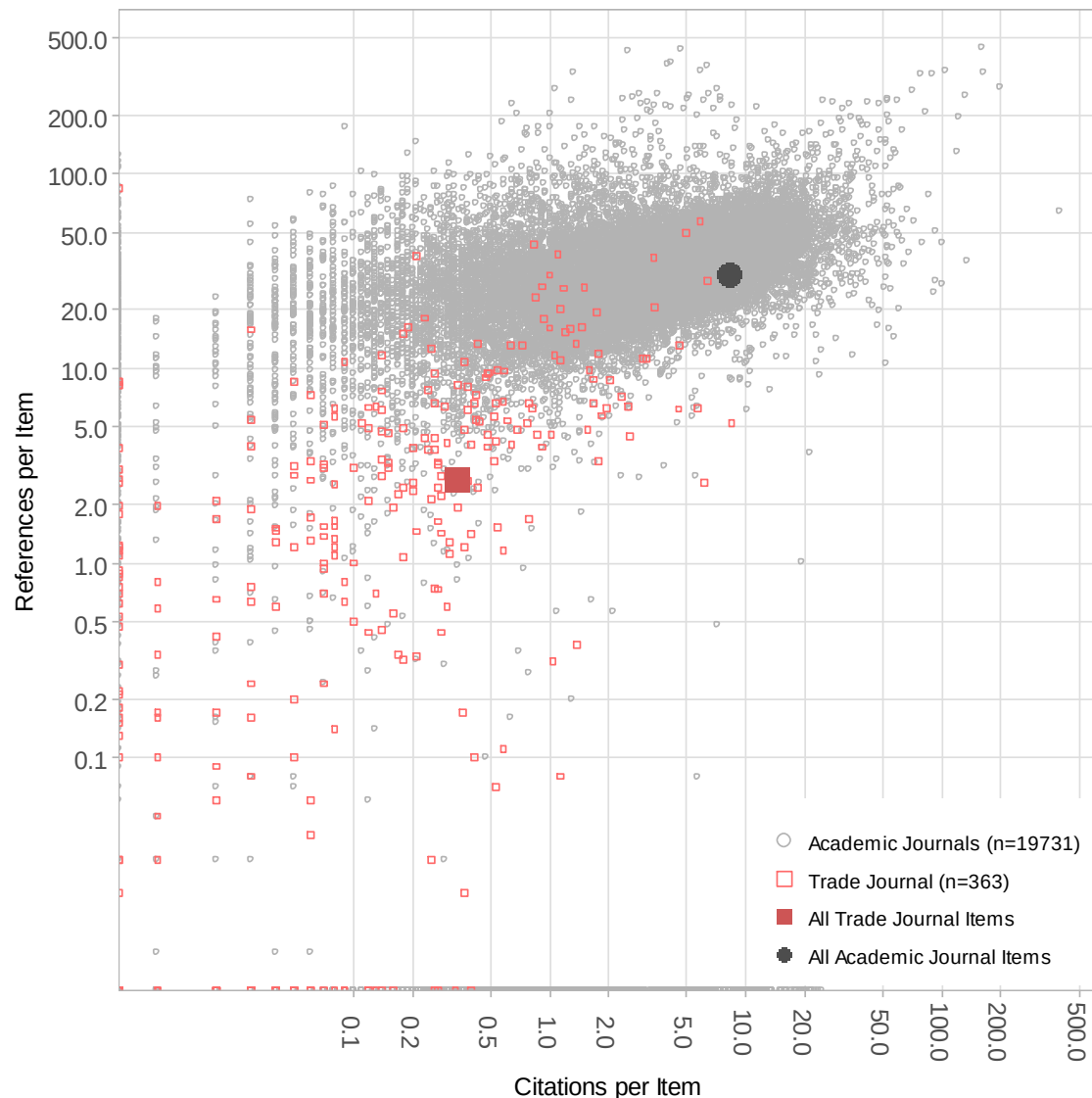
The share of uncited documents gives some insight in how weak the impact is that trade journals have on science (see figure 2). 88% of trade journal documents do not have a single citation, more than twice as many as academic journal items. This affects also average citation rates, which lie below one citation per paper for trade journals (Web of Science: 0.8, Scopus: 0.7), compared to 13.0 (Web of Science) and 13.7 (Scopus) for academic journals. Even if all uncited items are excluded, the image does not change much. Trade journals rise to 6.1 (Scopus) / 6.9 (Web of Science), academic journals to 20.4 (Scopus) / 21.7 (Web of Science). This distance is especially remarkable considering this way two thirds of academic journal items are compared with the 12% most highly cited trade journal documents.

A similar picture is drawn by the citation traffic in the other direction. On average, reference lists of academic journal documents are ten times longer than those of trade publications⁴. 83% of trade journal items in Scopus and 60% in Web of Science do not cite any scientific source (see Elsevier, 2017: 7), while this is only the case for 15% (Scopus) to 20% (Web of Science) of academic journal entries (see figure 2).

All these results hold true when controlled for publication year, different citation windows, document type, and scientific field. Notably, the differences between trade and academic journals seem less drastic in the Web of Science data, than in Scopus. This might be due to stricter inclusion standards in Web of Science regarding citation behaviour but this remains speculation.

Besides the well-known shortcomings of average citation rates, both statistically and theoretically, another aspect also limits these findings. There are several trade journals that have more citations or more references per paper than the average academic journal and even more academic journals with similar citation properties as trade journals (see figure 3)⁵.

Figure 3: Average number of citations and references for trade journals and academic journals with more than ten items in 2011 (data: Scopus).



Field differences

Average citation rates also play a big role in field normalisation algorithms that are widely used in bibliometric analyses. Considering that trade journals only make up a small portion of all publications in the databases (only about 2.2%), one could assume that they do not have a big influence on impact calculations. But since impact indicators are (and should be) usually field-normalized, this might not be the case. The next step in scrutinizing trade journals is therefore to look at their influence in calculating citations per paper (CPP) on the level of scientific fields.

As can be seen in table 2 some fields⁶ consist to a high degree of trade journal publications. In extreme cases, up to 47% of a field's documents origin from trade journals, mainly in engineering and material science, but also in some management as well as humanities fields.

This has severe consequences for CPP rates in these fields. Excluding the usually un- or low-cited trade journal publications from the calculations, increases the CPP considerably, in some cases by more than 50% (see fourth column in table 2). Again, these calculations were checked for effects of publication year, citation windows, and document type, without significant changes to the results. No case was found where omission of trade publications leads to a decrease in CPP rates.

At the same time, three quarters of all fields (Scopus: 74%, Web of Science: 78%) have less than one percent of their items in trade journals and their CPPs are therefore almost untouched by them. However, the disciplines affected by trade journals differ between the two databases; while in Scopus management science appears to publish a lot in trade journals, in Web of Science we find humanities to be amongst the affected fields. This difference is hard to explain and needs more detailed analysis.

Table 2: Average citation per paper (CPP) including and excluding trade journal documents and field's share of trade journal items for selected scientific fields in Scopus and the Web of Science.

	CPP without trade journals	CPP with trade journals	Difference (in %)	Share of trade journal items
Scopus All Science Journal Classification				
Media Technology	6.2	4.0	55%	37.1%
Marketing	13.3	9.7	37%	27.1%
Materials Science (misc.)	7.4	5.9	25%	25.0%
Fuel Technology	8.7	6.7	30%	23.5%
Economic Geology	7.6	6.1	25%	19.6%
Pharmacology, Toxicology and Pharmaceutics (misc.)	8.2	6.7	22%	18.7%
Web of Science Subject Categories				
Engineering, Petroleum	3.1	1.8	72%	47.3%
Music	0.4	0.3	33%	35.2%
Architecture	0.2	0.1	100%	26.5%
Engineering, Marine	4.6	3.5	31%	24.3%
Engineering, Chemical	11.2	8.7	29%	24.2%
Humanities, Multidisciplinary	0.7	0.5	40%	21.1%

Authors and Institutions

Lastly, we want to address the question of who publishes in trade journals. This is particularly interesting since one underlying assumption of this analysis is that trade journals target another audience than academic journals thus not aiming at taking part in the scientific discourse. Making those writing in trade journals visible, might lead us towards hints about who is addressed.

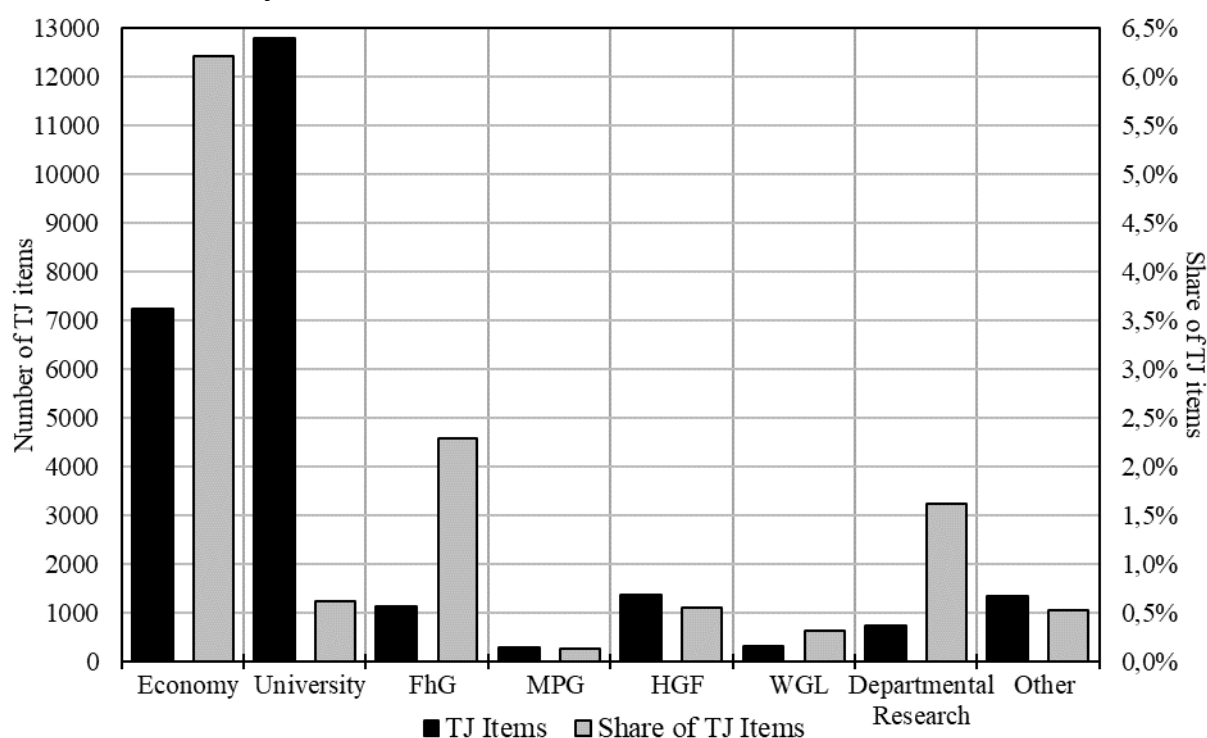
While raw institutional data in the bibliometric databases is not well homogenised and unfit for analysis, the German Competence Centre for Bibliometrics standardized all German addresses and attributed them to institutions with very high recall and precision (Rimmert, Schwechheimer, & Winterhager, 2017). These institutions are in a second step aggregated to sectors of the German science system.

Because these sectors are in fact very different in size, both the total number of documents in trade journals and the share of trade journals in the publication output of the sectors ought to

be considered (see figure 4). This way, two perspectives can be taken into account; which kinds of institutions publish the majority of trade journal documents and which institutions focus their output on trade journals.

While universities⁷, the sector with the biggest publication output overall in Germany, also dominate trade journal publications in sheer numbers, they do not focus especially on this format. Only 0.6% of university publications appear in trade journals. The second largest sector by volume is the private economy. Though publishing only about half as many items in trade journals, they put by far the most emphasis on them (6.2%). The only other parts of the German science system publishing more than one percent of their publications in trade journals are the Fraunhofer Society, a union of applied research facilities, and departmental research organisations, connecting bodies for science and policy-making. This trend is also visible in the list of the institutions with the most trade journal publications, which is comprised mostly of universities (prominently technical universities) and private companies.

Figure 4: Number and share of trade journal documents by sector of author's institution (data: Scopus, only publications with at least one German institution, full count for multiple institutions). Abbreviations: TJ: Trade Journals, FhG: Fraunhofer Society, MPG: Max Planck Society, HGF: Helmholtz Association, WGL: Leibniz Association



Although universities publish the most in trade journals, private economy and science organisations focussed on applied research are much keener to seek this platform, presumably because the target audience of trade journals is more interested in possible applications of scientific findings than in the endeavour of knowledge production itself (a presumption supported by Van Steijn and Rip 1988).

Findings and Conclusion

As we have shown, trade journals are a phenomenon in bibliometric databases that should not be neglected. On one hand they are systematically quite different from academic journals regarding the distribution of their publications on document types and their citation behaviour. On the other hand, there are no hard bibliometric criteria for the separation of the

two groups. This analysis had to rely on classifications provided by Scopus which are intransparent, limiting the results presented.

In some particular fields trade journals have a massive influence on the publication landscape, both in absolute and relative numbers, and the same is true for bibliometric indicator calculations. Excluding them (as suggested by some, Moed 2016) might reduce a field's number of items considerably, yet little to no citation traffic would be lost, lowering the benchmark for field-normalized citation rates, but leaving the network structure of scientific communication intact.

With regards to the publishing sectors, trade journals are mainly driven by (technical) universities but apparently more as a by-product of their huge publication output. Relatively, private economy and applied research organisations focus much more on trade journals as a publication platform.

This leads us to the conclusion that trade journals target another audience than academic journals, namely not scientists, but those interested in the applicability of scientific discoveries. This means that their part in the system of scientific communication is that of a transfer office, linking science to business⁸. Secondly, trade journals are thereby not bound to scientific norms. Peer-review, editorial overview, and referencing prior scientific work are not necessary when communicating scientific insights to non-scientists.

Taking this into account, the questions arise, why trade journals are still included in bibliometric databases and if they should be excluded for indicator calculations. We argue that these questions do not have general answers. Echoing Elsevier's statement concerning the inclusion of trade journals into the index (Elsevier, 2017); they are scientifically relevant. In some fields, communication with non-scientific audiences is an important part of publication practice. We know little about the degree to which scientists in these fields also consume trade journal literature and how they are benefitting from this reading. Van Steijn and Rip (1988) argue in a case study that trade journals facilitate a mutual exchange between scientific and applied technologic communities but more comprehensive and updated research is needed.

Future bibliometric studies should be aware of the existence of trade journals and other formats of questionable scientific character in the databases and come to an informed decision on how to handle them.

This analysis covered trade journals but it reflects also on how bibliometricians are working with their databases. We seldom ask ourselves what exactly we are examining. Scientific literature is as diverse as bibliometric analyses and by being aware of this diversity we can increase validity in bibliometric indicator calculations.

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NOTES:

¹ While Scopus only covers publications since 1996 the reason to limit analyses in the Web of Science database to documents published since 1980 lies in the license agreements of the Competence Centre for Bibliometrics and the database providers.

² There are a number of classifications (book reviews, music performance review, record review, art exhibit review, and the like) that can be grouped together under the umbrella term of ‘special reviews’.

³ One has to bear I mind that the database providers classify items in their document types, not the journal publishers. Therefore, we cannot argue that articles in trade journals are fundamentally different to articles in academic journals. The same is true for other document types which makes the issue of unknown classification procedures and criteria even more pressing.

⁴ Counting all references, academic journals have 21 (Web of Science) to 30 references per item (Scopus). Trade Journals cite 2.3 (Web of Science) to 2.9 items (Scopus). Excluding publications without a single reference, the distance between academic journals (Web of Science: 26.2, Scopus 32.0 references per document) and trade journals (Web of Science: 5.9, Scopus 11.4 references per document) shrinks, but again, we would compare very few trade journals with the majority of academic journals. No significant changes can be observed when the comparison is limited to literature references.

⁵ 481 or 2.4% of academic journals in figure 3 are less often cited than the average trade journal and give fewer references per paper.

⁶ Fields in this case were operationalized by the classification systems of the database providers (Elsevier’s All Science Journal Classification and Clarivate’s Subject Categories).

⁷ The sector combines all higher education providers, not only universities, but also academies of arts, universities of applied sciences, and others. The overwhelming majority of publications from this group are written in universities.

⁸ Interestingly, one of the very few publications about trade journals (Nederhof & Meijer, 1995) proposed to use them to design indicators for knowledge transfer from science to business.